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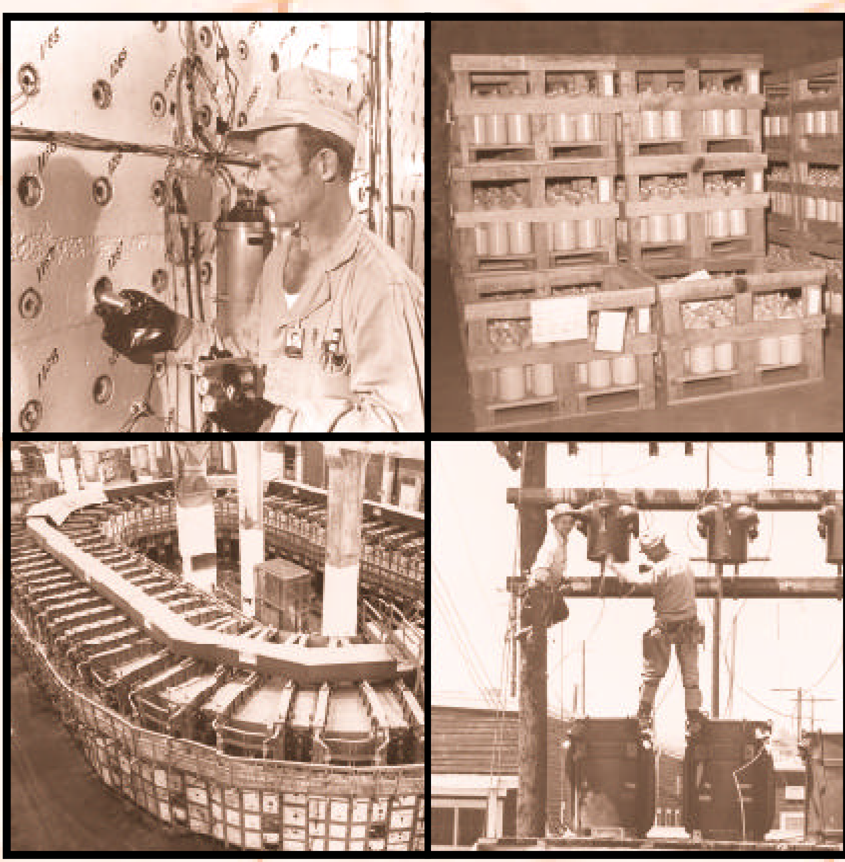
Mercury Releases from Lithium Enrichment at the Oak Ridge Y-12 Plant – a Reconstruction of Historical Releases and Off-Site Doses and Health Risks
– *APPENDICES* –



Submitted to the Tennessee Department of Health by

ChemRisk
A Service of McLaren/Hart

OAK RIDGE HEALTH STUDIES
OAK RIDGE DOSE RECONSTRUCTION

– TASK 2 REPORT –

MERCURY RELEASES FROM LITHIUM ENRICHMENT AT THE OAK RIDGE Y-12 PLANT– A RECONSTRUCTION OF HISTORICAL RELEASES AND OFF-SITE DOSES AND HEALTH RISKS

– *APPENDICES* –

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APPENDICES TO THE MERCURY DOSE RECONSTRUCTION REPORT

APPENDIX A

MINOR USES AND OCCURRENCES OF MERCURY AT Y-12, X-10, AND K-25

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APPENDIX A

MINOR USES AND OCCURRENCES OF MERCURY AT Y-12, X-10, AND K-25

Source terms were not developed for a number of minor mercury uses at Y-12, X-10, and K-25, due to the small quantities used, the lack of significant building ventilation, or because information identified by the project team indicated that significant releases (relative to releases associated with Y-12 lithium separation) did not occur. Information collected by the project team on these uses is summarized below.

A.1 MINOR USES AND OCCURRENCES OF MERCURY AT Y-12

Minor uses and occurrences of mercury at Y-12 included:

- the Orex Pilot Plant (Buildings 9733-1 and 9202),
- mercury bottling and cleanup campaigns,
- mercury compounds in weapons components, and
- mercury in instrumentation.

These process-related sources of mercury at Y-12 are described below. In addition, some of the mercury inventory at Y-12 may have been "lost" as the result of theft of the mercury.

A.1.1 Orex Pilot Plant (Building 9733-1)

In 1951 and 1952, X-10 personnel conducted Orex development work in Y-12 Building 9733-1 (UCCND 1983). Some small scale pilot plant work started on Orex dual temperature columns as a method for separating ^{6}Li on September 24, 1951. On November 16, 1951 Union Carbide issued a report that full scale research on dual temperature Orex (Orex DT) should be undertaken. On March 31, 1952 X-10 reported that the Orex DT pilot plant had demonstrated the feasibility of the process on a small scale, but numerous problems remained to be solved before it could be used for large scale production of ^{6}Li. In July 1952, the Orex DT process was dropped (ADP Chronology 1950-54).

A total inventory of 23,500 pounds of mercury was reported in the 1983 Mercury Task Force Report for Buildings 9733-1, 9733-2 and 9201-2 (UCCND 1983). No mercury air concentration data for any process prior to 1953 were located by the Task 2 team. However, Industrial Hygiene Section weekly mercury air analysis reports for January through March 1953 report a weekly average mercury air concentration of 0.06 mg m^{-3} for Orex in Room 25 of Building 9733-1. Although Orex DT was shut down in July 1952, initial work on the chemical reflux Orex process (Orex CR) may have occurred in Building 9733-1 prior to the April 1953 start up of Orex CR operations in Building 9202 (discussed below). This may explain the air monitoring activities in Building 9733-1 between January and March 1953.

No major losses of mercury were reported as a result of the early Orex development operations, but normal leaks and spills certainly occurred. Mercury that leaked or spilled in Building 9733-1 was reportedly collected from a steel trap installed in the floor drain system; this trap was routinely checked and emptied. According to the 1983 Mercury Task Force report, this type of trap was effective in preventing elemental mercury from Building 9733-1 from entering EFPC, and was therefore used in all future lithium separation facilities (UCCND 1983; Turner et al. 1989).

A.1.2 Orex Pilot Plant (Building 9202)

In August 1952, the decision was made to build a chemical reflux Orex (Orex CR) pilot plant in Y-12 Building 9202. The pilot plant was turned over for operation on April 28, 1953 (ADP Chronology 1950-54). Data on the quantity of mercury available at Y-12 in 1953 for Elex production scale operations indicate an inventory of 64,220 pounds of mercury was available from Y-12 Orex, presumably from Building 9202 (Tilson 1953). There were no reported leaks or spills associated with Orex CR, but 50,000 pounds of mercury were estimated as lost from inventory (Stoner 1983). On March 8, 1954, the Orex pilot plant was shut down because it failed to achieve maximum enrichment of ^{6}Li (ADP Chronology 1950-54). The floor drain trap and the storm sewer were excavated in an attempt to recover the missing mercury. The dirt from this excavation was later processed at the Building 81-10 mercury recovery facility (UCCND 1983; Turner et al. 1989).

Three documents were located by the Task 2 team regarding Orex operations in Building 9202 that have not been cited in previous investigations of mercury operations at the Y-12 Plant:

- A 1953 letter from W.L. Morgan to J.M. Case, Y-12 Plant Manager, states that Orex pilot plant "operations will be on a 3 shift basis starting on April 13, 1953 and that solvent [mercury] and other materials will be introduced within the following week or 10 days as systems are completed and released for operations" (Morgan 1953).

- An October 23, 1953 letter from W.H. Baumann, Industrial Hygiene Section, to H.M. McLeod, Building 9202, states that "the solvent [mercury] air contamination levels in Building 9202 have been equal or above the maximum permissible limit (MPL) of 0.1 mg m^{-3} for the last twelve operating weeks." Three recommendations to reduce the mercury air concentrations were made, including improved housekeeping practices and use of a floor sealer to keep mercury on the floor from volatilizing. The third suggestion involved the "installation of mechanical ventilation, both supply and exhaust, since present air movement is due to natural ventilation coming from open windows and doors" (Baumann 1953).

- A 1954 memorandum from G.B. Anderson and J. Lambdin of the Industrial Hygiene Section shows a comparison of indoor air mercury concentrations during various operating conditions, including shutdown, in Building 9202 between February and April of 1954. The conditions were "plant in operation, shutdown, renovation and evacuation". The memo also states that three exhaust fans were put into operation in Building 9202 on February 3, 4, and 12, 1954, but sizes or velocities of the fans are not given. The graph accompanying the memo shows mercury air concentrations ranging between 0.1 and 0.2 mg m^{-3} during operations and from 0.15-0.25 mg m^{-3} during the renovation, until they drop to below 0.05 mg m^{-3} after the evacuation of the building in early April. The renovation is described as the "removing of solvent [mercury] from the system, flushing and disconnecting of solvent lines and removing equipment from the area". Several spills and high outside temperatures during the renovation are cited as reasons for the elevated indoor air mercury concentrations (Anderson and Lambdin 1954).

The Task 2 team located mercury air concentration data for April 1953 through April 1954 in weekly mercury air analysis reports from the Industrial Hygiene Section that confirm this range of building air concentrations. However, the lack of mechanical ventilation in Building 9202 until just before shutdown suggests that air releases of mercury to the environment, even at building air concentrations of 0.1-0.2 mg m^{-3}, would be negligible during this period, compared to air releases from subsequent production scale lithium separation operations in buildings with 3 million cubic feet per minute ventilation systems.

A.1.3 Mercury Bottling and Cleanup Campaigns

Over 300,000 flasks of mercury were emptied at the Y-12 Plant. Some flasks were cleaned and reused, and about 200,000 empty flasks were sold as salvage. The first major bottling operation at Y-12 was in January and February 1957. The General Services Administration (GSA) requested that 13,750 flasks be shipped back to them. About 9,000 of the returned flasks had never been opened. The remainder of the flasks were refilled at a bottling station in Building 9201-4 (UCCND 1983).

The Atomic Energy Commission later directed Y-12 to return mercury to the government stockpile, or to have bottled mercury available for commercial sale or distribution to other government agencies. These additional minor bottling operations occurred in 1961, 1964-65, 1968, 1969, 1971 and 1975. Between January 1957 and December 1977, 285,084 flasks of mercury were bottled (UCCND 1983).

A second major bottling operation was conducted in 1977 to rebottle several million pounds of mercury remaining in Building 9201-4. A second bottling station was installed, and the existing station was upgraded. A new ventilation system was installed to exhaust each hood. Floor drains and other piping were modified to minimize mercury loss. A water treatment facility was installed to treat mercury-contaminated water before discharge. The water was chemically treated, filtered and sampled prior to disposal. Detailed safety analysis reports were prepared for the flasking and washing operations, and were approved by a committee from the USDOE Safety and Environmental Control Division. The flasking started in January 1977, and was completed in December 1977. According to a synopsis of the operation prepared in September 1978, the job was completed with no serious air contamination problems or incidents (Anderson 1976, 1978).

According to a 1985 study of sources of mercury discharge at Y-12, small quantities of mercury from historical deposits in buildings and the drainage system at the Y-12 Plant continued to be mobilized and transported off site (Turner et al. 1985). Specific cleanups of mercury in building sumps and removal of mercury-contaminated soils at Buildings 9733-1 and -2, 9201-2, 9204-4, 9201-5, 9201-4 and 81-10, and closure of New Hope Pond have occurred since publication of the 1983 Mercury Task Force report. In addition, three large projects have affected on-site sources of mercury release. The Reduction of Mercury in Plant Effluent Phase I (RMPE I) project involved cleaning 5500 feet of storm sewer and relining 8300 feet of storm sewer. The Utility Systems Restoration Project replaced 2000 feet of concrete pipe that carried storm flow and plant effluents from the western end of Y-12. Construction of the Perimeter

Intrusion Detection System (PIDAS) project required replacement of existing fill with clean soil of consistent properties. Soil removed from several Y-12 areas had high mercury concentrations, and was disposed of in the Chestnut Ridge Sediment Disposal Basin (MMES 1994).

A.1.4 Mercury Theft

An article titled "Mercury Means Larceny" appeared in the June 12 1965 issue of *Chemical Week.* The article describes thefts of mercury from various locations throughout the US and suggests economic conditions as the reason:

> ...Mercury has become prime loot for the underworld, and chemical companies that use and deal in the metal are being forced to take a new look at security and sources. Reasons for quicksilver's attractiveness as booty aren't hard to spot. In the last two years it's price has about quadrupled-- from about $180 for a 76-pound flask in 1963 to well over $700 last week. And published prices are largely nominal; there's virtually no mercury to be had. ...Dealers in the eastern US are paying premium prices for any mercury they can lay their hands on ...

In April 1965, an audit of physical and accounting controls over mercury at Y-12 was conducted (Christie 1965). The report concluded that mercury could be withdrawn at numerous points in Buildings 9201-5 and 9201-4 without difficulty, and the outdoor flask storage area was accessible to all vehicles except large trucks. The audit found that outgoing vehicles were not examined unless the guard became suspicious, and personal belongings were only inspected on the day shift. According to the audit report, there were no tight controls over the inventory of mercury flasks (i.e., they were not individually counted). However, flasks were serially numbered with metal dies at the request of the FBI, and a paper record of the serial numbers is kept on site. Surveillance of employee and vehicle movements at night was conducted as part of the audit. However, no incidents of theft were cited in the 1965 audit report.

According to the 1983 Mercury Task Force report (UCCND 1983), the FBI arrested and convicted two contractor employees for stealing about 100 pounds of mercury in 1969 when Building 9201-5 was being modified (Knoxville News Sentinel, June 4, 1969). Unsubstantiated claims of larger and more routine mercury thefts have reportedly been brought to the attention of the FBI, but no reports of additional arrests are available.

A.1.5 Mercury Compounds in Weapons Components

Mercury alloyed with thallium was used in the production of several weapon components at Y-12. The production process that used the mercury-thallium alloy is not currently active, but the details of the process are classified as SRD (Secret Restricted Data). The mercury-thallium alloy was mixed at the Bendex/Allied-Signal Plant in Kansas City using mercury supplied by Y-12, loaded into sealed bottles, and shipped to Y-12. The system that handled the mercury-thallium alloy was a closed system located in a hood that vented to a stack in Building 9204-2. The system tubing was periodically purged with air, and this resulted in a small release of mercury to the air. Approximately 300 pounds of mercury in the form of a mercury-thallium alloy were used at Y-12 (Radle 1996; Baylor 1996). The quantity of mercury used in this process was small compared to the large quantities of mercury used in lithium separation processes, and releases of mercury to air from the purging operation are believed to have been negligible compared to air releases from Colex and Elex operations.

Several 75-pound bottles of left-over mercury-thallium alloy are currently stored at Y-12 near Building 9720-18 (Radle 1996; Baylor 1996). The Industrial Hygiene monthly sampling program in May 1983 included the mercury-thallium operation in Building 9204-2E. A May 1983 letter from the Industrial Hygiene Department cited four air samples from Building 9204-2E, with mercury concentrations ranging from 0.02-0.03 mg m^{-3}. The American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value® (TLV) for mercury at that time was 0.05 mg m^{-3}. In addition, the letter emphasized the removal of any visible mercury contamination on any parts leaving the mercury-thallium area (Ford 1983).

A.1.6 Mercury in Instrumentation

Mercury was also used at Y-12 in the instrumentation associated with uranium enrichment calutrons between 1943 and 1946. Mercury was purified in the same way as it was at K-25. A July 1944 memorandum from an industrial hygienist regarding an investigation of mercury use in Y-12 Building 9202, Room 10, was located by the project team (Smith 1944). The memorandum says:

> Mercury purification has recently been taken over by Mr. DeHaan. This consists of washing and distillation. The washing is performed with aeration in a closed system. An all-metal still is used for distillation. This still and the cleaned mercury storage area are completely enclosed in a large hood with good draft which is used for this purpose alone. The hood discharges at the rear of the building about ten feet above the ground. No other buildings are located near this vent.

No additional information regarding this use of mercury at Y-12 was located by the project team.

A.2 MINOR USES AND OCCURRENCES OF MERCURY AT X-10

Minor uses and occurrences of mercury at X-10 included:

- Orex lithium isotope separation,
- feed materials processing,
- Metallex purification,
- Hermex processing, and
- other fuel reprocessing.

These process-related sources of mercury at X-10 are described below.

A.2.1 Orex Lithium Isotope Separation

The two Orex processes, chemical reflux and dual temperature, used the same chemical systems of lithium chloride in ethylene diamine contacted with lithium amalgam, but differed in the way reflux was accomplished. Chemical reflux had a higher overall isotope separation factor, but was more costly. Dual temperature reflux had a lower overall separation factor, but was simpler and therefore cheaper. Both types of reflux processes were developed simultaneously, although development of the dual temperature process proceeded more quickly. An Orex pilot plant for both the chemical reflux and dual temperature processes at X-10 was to be constructed and ready for operation in 1953 in Building 4501 (Carter et al. 1952).

The total mercury inventory at X-10 during Orex pilot plant operations was 150,000-200,000 pounds, taken from the Y-12 mercury inventory (LaGrone 1983). Calculations of the mercury inventory at ORR in 1953 include an estimate of 151,952 pounds of mercury for X-10 Orex (Tilson 1953). A March 1953 letter regarding mercury requirements for Orex operations (Carter 1953) says that the inventory of mercury for Orex at X-10 was 194,285 pounds.

To reduce mercury fumes in X-10 Building 4501, the concrete basement floor was flooded with four inches of water. A steel grate above the water supported equipment and personnel. Condensed mercury was pumped to a tank truck and transferred to X-10 Building 3592 for cleaning and recycling (Parker 1986, as cited in Taylor 1989). The X-10 Orex project was terminated in July 1954 (Larson 1954). According to Parker (Parker 1986, as cited in Taylor 1989), operating personnel estimated that 50,000 pounds of mercury may have been lost during the process (Parker 1986, as cited in Taylor 1989). It is unclear if this was an inventory shortage or mercury actually spilled. According to LaGrone (1983), Orex operating personnel estimated that 2,000-3,000 pounds of mercury were lost due to spills and leakage. Spills occurred when pumps failed while pumping amalgam to the upper level of the building. It is unclear how much of the spilled mercury may have been recovered at the time of the spill. However, soil samples taken in 1983 around X-10 Building 4501 confirmed that mercury escaped from the basement concrete floor seams (Taylor 1989).

Mercury from X-10 Building 4501 operations was cleaned using resin exchange columns in X-10 Building 3592. The clean mercury was placed in containers and later moved to Y-12. A spill of approximately 45,000 pounds of mercury occurred in X-10 Building 3592, and 5500-11,000 pounds were not recovered and were lost to the surrounding soil (Dinsmore 1986, as cited in Taylor 1989). X-10 Building 3503 was used to store empty mercury flasks and cleaned mercury from Building 3592 until 1963 (Taylor 1989). Mercury-contaminated soil has been found around X-10 Buildings 4501, 3592 and 3503 (USDOE 1989). Mercury has also been identified in the sediments of White Oak Creek and White Oak Lake (LaGrone 1983).

A.2.2 Feed Materials Processing

Mercury was used in the chemical separation of several actinides (i.e., thorium, uranium and plutonium) from other fission products and other impurities in nuclear fuel elements, and also in the reduction of thorium and uranium compounds to their metallic forms. Use of mercury as a solvent in chemical separations was an area of research and development at X-10 in the 1940s and 1950s. The actinides uranium, plutonium and thorium are more soluble in mercury than other fission products, fission product oxides, or contaminants such as iron, nickel or chromium. These actinide elements form amalgams with mercury, and in the presence of excess mercury, the actinide elements are "wetted" by the mercury, which prevents the highly pyrophoric metals from forming oxides (Dean et al. 1959; Dean and Ellis 1957). Research at X-10 on uses of mercury, taking advantage of these properties, included:

- as a catalyst in dissolving uranium coating alloys (Torrey 1943);
- for gamma decontamination (Powell 1944);
- in a cathode for analytical uranium determinations (Kitson 1945); and,
- for purification of uranium solutions (Baldwin 1946).

No information on the quantities of mercury used in these experiments was located by the project team. However, it is likely that very small quantities were used in these bench scale experiments.

A.2.3 Metallex Purification

In a January 1955 proposal to the US Atomic Energy Commission, C.E. Larson, Director of ORNL, requested expansion of a present study of a process called Metallex for purifying thorium metal. The letter states that the present thorium production process was expensive due to the use of a costly calcium reducing agent and an expensive remelting operation, and that the Metallex process could result in significant economies for the production of reactor grade thorium metal. The letter also states that the Metallex process was still in the laboratory stage of development, but appeared promising for production (Larson 1955). Another 1955 report on the status of the Metallex process (Blanco 1955) states that work was initiated at X-10 in fiscal year 1954 on more economical methods for preparing uranium and thorium metal from their compounds.

The Metallex process used sodium amalgam (sodium in mercury) for the reduction of uranium and thorium chlorides to their metal forms. Thorium tetrachloride reacted with sodium amalgam to form an amalgam (the reduction step), then was washed with dilute acid to remove impurities, filtered and cold-pressed to increase the thorium concentration in the amalgam, vacuum-distilled to remove the mercury, and compressed into billets for slug fabrication. Mercury was a contaminant in the final product at 13-40 ppm. However, mercury recovered during the process (90% during filtration and 9-10% during vacuum-distillation) was recycled to the amalgam maker for reuse.

Several X-10 reports written between 1955 and 1957 discuss continued work on the Metallex process, including further research on thorium reduction (Culler 1955); application of the Metallex process to direct reduction of uranium hexafluoride to uranium metal at Y-12 (Scott 1957); and making the Metallex a continuous process of batch and using it to purify metals (Dean 1957a).

A preliminary cost study of the Metallex process in 1954 (Schaeffer 1954) includes a projected material inventory for mercury of 79,100 pounds. A raw material inventory loss for mercury is estimated in the cost study as 1.93 pounds per day, or 11,600 pounds per year. (Note that mercury is a contaminant in the Metallex product, as discussed above, and therefore some mercury is lost from the process in the product.) According to Taylor (1989), Metallex was demonstrated in 1955 in X-10 Building 4505. Taylor cites, but does not identify, “an early report that indicated as much as 296,000 pounds of mercury were required for the [Metallex] process." Operating personnel estimated that 4,400 pounds may have been lost in spills (Dinsmore 1986, as cited in Taylor 1989). Soil samples taken near Building 4505 in 1983 showed mercury contamination (Taylor 1989). The project team did not locate any additional documentation regarding the quantities of mercury actually used or released as a result of Metallex processing.

Note that the early report cited in Taylor (1989) as the source of the estimate of 296,000 pounds of mercury used in Metallex operations is not identified. The Unit Operations Experimental Program, which conducted the fuel reprocessing development work, had an inventory of 45,200 pounds of mercury in 1953 (Carter 1953). A 1954 cost study projects that Metallex would require 79,100 pounds of mercury (Schaeffer 1954). A March 1953 letter (Carter 1953) gives a total mercury inventory at X-10 of 239,485 pounds, including Orex, which used 150,000-192,000 pounds of mercury (Tilson 1953; Carter 1953; LaGrone 1983). According to Hickman (1974), about 2.35 million pounds of mercury were received at the ORR during 1953 and 1954. About 1.8 million pounds were being used at Y-12 (Tilson 1953), leaving about 560,000 pounds of mercury theoretically available for X-10 use. An October 1954 letter (Scott 1954) states that 256,272 pounds of mercury were transferred from X-10 to the Y-12 Plant. In addition, information reviewed by theTask 2 team indicates that all of the mercury received at the ORR in 1955 and 1956 went to the Alpha-5 and Alpha-4 Colex plants at Y-12. Therefore, 304,000 pounds of mercury (560,000-256,000) may have remained at X-10 between 1955 and 1957, and could have been available for fuel reprocessing operations such as Metallex, Hermex, and possibly Purex.

A.2.4 Hermex Processing

In laboratory scale tests conducted at ORNL prior to May 1956, uranium was dissolved rapidly in boiling mercury and recovered from the cooled amalgam as uranium mercuride by filtering and pressing in a process called Hermex (Blanco et al. 1956). A January 1956 report (Morrison and Blanco 1956) describes proposed applications and experimental results to date for the Hermex process for metal decontamination. The basis of the Hermex process is the solubility of uranium and other metals in mercury. Mercury was used as the solvent in initial experiments that studied the removal of fission products from irradiated uranium, and recycle of scrap uranium. Initial laboratory work used boiling (356 F) mercury to dissolve irradiated uranium, followed by removal of the uranium-mercury solution from a slag containing 87% of the fission products and impurities, cooling the uranium-mercury amalgam to 25 C, vacuum filtration to concentrate the uranium in the amalgam, washing with dilute acid to remove an additional 6% of the fission products and impurities, volatilization of mercury from the amalgam, and melting of the uranium to dense metal. According to the process description, the mercury filtrate from the filtration step and the mercury volatilized in the final step were both recycled back to the dissolver (Morrison and Blanco 1956).

The 1956 report says that the process for recycling uranium scrap was dissolution in acid, purification by solvent extraction, conversion to salt, and reduction back to metal. It was claimed that the Hermex process could reduce many chemical costs, since uranium processed by Hermex did not require the oxidation and reduction steps. In addition, cooling times for processing irradiated uranium could be shortened due to the high decontamination indicated by initial Hermex experiments. The report also said that "a program is now underway to evaluate a number of applications for mercury as a metal reprocessing agent" (Morrison and Blanco 1956).

No indication of the building where Hermex was conducted, or inventories of mercury used, are provided in Morrison and Blanco (1956). However, an experiment is described which used 140 mL of mercury and produced a uranium button with mercury contamination of 10-30 ppm. A 1957 letter regarding costs of mercury in the Hermex process (Dean 1957b) estimated costs per pound of uranium processed. In this theoretical calculation, 573 pounds of mercury per pound of uranium processed was the estimate of mercury inventory. Theoretical losses were assumed to be 10%, but no basis for this assumption is given. In a paper on the Hermex process prepared for presentation at an American Nuclear Society meeting in December 1960 (Dean and Messing 1960), four experiments are described that used 200 mL, 200 mL, 1500 mL, and 300 mL of mercury, respectively. It is apparent that the Hermex process did not use significant quantities of mercury relative to Colex operations at Y-12. Hermex process documents indicate that the majority of the mercury used in Hermex experiments was recovered during the process and reused, and that the only documented losses occurred as trace contamination in the product.

A.2.5 Other Fuel Reprocessing

According to a 1989 Remedial Investigation Plan, mercury was used in the spent fuel reprocessing program known as Purex in the 1950s and early 1960s in Building 3503 (USDOE 1989). According to a statement made at the 1983 Congressional Subcommittee Hearings on Mercury Releases at ORR, Building 3503 housed a small R&D effort in support of the fission reactor fuel reprocessing program in the early 1960s (LaGrone 1983). The project team did not locate any documents regarding this use of mercury in Building 3503. However, these references could be references to Metallex or Hermex development work, or similar fuel reprocessing research.

To summarize, 304,000 pounds of mercury (560,000 lb. received minus 256,000 lb. in Orex) may have remained at X-10 between 1955 and 1957, and could have been available for fuel reprocessing operations such as Metallex, Hermex, and possibly Purex. Estimates of mercury spilled during Orex and fuel reprocessing operations from undocumented 1986 personal communications (Parker 1986 and Dinsmore 1986, as cited in Taylor 1989) range from 18,400 to 65,400 pounds. It is unclear how much of the spilled mercury may have been recovered at the time of the spills.

A.3 MINOR USES AND OCCURRENCES OF MERCURY AT K-25

A small distillation unit used to purify mercury to instrument grade operated at K-25 from 1948-1971 (LaGrone 1983). The operation existed in three different buildings during the period from 1948 until the early 1980s.

- Building K-1303 from 1948 to 1956,
- Building K-1024 from 1956 to 1960s,
- Building K-1420 from late 1950s to early 1980s.

Mercury was also present in coal burned at the K-25 powerhouse located near the S-50 site.

These process-related sources of mercury at K-25 are described below.

A.3.1 Building K-1303

According to a 1995 hazard classification report for Building K-1303 (LMES 1995), K-1303 provided storage and distribution of gaseous fluorine for the K-25 cascade beginning in 1944. In 1948, the fluorine process equipment was removed, and K-1303 became the decontamination facility for process converters from the K-25 building. A uranium recovery, mercury distillation, and oil recovery facility were also installed at that time. In 1948, the exhaust system was modified to direct and discharge mercury vapors to the atmosphere above the roof of the building. Condensation of mercury on the roof and rainfall runoff could have contaminated the soil around the building (Goddard et al. 1991). Dilute nitric acid used in the mercury distillation/washing process was discharged to the storm drains, and contained trace amounts of mercury. This drain system discharged eventually to the K-1407 holding pond (LMES 1995).

The following quantities of mercury were processed in the K-1303 Mercury Recovery Room during the periods listed below.

February 1-16, 1947	768 pounds	(Preuss 1947)
1947 Annual total	10,345 pounds	(Hartman 1948b)
week of September 6, 1948	160 pounds	(Hartman 1948a)
week of September 12, 1948	376 pounds	(Hartman 1948a)
week of September 19, 1948	192 pounds	(Hartman 1948a)
week of September 27, 1948	360 pounds	(Hartman 1948a)

The percentage recovery of mercury was 99%, and small losses resulted when the triple-distilled mercury was dried by passing it through a column of silica gel (Hartman 1948b).

A.3.2 Building K-1024

Building K-1024 was constructed in 1945 and used for the K-25 site's instrument maintenance shops until 1963 when the shops were relocated (MMES 1991). A January, 1946 memorandum from the Safety Department to L.L. Forward, Superintendent of the Instrument Division, recommends actions to be taken in the Electronic Shop in Building K-1024 to reduce mercury air concentrations (Bull 1946a). A November, 1946 letter from Bull to Forward says that the mercury vapor concentration had been reduced in the preceding nine months due to greatly improved housekeeping and improved general ventilation in Room 13 (Bull 1946b). A January, 1947 letter from Bull to Forward included an attachment prepared by a visiting Industrial Hygienist from Union Carbide that recommended general ventilation changes and installation of a hood for some processes conducted in K-1024 that vaporized mercury (Bull 1947). Minutes from a February, 1947 meeting of the Industrial Hygiene Committee (Bemor 1947) document a discussion of the proposed ventilation changes. The minutes say that the mercury vapor hazard in the Instrument Electronic Shop is almost completely under control due to improved housekeeping practices, and therefore the recommended ventilation changes are unnecessary. A July, 1947 memorandum from N.H. Ketcham and F.W. Hurd, Industrial Hygiene Section, to Dr. M.J. Costello, Medical Department, presents the results of air sampling conducted in Room 10 of K-1024 following a mercury spill on June 13, 1947. The quantity of mercury spilled is not reported (Ketcham and Hurd 1947).

Minutes from a discussion of a paper titled "Summary Report of the Nature of the Chemical Contaminants Found in the Atmosphere in K-25, K-27, and Fercleve Areas" that occurred on September 24, 1946 (Bull et al. 1946) indicates that mercury was used in the following areas:

- Building 1024, Rooms 13, 14, and 4- Instrument Repair (says they repaired line recorder tube racks, which involved working with mercury diffusion pumps and unplugging chemical traps containing mercury);

- Buildings 1401 and 1301- Mercury Recovery (says that they had moved out of both locations, and the recovery equipment was going to be installed in Building 1303);

- Building 1004-C, Rooms 261 and 265- Instrument Repair (says they were handling mercury diffusion pumps on line recorders).

A report titled "Industrial Hygiene Field Investigations During the First Half of 1948 (August 9, 1948)" includes a summary of locations in which investigations were made during the first half of 1948 (Ketcham 1948). A table of air analyses for chemical contaminants in May 1948 also shows sampling locations in various buildings (Visner 1948). According to these two documents, the following locations on the K-25 site were routinely sampled for mercury vapor in 1948:

- K-1004-A,-C and -D research laboratories
- K-1024 electronic shop and mercury recovery room
- K-1035 laboratory storage
- K-1037 barrier test room
- K-1095
- K-1303 decontamination room mercury stills
- K-1401 furnace area mercury stills and research laboratory

Results of mercury air sampling in K-1024 in 1961 and 1962 located by the project team indicate that mercury was used in K-1024 at least until October 1962.

A.3.3 Building K-1420

Operations in the K-1420 Mercury Recovery Room during the 1960s and 1970s included cleaning used mercury and recovering it from mercury-bearing wastes using a distillation process (MMES 1987). Results of mercury air sampling in K-1420 located by the project team indicate that mercury was used in K-1420 from 1958 to 1963 (Stoddard 1959, 1963).

The mercury recovery room was located on the ground floor of the K-1420 building. Mercury contaminated wastes and used mercury were washed with nitric acid and the solutions transferred to the distillation units. A triple distillation process, consisting of three stills in series, was used to purify elemental mercury by sequential vaporization and condensation. In the third distillation unit, mercury was condensed into a recovery bottle at a purity of 99.9%, and the water decanted. The sink contained a standpipe that prevented mercury from entering the drain at sink level. A floor drain in the center of the room was raised from floor level, preventing most spills from entering the drain line. Spills associated with the distillation units were contained in the curbed area beneath the stills. The effluent from the room's drain lines discharged into the K-1407-B holding pond (Goddard et al. 1991). When the allowable concentration limits for airborne mercury under the National Emission Standards for Hazardous Air Pollutants (NESHAP) changed, the Mercury Recovery Room's ventilation system had to be upgraded to meet the new standard. K-25 management decided not to renovate the exhaust system and the mercury recovery operation was shut down in the early 1980s (MMES 1987).

In the mid 1960s, 90,000 mercury shipping flasks from Y-12 were cleaned at K-25 and returned to Y-12 for draining Y-12 process equipment. As a result of these cleaning operations, small quantities of mercury were released to Poplar Creek (LaGrone 1983). The ORGDP (K-25) was contracted to recover approximately 1000 pounds of mercury from mercury batteries by a private company during 1968-70 (Herb 1970).

According to LaGrone (1983), several hundred pounds of mercury were purified per month at the K-25 mercury distillation facility (presumably this is representative of each of the various buildings). This estimate is supported by data located by the project team that shows about 800-1100 pounds were processed per month in 1947 and 1948. However, a total of 6327 pounds of mercury were used and processed by the ORGDP from 1968 through March of 1970 (Herb 1970), or only 230 pounds per month. As a result of the distillation operations, mercury was discharged to a holding pond (K-1407-B) that went to Poplar Creek (Goddard et al. 1991). In 1947, 99% recovery of mercury from the process was claimed (Hartman 1948b). The holding pond was dredged in the 1960s and again in 1973, and mercury contaminated sludge was removed and stored for disposal (LaGrone 1983). In 1991, mercury was found in the center floor drain of the K-1420 room, but not in sludge from the K-1407-B holding pond (Baer 1993). Operating personnel estimated that 1500 pounds of mercury were lost between 1948 and 1971 (LaGrone 1983). According to a September, 1985 letter from J.G. Rogers to L.W. Long regarding chemical release inventories at the ORGDP, reliable information for developing a mass balance of mercury at ORGDP prior to 1979 is unavailable due to a retention period for purchasing records of only six years (Rogers 1985). The basis for the 1,500 pound estimate is described in this letter:

> On June 10 1983 Mike Mitchell transmitted some information to Tom Scott at USDOE for a press release regarding the mercury balance at the ORGDP. He developed the information by using sampling data at effluent points and flow measurements at the same locations. He calculated that 265 pounds of mercury was discharged from all liquid effluent locations from 1971-1982. By assuming similar activities and release rates for the period from 1948-1971, an additional 600 pounds of mercury were estimated to have been released from ORGDP. Mike Mitchell also estimated that 600 pounds of mercury were lost during the 1960s bottle washing operation [described above]. This results in a total estimate of 1465 pounds of mercury released from the ORGDP from 1948-1982.

A.3.4 K-25 Powerhouse

From 1944 until June, 1962, the K-25 powerhouse located near the S-50 site burned 5.9 million tons of coal, according to a compilation of K-25 quarterly reports for this period (Pesci 1996). Assuming a mercury content of 0.5 mg/kg of coal (Turner et al. 1991) and no air pollution controls for mercury, 319 pounds of mercury per year would have been released to the air from the K-25 powerhouse between 1944 and 1962.

A.4 References

ADP Chronology 1950-54. Author, date unknown. *Chronology of the Alloy Development Plant Development Program 1950-54*. (ChemRisk Repository No. 3265).

Anderson 1976. J.S. Anderson. *Safety Analysis Report on Mercury Flasking*. December 6 1976. Y/MA-5556. (ChemRisk Repository No. 3265).

Anderson 1978. J.S. Anderson. *Mercury Flasking Synopsis*. September 25 1978. Y/HG-0268/del rev. (ChemRisk Repository No. 3265).

Anderson and Lambdin 1954. Memorandum from G.B. Anderson and J. Lambdin of the Industrial Hygiene Section regarding Building 9202 Orex operations. 1954. MS/ChR2-0216. (ChemRisk Repository No. 3262).

Baer 1993. Marv Baer. Personal communication. August 17 1993. Cited in ChemRisk (1993a).

Baldwin 1946. W.H. Baldwin. *Use of the Mercury Cathode for the Purification of Uranium Solutions*. November 5, 1946. ORNL/CF 46-11-89. (ChemRisk Repository No. 3269).

Baumann 1953. Memorandum from W.H. Baumann, Industrial Hygiene Section, to H.M. McLeod, Building 9202, regarding solvent air contamination, Orex. October 23, 1953. MS/ChR2-0198/del rev. (ChemRisk Repository No. 3262).

Baylor 1996. R. Baylor. Interview with Mr. Richard Baylor, Y-12 Classification Office, on November 6, 1996. (ChemRisk Repository No. 3270).

Bemor 1947. L.G. Bemor. Minutes from a February 7 1947 meeting of the Industrial Hygiene Committee at the ORGDP. (ChemRisk Repository No. 3268).

Blanco 1955. Memorandum from R.E. Blanco to F.L. Culler regarding status of the Metallex process. January 10, 1955. ORNL/CF 55-1-53. (ChemRisk Repository No. 3269).

Blanco et al. 1956. R.E. Blanco, W.K. Eister, and D.E. Ferguson. *Power Reactor Fuel Processing Preliminary Report.* ORNL/CF 56-5-48. May 14 1956. Cited in ChemRisk (1993a).

Bull 1946a. Memorandum from J.H. Bull, Safety Department, to L.L. Forward, Superintendent of the Instrument Division, regarding the electronic shop in Building K-1024. January 28, 1946. (ChemRisk Repository No. 3268 or 1194).

Bull 1946b. Memorandum from J.H. Bull, Safety Department, to L.L. Forward, Superintendent of the Instrument Division, regarding Building K-1024. November 14, 1946. (ChemRisk Repository No. 3268 or 1194).

Bull et al. 1946. J. Bull. Minutes from discussion of paper titled "Summary Report of the Nature of the Chemical Contaminants Found in the Atmosphere in K-25, K-27, and Fercleve Areas- Section C, Contaminant Mercury". September 24, 1946. (ChemRisk Repository No. 3268).

Bull 1947. Memorandum from J.H. Bull, Safety Department, to L.L. Forward, K-1034 Building, regarding mercury in the electronic shop, K-1024. January 24, 1947. (ChemRisk Repository No. 3268 or 1135).

Carter et al. 1952. Letter report from W.L. Carter, H.O. Weeren, and F.L. Culler to F.L. Steahly regarding notes on Orex Processes. April 21, 1952. ORNL/CF 52-4-167. (ChemRisk Repository No. 3269).

Carter 1953. Memorandum from W.L. Carter to F.L. Steahly and F.L. Culler regarding mercury requirements for Orex operations. March 23, 1953. ORNL/CF 53-3-178. (ChemRisk Repository No. 3269).

Christie 1965. Report from F.O. Christie, Chief, Audit Branch, to W.H. Henderson, Director of Finance regarding physical and accounting controls over mercury at Y-12. April 13, 1965. Y/TS-1630. (ChemRisk Repository No. 3265).

Culler 1955. Memorandum from F.L. Culler to W.A. Jenkins regarding Metallex. April 11, 1955. ORNL/CF 55-4-72. (ChemRisk Repository No. 3269 or 2788).

Dean 1957a. Memorandum from O.C. Dean to F.L. Culler regarding Metallex objectives. February 4, 1957. ORNL/CF 57-2-55. (ChemRisk Repository No. 3269).

Dean 1957b. Memorandum from O.C. Dean to F.L. Culler regarding mercury costs in the Hermex process. November 20, 1957. ORNL/CF 57-11-133. (ChemRisk Repository No. 3269).

Dean and Ellis 1957. O.C. Dean and G.K. Ellis. *The Preparation of Thorium Metal by Sodium Amalgam Reduction of Thorium Chloride: The Metallex Process.* To be presented at the American Nuclear Society Meeting October 28-31. ORNL/CF 57-10-28. (ChemRisk Repository No. 3269).

Dean et al. 1959. O.C. Dean, A.F. Messing, H.C. Forsberg. *The Use of Mercury in Reprocessing Nuclear Fuels.* To be presented at the American Society of Mechanical Engineers Meeting February 1960. ORNL/CF 59-7-60. (ChemRisk Repository No. 3269).

Dean and Messing 1960. O.C. Dean and A.F. Messing. *Hermex Process: The Solubilities of Selected Metals in Mercury.* For presentation at the American Nuclear Society Meeting December 12. ORNL/CF 60-8-107. (ChemRisk Repository No. 3269).

Ford 1983. Memorandum from R.T. Ford, Industrial Hygiene Department, to G.E. Isham, Building 9204-2E, regarding air sampling of the mercury-thallium operation in Building 9204-2. May 18, 1983. (ChemRisk Repository No. 3262).

Goddard et al. 1991. P.L. Goddard, A.J. Legeay, D.S. Pesce, and A.M. Stanley. *Site Description of Environmental Restoration Units at the Oak Ridge K-25 Site, Oak Ridge, Tennessee*. Martin Marietta Energy Systems. K/ER-47. (ChemRisk Repository No. 242). Cited in ChemRisk (1993a).

Hartman 1948a. W.C. Hartman. Chemical Operations Weekly Progress Reports for September 1948. K/EM-291 from KP-5/PTS 2-5. (ChemRisk Repository No. 3268 or 2802).

Hartman 1948b. W.C. Hartman. *Chemical Operations Department Annual Report 1947*. K/EM-184 from K-138. (ChemRisk Repository No. 3268).

Herb 1970. *Inventory of Mercury Usage at the ORGDP 1968- March 1970*. November 25 1970. (ChemRisk Repository No. 3268).

Hickman 1974. Letter from H.D. Hickman, Director Manufacturing Division, to D.K. Geston, Chief Uranium Enrichment Branch, regarding mercury purchases and sales 1950-1973. June 20, 1974. Y/HG-0264. (ChemRisk Repository No. 3265).

Ketcham 1948. N.H. Ketcham. *Report of Industrial Hygiene Field Investigations During the First and Second Quarters 1948-- Summary of Locations in Which Investigations Were Made*. August 9, 1948. K/EM-141 from K-247. (ChemRisk Repository No. 3268).

Ketcham and Hurd 1947. Memorandum from N.H. Ketcham and F.W. Hurd, Industrial Hygiene Section, to Dr. M.J. Costello, Medical Department, regarding mercury contamination in K-1024. July 7, 1947. (ChemRisk Repository No. 3268).

Kitson 1945. Memorandum from R.E. Kitson to B.F. Butler regarding a summary of the work done on the mercury cathode. July 26, 1945. ORNL/CF 45-7-476. (ChemRisk Repository No. 3269).

LaGrone 1983. J. LaGrone. Includes a written statement and the transcript of the actual testimony of Joseph LaGrone, Manager, U.S. DOE Oak Ridge Operations, included in Lloyd and Gore 1983. July 11, 1983. (ChemRisk Repository No. 3278).

Larson 1954. Memorandum from C.E. Larson to H.M. Roth regarding termination of the Orex project. August 3, 1954. ORNL/CF 54-8-50. (ChemRisk Repository No. 3269).

Larson 1955. Memorandum from C.E. Larson to H.M. Roth regarding proposal for a new program, Metallex. January 10, 1955. ORNL/CF 55-1-79. (ChemRisk Repository No. 3269).

LMES 1995. Lockheed Martin Energy Systems. *Hazard Classification for Building K-1303*. September 1995. ER033638. (ChemRisk Repository No. 3268).

MMES 1987. Martin Marietta Energy Systems. *RCRA Facility Investigation Plan K-1420 Mercury Room ORGDP*. November 1987. ER005565. (ChemRisk Repository No. 3268).

MMES 1991. Martin Marietta Energy Systems. *Remedial Site Evaluation Report on the K-1024 Diluting Pit*. ER025458. (ChemRisk Repository No. 3268).

MMES 1994. Martin Marietta Energy Systems. *Integrated Strategy for Mercury Remediation Plan for the Oak Ridge Reservation*. December 1994. Y/ER-63. (ChemRisk Repository No. 3274).

Morgan 1953. Letter from W.L. Morgan to J.M. Case, Y-12 Plant Manager, 9202 Orex, regarding startup of the Orex pilot plant operations. 1953. MS/ChR2-0198/del rev. (ChemRisk Repository No. 3262).

Morrison and Blanco 1956. Memorandum from B.H. Morrison and R.E. Blanco to F.L. Culler regarding the Hermex process for metal decontamination by mercury processing. January 25, 1956. ORNL/CF 56-1-151. (ChemRisk Repository No. 3269).

Pesci 1996. Nick Pesci. *Tabulation of Lifetime Coal Consumption*. Historical Investigation Special Report S/R 7. K-701 Power Station/ Boiler House.

Powell 1944. H.N. Powell. *Use of Hg and Ce for Gamma Decontamination, ORSD Case No. S-1432*. August 25, 1944. ORNL/CF 44-8-737. (ChemRisk Repository No. 3269).

Preuss 1947. Letter from H.M. Preuss, K-1300 Area Technical Supervisor, to E.D. Flickinger and L.L. Anthony, Jr. regarding semi-monthly progress report, K-1300 Area. February 24, 1947. KZ-5635. (ChemRisk Repository No. 3268).

Radle 1996. J. Radle. Interview with Mr. Jim Radle, Building 9204-2 operations, on November 6, 1996. (ChemRisk Repository No. 3270).

Rogers 1985. Letter from J.G. Rogers to L.W. Long regarding chemical release inventories at the ORGDP. September 17, 1985. (ChemRisk Repository No. 3268 or 1138).

Schaeffer 1954. Memorandum from W.F. Schaeffer regarding Metallex Process preliminary cost study. August 20, 1954. ORNL/CF 54-8-244. (ChemRisk Repository No. 3269).

Scott 1954. Memorandum from C. Scott, Materials Department, to D.W. Harrigan regarding solvent transfer from X-10. October 27, 1954. Y/HG-0083. (ChemRisk Repository No. 3265).

Scott 1957. Memorandum from C.D. Scott to J.C. Bresee regarding vapor phase Metallex studies. May 8, 1957. ORNL/CF 57-5-47. (ChemRisk Repository No. 3269).
Smith 1944

Stoner 1983. H.H. Stoner. *Y-12 Activities Related to Mercury 1950-66.* June 9, 1983. Y/HG-0071. (ChemRisk Repository No. 3265).

Taylor 1989. F.G. Taylor, Jr. *Mercury Assessment for Water and Sediment in Oak Ridge National Laboratory Streams*. March 1989. ORNL/M-713. (ChemRisk Repository No. 3269 or 163).

Tilson 1953. F.V. Tilson. Solvent Inventory calculations. September 20, 1953. Y/HG-0341. (ChemRisk Repository No. 3265).

Torrey 1943. Memorandum from J.V.P. Torrey to J.B. Sutton regarding solubility of uranium alloy coatings in nitric acid containing mercuric nitrate. March 12, 1943. ORNL/ CF 43-3-118. (ChemRisk Repository No. 3269).

Turner et al. 1985. R.R. Turner, G.E. Kamp, M.A. Bogle, J. Switek, R. McElhaney. *Sources and Discharges of Mercury in Drainage Waters at the Y-12 Plant.* June 1985. Y/TS-90. (ChemRisk Repository No. 450).

Turner et al. 1989. R.R. Turner, M.A. Bogle, E.A. Zeighami, T.M. Mercier. *RCRA Facility Investigation Plan for Mercury-Use Areas (S-127).* December 1989. Y/TS-597. (ChemRisk Repository No. 3273).

Turner et al. 1991. R.R. Turner, M.A. Bogle, L.L. Heidel and L.M. McCain. *Mercury in Ambient Air at the Oak Ridge Y-12 Plant July 1986 through December 1990*. August 1991. Y/TS-574. (ChemRisk Repository No. 396).

UCCND 1983. Union Carbide Company Nuclear Division. The 1983 Mercury Task Force. *Mercury at Y-12: A Study of Mercury Use at the Y-12 Plant, Accountability, and Impacts on Y-12 Workers and the Environment– 1950-1983*. Y/EX-21/del rev. August 18, 1983. (ChemRisk Repository No. 449).

USDOE 1989. United States Department of Energy. *Remedial Investigation Plan for ORNL Waste Area Grouping 1*. August 1989. ER003961. (ChemRisk Repository No. 3269 or 139).

Visner 1948. S. Visner. *Health Physics Activities for May 1948*. K-178/PTV/DEL. (ChemRisk Repository No. 3268).

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APPENDIX B

EXCERPTS DESCRIBING HISTORICAL MONITORING, ANALYSIS, AND SPECIATION OF MERCURY IN AIR AND WATER AT Y-12

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APPENDIX B

EXCERPTS DESCRIBING HISTORICAL MONITORING, ANALYSIS, AND SPECIATION OF MERCURY IN AIR AND WATER AT Y-12

This appendix presents excerpts taken from Y-12 reports that document monitoring and analytical methods historically used by Y-12 staff to measure mercury concentrations in building air and liquid effluent at Y-12, as well as information on the speciation of mercury in various media. [*Throughout this appendix, comments in brackets and italics have been inserted by the project team*.]

B.1 Monitoring Procedures and Analytical Instrumentation for Airborne Releases

The following information describing methods for monitoring mercury in building air is provided in the 1983 Mercury Task Force Report (UCCND 1983a):

> A routine sampling program for mercury vapor in air was initiated at Y-12 in 1949. In 1950, mention was made of use of the General Electric mercury vapor detector. By 1952, reports from the [*Y-12*] Industrial Hygienist showed that more than 6,000 air samples were taken that year. At the time large-scale use of mercury for lithium separation at Y-12 had developed, methods of air sampling were still being investigated by the IH group. Only three commercially available methods were found. Of the three, only the General Electric Instantaneous Mercury Vapor Detector was found to be reliable. Although it was not a fully portable instrument, it was used successfully in Y-12 during many years of these [*lithium separation*] operations. The GE detector operated on 110 volts AC, weighed 35 pounds, was equipped with neck strap harness and, within the limitations of the power cord, was portable. The air was continuously drawn into the instrument by a blower and passed through a detection chamber. In the detection chamber, the 3537 [*should be 2537*] angstrom wavelength from an ultraviolet light was absorbed by the mercury proportionally to the mercury vapor concentration. Each mercury vapor detector had its own calibration chart from which the mercury concentration could be read. The meter was found to be accurate and sensitive over the range of 0.01-1.5 mg/m^3. The instrument was calibrated by passing a known flow rate of nitrogen over heated mercury and cooling it with a condenser to get a saturated mercury vapor. With this flow rate and known saturation concentration of mercury at recorded temperatures, various concentrations could be obtained by mixing pure nitrogen with nitrogen saturated with mercury. The mercury vapor detector was calibrated at a variety of concentrations.
>
> A version of the instrument described above had a recording chart and could be used on a continuing basis to record the mercury vapor level at a location over a continuous period of time. Because of the heavy weight of the GE instrument described above and the difficulty of using it under Y-12 operating conditions with the very long cord required, a great deal of effort was put into developing a smaller cordless instrument. Such an instrument using DC current was developed and used in the latter parts [*from July 1957-62*] of the Colex program. Subsequently, lightweight DC detectors became commercially available. Such instruments were used for mercury sampling until 1976. Since 1976, mercury vapor sampling tubes have been used for air sampling. These tubes contain impregnated, activated charcoal. A known volume of air is drawn through the tube, and the mercury vapor is absorbed in the charcoal. The amount of mercury absorbed is measured with an atomic absorption spectrophotometer and the results in mg/m^3 are calculated. Since 1980, a gold film mercury

vapor analyzer has been used as a check instrument, but reported results have been taken with the sampling tubes.

Air sampling was done routinely in development and production areas facilities. Most of these samples were taken with the portable GE instrument and were of the spot type and only represent concentration at the time the sample was taken. Generally, these were taken in predesignated locations on a scheduled basis. Most of the sampling was done on the day shift, and the averages were perhaps biased high because daytime temperatures were higher, causing more of the mercury to vaporize. Sampling results were reported routinely to concerned supervision on a daily, weekly and/or monthly basis. A summary of mercury sample results was reported routinely to AEC in the Y-12 Plant Quarterly Reports. Special sampling was a common practice. Sources of mercury vapor contamination were frequently found and reported to building supervision or engineers so that changes could be made to reduce air contamination levels. Another study was done to compare mercury concentrations in the building exhaust system with the average mercury concentrations in the building. This study showed the two concentrations to be essentially the same. This information was used to estimate how much mercury was being exhausted from buildings.

The Task 2 team located a number of other references that substantiate the above unreferenced statements in the 1983 Mercury Task Force Report. A Y-12 Health Physics report dated November 1, 1957 states:

A routine mercury vapor sampling program is maintained in Buildings 9201-2, 9201-4, 9201-5, 81-10 and 9204-2 [*should be 9204-4*]; buildings in which a potentially serious mercury vapor problem may exist. Samples are collected at locations other than these at the request of the Industrial Hygienist or area supervision. Two instruments are available for detecting and measuring the concentration of mercury vapor in the atmosphere; one AC powered instrument built by the General Electric Company, and one more portable, battery powered instrument designed and built by the Y-12 Development Department. Because of the greater portability and other desirable features, the latter instrument has become the standard one in the Y-12 mercury vapor sampling program. Both instruments utilize the absorption by mercury vapor of ultra-violet light of 2537 angstrom wavelength; the amount of absorption being proportional to the concentration of mercury vapor in the atmosphere.

Scheduling of the routine sampling programs is accomplished by agreement between the Industrial Hygienist, area supervision and the Health Physics Department. “Survey summary sheets”, which show the optimum and minimum sampling frequencies, are provided for the guidance of the persons doing the sampling. These sheets serve also as a check sheet of work completed and work yet to be done. Mercury vapor samples are classified as either “Spot General Air” (SGA) samples or “Source Samples”. The SGA samples serve the same purpose and are collected for the same reason as uranium general air samples, to determine the average concentration of contaminant in the atmosphere of a given area. Unfortunately, permanent continuous sampling devices have not proven satisfactory for mercury sampling, so a series of samples at many locations or spots must be taken to determine the area average or general air level. SGA samples are taken with the instrument approximately at the height of the breathing zone and at predetermined locations. Source samples are an exploratory type of sample; taken while the instrument is moved from place to place near equipment, floors, drains, in an effort to locate sources of a high mercury vapor concentration.

> For all areas in which mercury vapor sampling is a routine program, "Solvent Air Analysis Report" (SAAR) forms are provided. The SAAR form is used to record and report the information obtained by the survey. Indications of unusually high mercury vapor concentration detected by either SGA or source samples are reported to area supervision immediately. Otherwise, the [*SAAR*] reports are sent to the Industrial Hygienist, the Alloy Division superintendent, area supervision, and the Health Physics Department files. For the requested, non-routine samples the reports are sent to the IH, area supervision and the HP Department files.

A technical report "Control of Mercury Vapor in Colex Operations" (11-14-57) provides additional detail regarding mercury vapor detection equipment used at Y-12:

> An ultraviolet mercury lamp emitting 78% of its energy at 2537 angstroms is directed towards two phototubes, one of which is shielded by Pyrex glass that absorbs at 2537 angstroms. The two phototubes are connected in a bridge circuit. Since the air sample passes by both tubes, any substance which alters the beam of light with energy other than 2537 angstroms, affects both sides of the bridge circuit equally. The bridge circuit is balanced with pure air just prior to use. When air containing mercury vapor passes through the unit, the mercury vapor absorbs the UV light at 2537 angstroms and unbalances the bridge. The degree of unbalance is proportional to the mercury vapor concentration in the air. The output is read directly on a milliammeter. Each vapor detector has its own milliampere-mercury vapor concentration calibration chart from which the vapor concentration is obtained. [*Some text deleted here because quoted earlier from another reference*].
>
> When greater sensitivity was desired for the study of respirator contamination, a GE Vapor Detector was modified by removing the blower and inserting two quartz cells between the phototubes and the UV lamp. The meter was used successfully in the testing of rubber and other small air samples. Another modified detector was used to provide an indication of mercury contamination on the hands.
>
> When a portable mercury vapor detector was desired due to the weight and AC power cord required by the GE detector, several attempts were made to develop a reliable portable meter. The first battery powered unit designed used a photomultiplier to obtain the desired voltage for the standard GE supplied UV lamp and phototubes. That meter was tested and found unstable in the region of 0.1 mg/m^3 mercury vapor concentration. The second meter was designed with lower voltage phototubes and with no photomultiplier. This meter was not found stable enough to use. A third detector was designed incorporating a low voltage, DC centrifugal blower. All components of this meter have been field tested and found satisfactory; several units are now in routine use.

A technical report "Mercury Vapor Detector" (1-7-58) provides additional detail specifically about the portable mercury vapor detector designed by Y-12:

> The detection system utilizes two phototubes. One Type 934 is used as the reference which responds only to light in the visible spectrum, and the other is a Type 935 which responds to light in both the visible and ultraviolet regions. With no mercury vapor present in the absorption cell, the output voltages of the reference and signal phototubes are balanced such that their voltage difference is zero. Introduction of mercury vapor into the system decreases the UV radiation, thereby causing a reduction in output voltage. The reference

phototube is unaffected by the presence of mercury vapor and its output voltage remains the same. The difference in voltage is a function of mercury vapor concentration. A subminiature vacuum tube voltmeter is used to measure and display this voltage difference. The source of UV radiation is a mercury discharge lamp. A Type B-H6 was the most suitable. The main difficulty encountered in operation of the lamp at 0.75 milliampere is the effect of temperature on the intensity, and a slight change in the ratio of UV to visible emission. This effect was reduced by sealing the lamp within a quartz tube that utilizes the trapped air as a thermal insulating medium. Although this increased the warm-up time [*to 20 minutes*], it reduced the zero shift due to changes in ambient temperature. The outputs of the reference and signal phototubes are amplified by two Type CK526AX subminiature tubes. Sufficient power is developed to operate a 20 microampere meter which indicates the difference between the two phototube signals. Calibration of the instrument is accomplished by adjusting the meter sensitivity.

Air to be measured for mercury vapor content is introduced into a three foot section of 0.75 inch ID neoprene tubing attached to the instrument. A low power, battery-operated centrifugal blower transports the sample through the absorption cell at the rate of 0.5 cfm. Sampling time is five seconds; flushing time is 10 seconds. The blower is operated only during sampling. Field calibration is obtained by checking the instrument at two points on a response curve. The instrument is adjusted for zero response with no mercury vapor present. The second point, full scale, is provided using the absorption of 2536.5 angstrom wavelength light by Pyrex glass. A filter of Pyrex glass is inserted between the lamp and signal detector to produce an output equivalent to 3.5 mg/m^3 of mercury in air. A warm-up period of 20 minutes is required to minimize drift. After this period, the drift is less than 1.5 meter divisions per hour. The instrument requires minor zero adjustment with shift in ambient temperature, however field calibration adjustments are made in less than two minutes. Instrument reproducibility at any mercury vapor concentration is one meter division (2% of full scale). The portable mercury vapor detector had a minimum range from 0 to 0.2 mg/m^3 of mercury.

A Y-12 Radiation Safety Manual dated May 11, 1965 states:

The mercury program is administered in the Y-12 Plant by the joint efforts of the Industrial Hygiene (IH) Section and the Medical Department. The IH section is responsible for monitoring operating areas for mercury vapors and advising area supervision of the air concentration in their respective areas. A routine mercury vapor sampling program is maintained in buildings in which mercury is handled on a continuing basis. Samples are collected in other areas as the need arises. A portable, battery-powered instrument, which was designed and built by Y-12 Development, is used for detecting and measuring the concentration of mercury vapor in the atmosphere. [*Some text deleted here because quoted earlier from another reference*].

The mercury vapor detector calibrating facility is shown in Figure 45 [*photograph not included here*]. This station has a generator (a flask and a hot plate) in which mercury vapors are produced. A measured flow of nitrogen passing over the heated mercury picks up the mercury vapor and carries it through a condenser used to convert the excess mercury back to a liquid, leaving the nitrogen stream saturated with the vapor. Knowing the temperature of the saturated nitrogen stream, reference can be made to the mercury vapor ratio curves to determine the dilution ratio to get approximately the desired mercury concentration at this temperature. The vapor-laden nitrogen is passed into a mixing flask

> where it is diluted with a predetermined quantity of uncontaminated nitrogen which has been measured through a second rotameter. The temperature of the vapor in the mixing flask is measured so that a volume correction for temperature changes can be made. Vapor readings at various mercury concentrations are taken with the instrument and are calibrated and recorded against the concentrations to give a calibration table. A plotted curve of vapor readings vs. concentrations is attached to the instrument for use in field operations.

B.2 Monitoring Procedures and Analytical Instrumentation for Liquid Effluent

The following information describes methods used to sample and measure mercury in water.

B.2.1 Monitoring Procedures for Liquid Effluent

The following description of monitoring procedures for mercury in EFPC, at the Y-12 discharge point, is provided in the 1983 Mercury Task Force Report (UCCND 1983a):

> Composite samples of East Fork Poplar Creek have been collected for laboratory analysis since the early 1950s. The information generated was used primarily to monitor process losses. After the processes that produced the mercury losses were discontinued, the sampling and analysis continued and formed the basis of the environmental program. From 1951 to 1955, a Y-12 designed trickle sampler was used to collect weekly composite samples of East Fork Poplar Creek (EFPC) water. The sampler was designed to collect a 5-gallon composite sample in a week. The sample collected from the top of the stream did not represent all the suspended particulate matter in the creek, and therefore, the mercury data obtained from these samples were likely biased to give lower amounts than what was actually present. An estimated correction factor was therefore applied. [*Actually, since water flow rate data were not available until late 1955, a factor representing 2.5% of inventory lost to EFPC was applied by the Mercury Task Force for each of the years 1950-1954. Consequently, 11,300 pounds of mercury were added to the losses estimated by the Task Force for 1955-1982 by multiplying the concentration of mercury measured in EFPC by the flow rate of EFPC.*] In 1955, a TVA designed system was installed in the creek behind Building 9720-8 [*the Y-12 warehouse*]. The system consisted of a weir from which flow estimates were made and a tribullar sampler (dipper type) that provided time-proportional, weekly, 5-gallon composites. In 1963, New Hope Pond was constructed, and the sampling point for the weekly composites was moved to the outfall of the pond. A time-proportional sampler was used to fill a 55-gallon drum from which the weekly composite was taken. Starting in 1973, the weekly composites were poured into a larger bottle to form a monthly composite that was analyzed for mercury and other constituents. Since December 1977, weekly grab samples have also been taken at the outfall of the pond and analyzed for mercury. (The samples prior to 1977 were not preserved by acidification to avoid losses of mercury during storage due to the fact that these samples were also used to monitor water quality parameters. The separate grab samples collected after 1977 were acidified in the laboratory. Since 1982, these grab samples have been acidified in the field rather than when they arrive at the laboratory.) In mid-1981, the time-proportional samplers used since 1963 were replaced with flow-proportional samplers.

The project team located additional references to substantiate the above unreferenced statements in the 1983 Mercury Task Force Report. A Y-12 Health Physics report dated November 1, 1957 states the following:

> Samples are taken from all effluent streams and disposal areas in the Y-12 plant. From these samples the level of contamination, which is discharged into the streams from the operating processes, may be determined. Table IV.6 gives a sampling schedule for all streams and disposal areas. [*Table IV.6 states that (the East Fork of) Poplar Creek is sampled continuously.*] Since [*the East Fork of*] Poplar Creek carries off most of the liquid wastes which are discharged into area streams, the greater emphasis is placed on its sampling. A special sampling installation is located in the creek approximately 75 yards south of Building 9720-8. A dam across the creek makes the stream deep enough to permit the use of automatic continuous water level recording and sampling equipment. Both the level of the stream and the rate of flow can be determined from the charts of the automatic level recorder and calibration curves. The automatic sampling equipment is a proportional sampler which removes from the creek and stores in a sample reservoir a sample of water proportional to the amount of water flowing in the creek. The actual amount of sample obtained can be varied by adjusting the automatic timing device. Each day two samples are taken from the sample reservoir, one 14-ounce daily sample, and 1/5 of a gallon sample which becomes part of a composite weekly sample. The daily samples are analyzed for pH and the presence of alkali metals. The one gallon weekly composite samples are analyzed for mercury and gross alpha and beta-gamma activities. [*This implies that samples were only taken 5 days per week; 1/5 of a gallon sample x 5 days = 1 gallon weekly composite sample.*]

A January 1958 memorandum to S. R. Sapirie, USDOE ORO, from C.E. Center, Y-12 Plant Superintendent, describing Y-12 monitoring procedures states:

> There is a water sampling station due south of the Building 9720-8. An automatic sampling device takes water samples from the [*East Fork Poplar*] creek at approximately 15-minute intervals. This sampler is so designed that it takes a sample proportional in volume to the amount of water flowing in the creek. A portion of this sample is analyzed daily for pH and the alkali metals sodium, potassium and lithium. Another portion is composited into a weekly sample which is analyzed for alpha, beta, and mercury.

A Y-12 Radiation Safety Manual dated May 11, 1965 states:

> Samples are taken from all effluent streams and disposal ponds in the Y-12 area. From these samples the level of contamination which is discharged into these streams from process operations may be determined. Table 12 gives an example of a sampling schedule for all streams and disposal areas. [*Table 12 states that mercury is sampled weekly in Creek A*]. This creek [*East Fork Poplar Creek*] originates near the west end of the Y-12 area and flows east through the plant area into a lagoon or settling basin [*New Hope Pond*]. Since this stream carries the major portion of the Y-12 liquid waste, a continuous sampling program is maintained by means of a proportional sampler in order to give a rapid indication of unusual conditions. The proportional sampler has sampling intakes at the influent and effluent ends of the lagoon [*New Hope Pond*]. A diagram of the sampling system is shown in Figure 38 [*diagram not included here*]. Depth and flow of the stream are recorded continuously. The pH value is telemetered into the Plant Shift Superintendents' office where any abnormal change may be readily noted. Water is collected, composited, and sampled weekly, monthly and quarterly. Samples are analyzed for the materials shown in Table 12 by the Laboratory who forwards the results to Health Physics. A summary of the radiological results is included in the Health Physics quarterly report to the Plant Superintendent. The remaining results go to the Industrial Hygienist for his information and review.

B.2.2 Analytical Methods for Liquid Effluent

The following description of analytical methods for mercury in liquid effluent is provided in the 1983 Mercury Task Force Report (UCCND 1983a):

> From 1951 until June 1957, the mercury content of EFPC water was determined by a colorimetric technique adapted from methods published by Snell and Snell [*reference not provided*]. The method involved wet ashing the sample with sulfuric acid and potassium permanganate followed by a chloroform extraction of a mercury-dithiazone complex. The complex was then measured spectrophotometrically at 485 nm. This method provided a detection limit of 0.1 mg/ml with a relative limit of error for a single analysis of ± 50%.
>
> In July 1957, the colorimetric method was replaced by the mercurometer method, which involved isolation of the mercury as the sulfide followed by vaporization in a heated chamber and detection with a General Electric mercury vapor detector. Conversion of the mercury to the sulfide was done by filtering the sample through a filter paper impregnated with cadmium sulfide. All mercury would be trapped, most converted to the highly insoluble sulfide. This method provided a much shorter analysis time, a detection limit of 0.01 mg/L, and a relative limit of error for a single analysis of ± 40%.
>
> In August 1967, an atomic absorption method providing a detection limit of 0.001 mg/L with a relative limit of error for a single analysis of ± 20% was adopted. The method in use today [*1983*] is based on EPA Method 245.1 and involves an acid-permanganate-persulfate digestion for 2 hours at 95 degrees C followed by reduction of the mercury to the elemental state and aeration from solution. The mercury vapor passes through a cell positioned in the light path of an atomic absorption spectrophotometer, and an absorption measurement is made.
>
> During the period from the early 1950s to 1982, samples were reportedly analyzed for total mercury, except between 1974 and 1977 when the samples were analyzed for only soluble mercury, due to a filtration step prior to conversion of all mercury in the sample to a soluble form. [*Although no attempt was made to estimate suspended mercury losses, the 1983 Mercury Task Force report states that*] it appears reasonable to assume that suspended losses from January 1974 to June 1977 would have been less than 1000 pounds (This is based on consideration of the losses estimated for the years immediately preceding 1974 and following 1977, and the fact that there is no evidence of activities at Y-12 that would have led to unusual mercury losses between 1974 and 1977.) [*Note that no adjustment was made by the Mercury Task Force to the estimate of total pounds of mercury lost due to this error.*]

To substantiate the above unreferenced statements in the 1983 Mercury Task Force Report, additional references were located. A technical report "A Rapid Determination of Micro Quantities of Mercury in Urine and Water Using the Mercurometer" (9-13-57) states:

> Mercury is isolated by filtering a sample of urine or water through an asbestos pad impregnated with cadmium sulfide. The pad, containing the mercury as the sulfide, is placed in the vaporizer chamber heated to 420 degrees C to completely vaporize the mercury. The vaporizer chamber is connected to a General Electric Instantaneous Mercury Vapor Detector [*the same instrument used to measure mercury air concentrations in the*

> *process buildings*] equipped with an integrating device that records on a count register. Each count represents a known quantity of mercury. A machine factor is applied to convert the count value to µg of mercury. The machine factor is determined by processing standard solutions of mercury. The method allows the determination of 1 to 10 µg of mercury in a sample. [*The detection limit for this method is reported to be 0.05 µg/ml in the technical paper (Dill 1967) described below.*] The reproducibility of this method was reported as ± 15% limit of error at 0.8-1 mg/l [*lower limit of range of monthly average mercury concentrations in 1957-59*]; ± 30% at 0.2-0.5 mg/L *[range of mercury concentrations 1959-61*]; and ± 40% at 0.1 mg/L [*upper limit of range of mercury concentrations 1962-67*].

A December 23, 1957 memorandum to S.R. Sapirie, USDOE, from C.E. Center, Y-12 Plant Superintendent, describing Y-12 monitoring procedures states:

> Mercury in the water sample is separated as the insoluble sulfide, on a cadmium sulfide impregnated asbestos filter pad. The pad is inserted into a tube furnace where the mercury is volatilized and the quantity of vapor is measured with the mercurometer.

Another technical paper titled "Determination of Submicrogram Quantities of Mercury in Water and Lithium Hydroxide Solutions (3-28-67)" states:

> An atomic absorption spectrophotometric method for determining submicrogram quantities of mercury converts the mercury ions to the metal, expels the metallic mercury as the vapor and measures the mercury in an absorption cell. This method has a detection limit of 0.0002 µg/ml, and the total amount of mercury in a sample must be less than 1 µg. The precision for this method is ± 10% at the 0.002 µg/ml level in a 50 ml sample.

No technical reports on the colorimetric method used between 1951 and 1957 were located.

B.3 Mercury Speciation in Releases

The 1983 Mercury Task Force Report is the only document located by the project team that refers to the chemical and physical forms of mercury released from Y-12 into EFPC. According to analytical information in the 1983 Mercury Task Force Report, total mercury was historically measured by the Y-12 Plant laboratory except for a few years in the mid-1970s when only soluble mercury was measured. Forms of mercury released to EFPC (other than metallic mercury) as a result of specific processes are identified in the following citations. All information in the 1983 Mercury Task Force Report regarding mercury speciation is excerpted and presented here. Page numbers of the 1983 Mercury Task Force Report where the information is presented are at the end of each quotation. Comments in parentheses are part of the original text and comments in brackets are inserted by the project team.

Forms of Mercury Related to Processes

> Losses to water (i.e., EFPC) are largely traceable to a process waste stream. The operation responsible for generating this waste was essential to the operations of the process but was modified in 1958 to reduce the mercury losses. In the period before 1961, about 200,000 pounds of mercury was discharged to the creek from the Colex waste stream as a very dilute (ppm of mercury), neutralized [*nitric- see p.*112] acid waste. The appearance of the waste stream carrying this

mercury into the creek was that of an almost clear solution in the concentrations involved. Simulated solutions made up in the laboratory from neutralized mercuric nitrate appear clear and water-white, as would be expected since the solubility of mercuric oxide is 50 ppm and the concentrations discharged were less than this.

In 1963 and 1964 New Hope Pond was built to permit mixing and thus to even out the varying pH in the effluent from the Y-12 Plant. An unanticipated secondary benefit was the retention of substantial quantities of mercury-containing sediment. These sediments, as well as the continuing discharge of mercury since then, came from secondary sources of mercury, not from the aforementioned process waste stream that was improved in 1958 [*i.e., stopped using acid to wash the mercury- see p.112*] and finally discontinued in 1963. The secondary sources of mercury contamination are building drain systems, sewers, and lines connecting to the creek headwaters or Upper EFPC. These lines contain [*metallic mercury, and mercuric chloride due to the use of sodium hypochlorite to wash building floors- see p.231*] mercury in some of the joints as well as contaminated sludges, etc., which continue to serve as a source for small amounts of mercury.

The initial form of the majority (80%) of the 239,000 pounds was soluble or a very finely divided suspension of mercuric oxide, so it could well have been transported considerable distances. [*p.30-32 Executive Summary*]

The majority of the mercury was discharged in a very dilute process waste stream (not as metallic mercury) between 1956 and 1959. [*p. 37*]

Within the process area, process mercury was cleaned with nitric acid until June 1958. Discharge from the acid wash system was treated with excess caustic to precipitate heavy metals prior to discharge into the collection tank system. In June 1958, the mercury cleaning operation was changed. This reduced the quantity of soluble and suspended mercury leaving Process Buildings 9201-4 and 9201-5. Mercuric nitrate is very soluble in water. Neutralization, however, would have formed mercuric oxide, which is only slightly soluble and forms a yellow precipitate at a concentration above 50 ppm. Mercuric oxide formed in this manner in the dilute concentrations involved here does not settle readily, and flowing water would keep it in suspension. When in suspension, acid discharges would readily resolubilize the precipitated oxide. This could have occurred by acid discharges of other processes. Consequently, during occasional acid-dominated periods, a major portion of the mercury loss to EFPC would have been in the soluble form. Elemental mercury released was most likely to have been sorbed on finely divided particulate matter, both organic and inorganic, that would have been easily transported. While elemental mercury is generally considered to be insoluble in water, it is soluble in distilled water to the extent of 25 parts per billion, or ppb. Solubility increases in aerated water and with increasing concentrations of halides [*i.e., chlorides*]. Sodium hypochlorite, an oxidant, was used in building washing solutions, which increased solubility of mercury ($HgCl_2$ 36 g/L). This release was through the floor drain system. [*p. 112*]

Forms of Mercury Suggested by Analysis

The current [*1983*] figure [*for pounds of mercury released to EFPC*] is largely made up of the Colex waste stream measurement of 199,500 lb [*containing soluble mercuric nitrate and mercuric oxide, due to the acid washing and subsequent neutralization process used to clean the mercury, and soluble mercuric chloride, due to the use of sodium hypochlorite to wash building floors, which both occurred in the 1950s*], plus the 19,500 pounds *[9% of the total* *pounds of mercury released to EFPC*] measured since 1961 *[between 1961 and 1983 more of the mercury released would have been in the metallic form*]. ... At that time [*1977*], it was erroneously concluded that the analytical procedures used over the years measured only the soluble mercury, since it was well known that insoluble mercury was also present in the plant discharge, ...At the time the report was prepared [*1977*], the water samples from the creek were indeed being filtered and only soluble mercury was being measured. This practice was, however, only begun in January 1974, and prior to that time, the analyses produced numbers which included all the mercury in the sample, soluble and insoluble. ... In June 1977 the practice [*of measuring only soluble mercury*] was stopped. [*p. 30-32, Executive Summary*]

During the period from January 1974 to June 1977, the water samples from EFPC were only analyzed for soluble mercury. The estimated soluble loss for this time period, assuming less than values at the minimum detectable level, was 313 pounds. No attempt was made to estimate the loss through suspended [*insoluble*] mercury. There is no evidence of activities at Y-12 that would have led to unusual mercury losses during this time period [*like the 1950s acid wash*]. Considering the losses estimated for the years immediately preceding 1974 and following 1977, it appears reasonable to assume that suspended losses from January 1974 to June 1977 would have been less than 1,000 pounds. [*p. 117*]

However, other portions of the report add:

A few grab samples have been collected and filtered (0.45 micron filter) to determine whether mercury released from New Hope Pond [*built in 1963, dredged in 1973, and closed in 1983*] was soluble or insoluble. In all cases, mercury concentrations in the filtrate (soluble) were less than the detectable limit (0.1 µg/L), indicating that mercury is being discharged predominately (>90%) in suspended (insoluble) form. [*p. 259*]

But a greater concern is whether quantities of mercury might have been discharged as either metallic mercury or in sludges containing adsorbed or metallic mercury which were very heavy and stayed on the bottom of the creek, thus not being picked up by the water samples ... [*p. 30-32, Executive Summary*]

Forms of Mercury in Air

The Y-12 Plant personnel exposure to mercury was and is almost entirely to the metal vapor. Although relatively small amounts of inorganic mercury compounds were by-products of these operations, their exposure potential was judged to be inconsequential relative to that from metallic vapor. No methylmercury or other organic compounds in quantities of health significance were associated with any of these processes. [*p. 265*]

Forms of Mercury in New Hope Pond Sediment

...Organic mercury was analyzed [*in 1982*] for New Hope Pond Samples 3, 6, and 13 [*sediments*]. Organic mercury concentrations were 0.04, 0.06, and 0.11 mg/L, less than 1% of the total mercury in each sample. [*p. 264*]

Forms of Mercury Spilled to the Ground

The 425,000 pounds of mercury lost to the ground through spills, and thought to be retained in areas such as building footings (due to vertical transport) or recovered later in dirt at Building 81-10, was probably all metallic mercury. If this mercury moved horizontally and ended up in the creek before the monitoring point, it could have sunk to the bottom and not have been measured by surface sampling, but it would likely have not migrated beyond the weir on EFPC due to its metallic form.

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APPENDIX C

LIST OF INTERVIEW QUESTIONS FOR MERCURY TASK FORCE MEMBERS

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INTERVIEW QUESTIONS

1. How and why was the Mercury Task Force created?

2. Describe the process the Task Force used to collect the data used in their report (Y/EX-24).

3. Do interview notes, calculation worksheets, or drafts of the task force report exist? Where?

4. Were copies of documents collected during the investigation made, or were the originals moved to the Mercury Files (M1-M853)?

5. Why is there so much documentation on flasking, inventory, storage, transfer, shipping and sales of mercury in the Mercury Files when the section on this issue is only 12 pages?

6. How were the various report series (i.e., Health Physics Progress Reports, Y-12 Quarterly Reports, Technical Reports) used?

7. What data were collected during the preparation of the Case 1977 report (Y/AD-428)? To what extent were the Case report data used in the Mercury Task Force report?

8. What is the relationship between the Mercury Files and the boxes of records in the Y-12 Records Center belonging to the Health Physics group? Were these boxes searched/used during the Task Force investigation? How?

9. Do raw data (individual measurements) for (1) building air mercury concentrations, (2) building ventilation rates, (3) discharges of mercury to East Fork Poplar Creek, and (4) creek flow rates exist? Where? Did the Task Force use raw data or summary data? Which groups collected data other than Health Physics (i.e., Engineering, Industrial Hygiene)?

10. What is the difference between the mercury air data collected in Alpha-5 by Little prior to his March, 1956 report, and the routine mercury air data collected from all buildings? (Why couldn't routine A-4 air data be used to estimate releases from A-4?)

11. Are you aware of any additional data that became available after your investigation that you were not able to use?

12. If you had a second shot at improving any of the estimates in the Task Force report, which ones would you choose? Which estimates do you think are impossible to improve?

13. What is the supporting documentation for the assumption that total mercury was actually measured in water samples from 1954-1974? Was any correction factor considered for the lack of sample acidification of water samples prior to 1977 (or 1982)? Were any comparisons between the results of acidified and non-acidified duplicate samples made?

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APPENDIX D

GUIDE TO THE MERCURY TASK FORCE FILES

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APPENDIX D

GUIDE TO THE MERCURY TASK FORCE FILES

This appendix presents a listing of M-files contained in the Y-12 Mercury Task Force Files. Each listing contains a brief description of file contents and the date of the file, followed by several columns that indicate whether the file was identified in the June 1983 Mercury Task Force database printout, whether the file was identified as relevant to dose reconstruction in History Associates Inc.'s (HAI) 1994 review of the Mercury Task Force Files, and the numbers of Y/HG- or Y/EXT- documents created from the file. Y/HG- documents (numbers preceded by an H, e.g., H92 for document Y/HG-92) were created during Large Scale Review project and Y/EXT- documents (numbers preceded by an E, e.g., E31 for document Y/EXT-E31) are extracts of classified documents requested by the project team during the Task 2 review. The last column in the spreadsheet indicates whether material from the file was copied for potential use in reconstructing source terms and subsequently entered into the project's repository database.

Because the Mercury Task Force Files were voluntarily submitted following the issuance of the letter in May 1983 as described in the May 16, 1983 Records Management Directive, some documents unrelated to mercury or lithium separation operations at Y-12 were included (e.g., M206, M240, M241, M242, M373, M578). Many production documents focus on the technology used to separate lithium isotopes and do not discuss mercury use or release (e.g., M93 and M722). There are also many financial accountability documents that focus on the transfer of mercury between Y-12 and the General Services Administration, and between Y-12 and private companies and do not discuss the use or release of mercury (e.g., M780). In addition, there are many duplicate documents in the files (e.g., 1976 Flasking Safety Analysis Report in M347, M348, M407, M409).

Several key production and financial documents in the Mercury Task Force Files were identified and reviewed by the Task 2 team. These documents are classified as SRD (Secret Restricted Data) or CRD (Confidential Restricted Data). Although only a very small amount of information relevant to dose reconstruction is contained in these documents, they do provide a detailed understanding of the processes and equipment used in lithium separation. The titles of these documents have been made publicly available, and are as follows:

- Status Report of the Colex Process Covering the Period from July 1, 1953 through June 30, 1954 by G.A. Strasser, L.P. Twichell, and H.T. Kite (July 15, 1954) Y-1084, M-90

- Status Report of the Colex Process Covering the Period from July 1, 1954 through June 30, 1955 by the Cascade Development Department (April 15, 1956) Y-1117, M-93

- Description of Processes for Separating Lithium Isotopes by F.B. Waldrop (February 15, 1968) Y/DA-2098, M-420

- Status and Technical Feasibility Report on the Colex Process– Progress through June 30, 1953 by G.A. Strasser and L.P. Twichell (July 20, 1953) Y-988, M-442

- Material Accountability Data by H. McCollum (June 1983), M-473

- General Operating Procedure– Alloy Division Multi Column and Pump Test Facility Procedure (no author or publication date), M-484

- Alpha-5 Production Reports– Report 1-25-55 through 12-31-56 (no author or publication date) LXXXV-4610-1A, M-722

- Standard Procedures for the Alpha-4 and Alpha-5 Plants of the Alloy Division (no author; 1956-57) Y-FC-1635-82 and Y-FC-1635-83, M-751 and M-752

- Material Accountability Data– GSA File Investigation by H. McCollum and C. Doty (June 1983), M-780

- History of Operations of Colex Processes (Alpha-4, Alpha-5, & Colex Auxiliaries) by Neal Dow (November 20, 1964) Y-MA-190, M-814

Guide to the Mercury Task Force Files

Review'd by Project Team	M File #	Description of File Contents	In 6/83 printout?	In HAI report?	Y-, Y/HG-, or Y /EXT- number	Copy?
X	1	Technical Division Monthly Report (1/55)	Yes	Yes	E23	Yes
X	2	Technical Division Monthly Report (2/55)	Yes	Yes	E22	Yes
X	3	Technical Division Monthly Report (3/55)	Yes	Yes	E15	Yes
X	4	Technical Division Monthly Report (4/55)	Yes	Yes	E21	Yes
X	5	Technical Division Monthly Report (5/55)	Yes	Yes	E16	Yes
X	6	Technical Division Monthly Report (6/55)	Yes	Yes	E17	Yes
X	7	Technical Division Monthly Report (7/55)	Yes	Yes	E18	Yes
X	8	Technical Division Monthly Report (8/55)	Yes	Yes	E19	Yes
X	9	Technical Division Monthly Report (9/55)	Yes	Yes	E20	Yes
X	10	Technical Division Monthly Report (10/55)	Yes	Yes	E24	Yes
X	11	Technical Division Monthly Report (11/55)	Yes	Yes	E25	Yes
X	12	Technical Division Monthly Report (12/55)	Yes	Yes	E26	Yes
X	13	Technical Division Monthly Report (1/56)- continues at M94	Yes	Yes	E28	Yes
X	14	Quarterly Technical Progress Report (3Q59)	Yes	Yes	E31	Yes
X	15	Quarterly Technical Progress Report (2Q63)	Yes	Yes	E29	Yes
X	16	no folder	**Missing**	Yes		
X	17	Technical Report- mercury vapor detector (1/58)	Yes	Yes		
X	18	Technical Report- amalgam study (5/56)	Yes	Yes		
X	19	Y-12 Plant Quarterly Report (3Q56)	Yes	Yes	E13	Yes
X	20	Technical Report- mercury ions (6/47)	Yes	**No**	H30	
X	21	Technical Report- mercury isotopes (12/49)	Yes	**No**	H32	
X	22	Technical Report- mercury isotopes (8/51)	Yes	**No**		
X	23	Technical Report- temperature study	Yes	**No**		
X	24	Y-12 Plant Quarterly Report (4Q52)	Yes	Yes	E5	Yes
X	25	Y-12 Plant Quarterly Report (1Q53)	Yes	Yes	E30	Yes
X	26	Y-12 Plant Quarterly Report (2Q53)	Yes	Yes	E3	Yes
X	27	Y-12 Plant Quarterly Report (3Q53)	Yes	Yes	E4	Yes
X	28	Y-12 Plant Quarterly Report (4Q53)	Yes	Yes	E6	Yes
X	29	Y-12 Plant Quarterly Report (1Q54)	Yes	Yes	E27	Yes
X	30	Y-12 Plant Quarterly Report (2Q54)	Yes	Yes	E14	Yes
X	31	Y-12 Plant Quarterly Report (3Q54)	Yes	Yes	E7	Yes
X	32	Y-12 Plant Quarterly Report (4Q54)	Yes	Yes	E8	Yes
X	33	Y-12 Plant Quarterly Report (1Q55)	Yes	Yes	E9	Yes
X	34	Y-12 Plant Quarterly Report (2Q55)	Yes	Yes	E10	Yes
X	35	Y-12 Plant Quarterly Report (3Q55)	Yes	Yes	E11	Yes
X	36	Y-12 Plant Quarterly Report (4Q55)	Yes	Yes	E12	Yes
X	37	Y-12 Plant Quarterly Report (1Q56)	Yes	Yes	E34	Yes
X	38	Y-12 Plant Quarterly Report (2Q56)- see M19 for 3Q56	Yes	Yes	E35	Yes
X	39	Y-12 Plant Quarterly Report (4Q56)- continues at M86	Yes	Yes	E36	Yes
X	40	Mercury Inventory (1960-68)	Yes	Yes		
X	41	Mercury Storage and Inventory (1961-65)	Yes	Yes	H474-479	
X	42	Mercury Flasking and Storage (1972-75)	Yes	Yes	H363-371	
X	43	Mercury Inventory (no date)	Yes	Yes	H451	
X	44	Mercury Inventory (1963-75)	Yes	Yes		
X	45	Mercury Inventory- A4 (1956-57))	Yes	Yes		
X	46	Mercury Inventory- capitalization (1956-62)	Yes	Yes	H3	
X	47	Sump Loss Study (4-57 to 4-59)	Yes	Yes	H347/DEL	Yes
X	48	Mercury Inventory (1956-65)	Yes	Yes	H73,155,259,351-55,358,420-28,500	
X	49	Mercury Inventory (1950s,60s)	Yes	Yes	H7,348-350,356-357,359	Yes
X	50	Mercury Inventory (1959-60)	Yes	Yes	H92	
X	51	Mercury Inventory (1967)	Yes	Yes	H342	
X	52	no folder	**No**	Yes		
X	53	Mercury Recovery and Flasking logbook (1957-65)	Yes	Yes		
X	54	no folder	Yes	Yes		
X	55	Mercury Flasking- logbook (1965,71)	Yes	Yes	H29	
X	56	Mercury Flasking- logbook (1968-75)	Yes	Yes	H28	
X	57	Mercury Flasking- A4 (1969)	Yes	**No**	H27	
X	58	empty folder	Yes	**No**		
X	59	Technical Memorandum- mercury physical properties (1957)	Yes	Yes	H26	
X	60	Mercury Inventory- worksheets (<1957)	Yes	Yes		
X	61	Mercury Inventory- worksheets A4 (1956-58)	Yes	**No**		
X	62	Mercury Flasking- A4 (1968)	Yes	**No**	H25	
X	63	Mercury Inventory- A4 (1967)/ worksheets (1958-59)	Yes	**No**	H488	
X	64	Mercury Shipments- A5; Inventory- A4 (1962)	Yes	Yes	H24	Yes
X	65	Mercury Inventory- Building 81-10 operation logsheets (1957-62)	Yes	**No**	H5	Yes
X	66	Mercury Inventory- A5 (1957-59)	Yes	Yes		
X	67	Lithium tails worksheets (1962-63)	Yes	**No**		
X	68	Mercury Inventory- Building 81-10 operation logsheets (1958-62)	Yes	**No**	H23	Yes
X	69	Technical Memorandum- tails/feed ratios (1959-61)	Yes	Yes		
X	70	Technical Memorandum- Building 9720-26 Hg storage (1962-63)	Yes	Yes		
X	71	Mercury Inventory- A5 since start-up (1957)	Yes	Yes	H84	
X	72	Mercury Storage- pre Building 9720-26 (1962)	Yes	Yes	H346,506	
X	73	Mercury Flasking- synopsis (1978)	Yes	**No**	H450	Yes
X	74	Mercury Inventory- column data sheets (1967)	Yes	Yes	H344	
X	75	Mercury Inventory- mercury recovery from extract (1970)	Yes	**No**		
X	76	Mercury Inventory- A4,A5; Flasking A4 (1959-63)	Yes	Yes		
X	77	Y-12 Production/Operations- feed changes A4 (1957)	Yes	Yes		
X	78	Mercury Shipments- purity (1959,1962); stability (1956)	Yes	Yes	H374,375	
X	79	Mercury Inventory- A5 (1957)	Yes	Yes		
X	80	Technical Memorandum- Building 81-10 operations (1958)	Yes	Yes	H360-362,499	Yes
X	81	Mercury Flasking and Inventory (1960-76)	Yes	**No**		
X	82	Mercury Shipments- transfer receipts (1964-68)	Yes	**No**		
X	83	Mercury Inventory- Colex (1956-60)	Yes	Yes	H452	

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Review'd by Project Team	M File #	Description of File Contents	In 6/83 printout?	In HAI report?	Y-, Y/HG-, or Y /EXT- number	Copy?
X	84	Mercury Inventory- notes (1965-66)	Yes	**No**		
X	85	Technical Memorandum- process equipment changes (1956-61)	Yes	Yes		
X	86	Y-12 Plant Quarterly Report (1Q57)	Yes	Yes	E37	Yes
X	87	Y-12 Plant Quarterly Report (2Q57)	Yes	Yes	E38	Yes
X	88	Y-12 Plant Quarterly Report (3Q57)	Yes	Yes	E39	Yes
X	89	Y-12 Plant Quarterly Report (4Q57)- continues at M121	Yes	Yes	E40	Yes
X	90	Technical Report- Colex Status FY1954 (see M443 for FY53)	Yes	Yes		
X	91	Technical Report- lithium amalgam study (1954)	Yes	Yes		
X	92	Technical Report- evaporator feed tank hydrogen explosion A4 accident report (6-17-55)	Yes	Yes		
X	93	Technical Report- Colex Status FY1955	Yes	Yes		
X	94	Monthly Technical Division Progress Report (2-56)	Yes	Yes	E75	Yes
X	95	Monthly Technical Division Progress Report (3-56)	Yes	Yes	E76	Yes
X	96	Monthly Technical Division Progress Report (4-56)	Yes	Yes	E77	Yes
X	97	Monthly Technical Division Progress Report (5-56)	Yes	Yes	E78	Yes
X	98	Monthly Technical Division Progress Report (6-56)	Yes	Yes	E79	Yes
X	99	Monthly Technical Division Progress Report (7-56)	Yes	Yes	E80	Yes
X	100	Monthly Technical Division Progress Report (8-56)	Yes	Yes	E81	Yes
X	101	Monthly Technical Division Progress Report (9-56)	Yes	Yes	E82	Yes
X	102	Monthly Technical Division Progress Report (10-56)	Yes	Yes	E83	Yes
X	103	Monthly Technical Division Progress Report (11-56)	Yes	Yes		
X	104	Monthly Technical Division Progress Report (12-56)	Yes	Yes		
X	105	Technical Report- lithium amalgam study	Yes	Yes		
X	106	Monthly Technical Division Progress Report (1-57)	Yes	Yes		
X	107	Monthly Technical Division Progress Report (2-57)	Yes	Yes		
X	108	Monthly Technical Division Progress Report (3-57)	Yes	Yes		
X	109	Monthly Technical Division Progress Report (4-57)	Yes	Yes		
X	110	Monthly Technical Division Progress Report (5-57)	Yes	Yes		
X	111	Monthly Technical Division Progress Report (6-57)	Yes	Yes	E84	Yes
X	112	Monthly Technical Division Progress Report (7-57)	Yes	Yes		
X	113	Monthly Technical Division Progress Report (8-57)	Yes	Yes		
X	114	Monthly Technical Division Progress Report (9-57)	Yes	Yes		
X	115	Monthly Technical Division Progress Report (10-57)	Yes	Yes		
X	116	Monthly Technical Division Progress Report (11-57)	Yes	Yes		
X	117	Monthly Technical Division Progress Report (12-57)- continues at M142	Yes	Yes		
X	118	Technical Report- lithium amalgam study (1957)	Yes	Yes		
X	119	Technical Report- mercury Vapor in Colex (1957)	Yes	**No**	Y-1185/DEL	Yes
X	120	Technical Report- Colex decomposers (1958)	Yes	Yes		
X	121	Y-12 Plant Quarterly Report (1Q58)	Yes	Yes	E41	Yes
X	122	Y-12 Plant Quarterly Report (2Q58)	Yes	Yes	E42	Yes
X	123	Y-12 Plant Quarterly Report (3Q58)	Yes	Yes	E43	Yes
X	124	Y-12 Plant Quarterly Report (4Q58)	Yes	Yes	E44	Yes
X	125	Y-12 Plant Quarterly Report (1Q59)	Yes	Yes	E45	Yes
X	126	Y-12 Plant Quarterly Report (2Q59)	Yes	Yes	E46	Yes
X	127	Y-12 Plant Quarterly Report (3Q59)	Yes	Yes	E47	Yes
X	128	Y-12 Plant Quarterly Report (4Q59)	Yes	Yes	E48	Yes
X	129	Y-12 Plant Quarterly Report (1Q60)	Yes	Yes	E49	Yes
X	130	Y-12 Plant Quarterly Report (2Q60)	Yes	Yes	E50	Yes
X	131	Y-12 Plant Quarterly Report (3Q60)	Yes	Yes	E51	Yes
X	132	Y-12 Plant Quarterly Report (4Q60)	Yes	Yes	E52	Yes
X	133	Y-12 Plant Quarterly Report (1Q61)	Yes	Yes	E53	Yes
X	134	Y-12 Plant Quarterly Report (2Q61)	Yes	Yes	E54	Yes
X	135	Y-12 Plant Quarterly Report (3Q61)	Yes	Yes	E55	Yes
X	136	Y-12 Plant Quarterly Report (4Q61)	Yes	Yes	E56	Yes
X	137	Y-12 Plant Quarterly Report (1Q62)	Yes	Yes	E57	Yes
X	138	Y-12 Plant Quarterly Report (2Q62)	Yes	Yes	E58	Yes
X	139	Y-12 Plant Quarterly Report (3Q62)	Yes	Yes	E59	Yes
X	140	Y-12 Plant Quarterly Report (4Q62)	Yes	Yes	E60	Yes
X	141	Y-12 Plant Quarterly Report (1Q63)- continues at M160	Yes	Yes	E61	Yes
X	142	Monthly Technical Division Progress Report (1-58)	Yes	Yes		
X	143	Monthly Technical Division Progress Report (2-58)	Yes	Yes		
X	144	Monthly Technical Division Progress Report (3-58)	Yes	Yes		
X	145	Monthly Technical Division Progress Report (4-58)	Yes	Yes		
X	146	Monthly Technical Division Progress Report (5-58)	Yes	Yes		
X	147	Monthly Technical Division Progress Report (6-58)	Yes	Yes		
X	148	Monthly Technical Division Progress Report (7-58)	Yes	Yes	E85	Yes
X	149	Monthly Technical Division Progress Report (8-58)	Yes	Yes	E86	Yes
X	150	Monthly Technical Division Progress Report (9-58)	Yes	Yes	E87	Yes
X	151	Monthly Technical Division Progress Report (10-58)	Yes	Yes	E88	Yes
X	152	Monthly Technical Division Progress Report (11-58)	Yes	Yes	E89	Yes
X	153	Y-12 Plant Monthly Progress Report (12-58)- continues at M157	Yes	**No**	E90	Yes
X	154	Technical Report- lithium amalgam study (1958)	Yes	Yes		
X	155	Technical Report- lithium amalgam study (1958)	Yes	Yes		
X	156	Y-12 Production/Operations- Elex Handbook by F.B. Waldrop (12-52)	Yes	**No**	H373	
X	157	Quarterly Technical Progress Report Y-12 (4Q59)	Yes	**No**		
X	158	Technical Report- amalgam study (1959)	Yes	Yes		
X	159	Technical Report- mercury reduction cell for U ops (1960)	Yes	Yes		
X	160	Y-12 Plant Quarterly Report (2Q63)	Yes	Yes		
X	161	Y-12 Plant Quarterly Report (3Q63)	Yes	Yes		
X	162	Y-12 Plant Quarterly Report (4Q63)	Yes	Yes		
X	163	Y-12 Plant Quarterly Report (1Q64)	Yes	Yes		
X	164	Y-12 Plant Quarterly Report (2Q64)	Yes	Yes		
X	165	Y-12 Plant Quarterly Report (3Q64)	Yes	Yes		
X	166	Y-12 Plant Quarterly Report (4Q64)	Yes	Yes		

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X	167	Y-12 Plant Quarterly Report (1Q65)	Yes	Yes		
X	168	Y-12 Plant Quarterly Report (2Q65)	Yes	Yes		
X	169	Y-12 Plant Quarterly Report (3Q65)	Yes	Yes		
X	170	Y-12 Plant Quarterly Report (4Q65)	Yes	Yes		
X	171	Y-12 Plant Quarterly Report (1Q66)	Yes	Yes		
X	172	Y-12 Plant Quarterly Report (2Q66)	Yes	Yes		
X	173	Y-12 Plant Quarterly Report (3Q66)	Yes	Yes		
X	174	Y-12 Plant Quarterly Report (4Q66)	Yes	Yes		
X	175	Y-12 Plant Quarterly Report (1Q67)	Yes	Yes		
X	176	Y-12 Plant Quarterly Report (2Q67)	Yes	Yes		
X	177	Y-12 Plant Quarterly Report (3Q67)	Yes	Yes		
X	178	Y-12 Plant Quarterly Report (4Q67)	Yes	Yes		
X	179	Y-12 Plant Quarterly Report (1Q68)	Yes	Yes		
X	180	Y-12 Plant Quarterly Report (2Q68)	Yes	Yes		
X	181	Y-12 Plant Quarterly Report (3Q68)	Yes	Yes		
X	182	Y-12 Plant Quarterly Report (4Q68)	Yes	Yes		
X	183	Y-12 Plant Quarterly Report (1Q69)	Yes	Yes		
X	184	Y-12 Plant Quarterly Report (2Q69)	Yes	Yes		
X	185	Y-12 Plant Quarterly Report (3Q69)	Yes	Yes		
X	186	Y-12 Plant Quarterly Report (4Q69)	Yes	Yes		
X	187	Y-12 Plant Quarterly Report (1Q70)	Yes	Yes		
X	188	Y-12 Plant Quarterly Report (2Q70)	Yes	Yes		
X	189	Y-12 Plant Quarterly Report (3Q70)	Yes	Yes		
X	190	Y-12 Plant Quarterly Report (2Q73)- continues at M690	Yes	Yes		
X	191	Y-12 Plant Quarterly Report (4Q70)	Yes	Yes		
X	192	Y-12 Plant Quarterly Report (1Q71)	Yes	**No**		
X	193	Y-12 Plant Quarterly Report (2Q71)- continues at M238	Yes	**No**		
X	194	Y-12 Plant Quarterly Report (1Q73)	Yes	Yes		
X	195	Mercury Inventory- transfer from B4 to A4 and A5 (1953-57)	Yes	**No**	H83,453-457,459,466-471,531	
X	196	Mercury Inventory and Flasking (1958-69)	Yes	**No**	H3,7,8,12,25,107,139,155	
X	197	Y-12 Plant Quarterly Report (4Q73)- continues at M690	Yes	Yes		
X	198	Quarterly Technical Progress Report Y-12 (3Q64)	Yes	Yes		
X	199	Quarterly Technical Progress Report Y-12 (3Q63)	Yes	Yes		
X	200	Quarterly Technical Progress Report Y-12 (3Q66)	Yes	Yes		
X	201	Quarterly Technical Progress Report Y-12 (2Q66)	Yes	Yes		
X	202	Quarterly Technical Progress Report Y-12 (1Q67)	Yes	Yes		
X	203	Quarterly Technical Progress Report Y-12 (3Q67, Vol 1)	Yes	Yes		
X	204	Quarterly Technical Progress Report Y-12 (3Q67, Vol 2)- continues at M226	Yes	Yes		
X	205	Technical Report- mercury analytical: atomic absorption (1980)	Yes	Yes		
X	206	Technical Report- mercury porosimetry (1980)	Yes	Yes		
X	207	Technical Report-Colex optimization studies(1958,59,61); Colex history A5(10-57) Box40-	Yes	Yes		
X	208	Mercury Shipments- orders, costs (1954-77)	Yes	Yes		
X	209	Mercury Inventory- worksheets A2,B4; FY59 losses(1956-64); 1949 Hg storage Building 9	Yes	Yes		
X	210	Mercury Flasking (1978)	Yes	Yes	H376-378	
X	211	Y-12 Production/Operations- Colex experiment notebook (1953)	Yes	**No**	H379	
X	212	Mercury Inventory- A4 (1958-59,63)	Yes	Yes		
X	213	Mercury Inventory- receiving reports (1954-56); property record cards (1955-63)	Yes	Yes		
X	214	Mercury Inventory and Flasking- mercury excesses, flasking plans (1964-65)	Yes	Yes		
X	215	Mercury Inventory- A5 (1955,65)	Yes	Yes		
X	216	Mercury Inventory- A4 (1969)	Yes	Yes		
X	217	Mercury Inventory- mercury excesses (1964)	Yes	**No**		
X	218	Mercury Inventory- requirements (1969)	Yes	**No**		
X	219	no folder	**No**	**No**		
X	220	Mercury Flasking- A4 (1977)	Yes	**No**	H94,134,383,386	
X	221	Mercury Environmental- correspondence(1983) Hg clean-up, press release, 1977 Case re	Yes	**No**		Yes
X	222	Mercury Inventory- mercury costs (1955-66)	Yes	Yes	H343	
X	223	Hg Inventory- 900# NBS loan(1960);1965AEC audit;1968 losses;1966spill; ship/recv(1976	Yes	Yes	H138,157	
X	224	Mercury Inventory and Shipments- shipping orders, cost worksheets (1964-74)	Yes	Yes		
X	225	Mercury Flasking- flasking synopsis (1978)/ safety analysis report (1976)	Yes	**No**		
X	226	Quarterly Technical Progress Report Y-12 (4Q67)	Yes	Yes		
X	227	Quarterly Technical Progress Report Y-12 (1Q68)	Yes	Yes		
X	228	Technical Report- mercury analytical (3-67)	Yes	**No**		
X	229	Quarterly Technical Progress Report Y-12 (2Q68)	Yes	Yes		
X	230	Quarterly Technical Progress Report Y-12 (2Q75)	Yes	Yes		
X	231	Quarterly Technical Progress Report Y-12 (2Q71)	Yes	Yes		
X	232	Y-12 Plant Quarterly Report (2Q77)	Yes	Yes		
X	233	Y-12 Plant Quarterly Report (4Q72)- see M194,M190 for 1Q73,2Q73	Yes	Yes		
X	234	Technical Report- Bureau of Mines mercury survey (3-59)	Yes	**No**		
X	235	Y-12 Plant Quarterly Report (2Q72)- see M724 for 3Q72	Yes	Yes		
X	236	Y-12 Plant Quarterly Report (1Q72)	Yes	Yes		
X	237	Y-12 Plant Quarterly Report (4Q71)	Yes	Yes		
X	238	Y-12 Plant Quarterly Report (3Q71)	Yes	Yes		
X	239	Technical Report- Determination of mercury in lithium (1965)	Yes	Yes		
X	240	Technical Memorandum- mercury porosimetry equations (1982)	Yes	Yes		
X	241	Technical Memorandum- mercury porosimetry equations (1982)	Yes	Yes		
X	242	Technical Memorandum- mercury porosimetry equations (1982)	Yes	Yes		
X	243	Technical Memorandum- Preliminary Report on Personnel Exposure to Mercury in Colex (	Yes	Yes	H106	Yes
X	244	Mercury Inventory (1975-79)	Yes	**No**	H4	
X	245	Mercury Inventory (1977-79)	Yes	**No**		
X	246	Y-12 Production/Operations- feed prep extract daily log sheets (1961)	Yes	Yes		
X	247	Y-12 Production/Operations- decomposer logbook (1956)	Yes	Yes		
X	248	Y-12 Production/Operations- Colex cascade instruction log for shift changes (1955-57)	Yes	Yes		
X	249	Y-12 Production/Operations- Colex cascade instruction log for shift changes (1957-58, 19	Yes	Yes		

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Review'd by Project Team	M File #	Description of File Contents	In 6/83 printout?	In HAI report?	Y-, Y/HG-, or Y /EXT- number	Copy?
X	250	Y-12 Production/Operations- A5 power log (1962-63); cascade foreman log (1962)	Yes	Yes		
X	251	Y-12 Production/Operations- marble cascade log (1962-63)	Yes	Yes		
X	252	Y-12 Production/Operations- Colex auxiliary instruction log for shift changes (1957-58)	Yes	Yes		
X	253	Y-12 Production/Operations- A4 lithium and mercury losses (2 books: 1958-61, 1960-61)	Yes	Yes		
X	254	Y-12 Production/Operations- Colex sump losses (A4- 1961; A4,5- 1962-63)	Yes	Yes		
**	255	no M number on printout	**No**	**No**		
**	256	no M number on printout	**No**	**No**		
**	257	no M number on printout	**No**	**No**		
**	258	Mercury Environmental- air analysis reports 11-54 to 12-58 (Boxes 20-9-15,20-9-16)	Yes	**No**		
**	259	Mercury Environmental-air analysis reports 1-56 to 12-58; 10-55 to 1-56; A4, B4 (Box14-4-	Yes	**No**		
**	260	Mercury Environmental- air analysis reports 1-58 to 12-58; A4, A5 (Boxes 14-4-12,-13,-14)	Yes	**No**		
**	261	Mercury Environmental- air analysis reports 1-58 to 12-58; A4, A5 (Boxes 14-4-12,-13,-14)	Yes	**No**		
**	262	no M number on printout	**No**	**No**		
**	263	no M number on printout	**No**	**No**		
X	264	Y-12 Production/Operations- foreman's logbook (1960)	Yes	**No**		
**	265	Mercury Environmental-air analysis reports,urinalysis, Poplar Creek flow 1955-57(Box20-9	Yes	**No**		
**	266	Mercury Environmental- air analysis reports 4-61 to 8-63 (Box 19-7-10,14-11-12)	Yes	**No**		
**	267	no M number on printout	**No**	**No**		
**	268	no M number on printout	**No**	**No**		
**	269	Mercury Environmental- air analysis reports 12-55 to 5-56, 9-56; A4 (Box 19-1-10)	Yes	**No**		
**	270	Mercury Environmental- mercury control 1-60 to 12-60	Yes	**No**		
**	271	Mercury Environmental-Poplar Creek,urinalysis,air1954-60(Box18-10-1,12-1-23,11-8-8,14	Yes	**No**		
**	272	Mercury Environmental- air, stack, urinalysis 1955-57 (Box 14-4-14?)	Yes	**No**		
**	273	no M number on printout	**No**	**No**		
**	274	no M number on printout	**No**	**No**		
**	275	Mercury Environmental- air analysis reports 10-56 to 12-57 (Box 20-9-19, A5)	Yes	**No**		
**	276	Mercury Environmental- air analysis reports 11-56 to 3-57; A5 (Box 20-2-7)	Yes	**No**		
**	277	Mercury Environmental- air analysis reports 1956-57	Yes	**No**		
**	278	Mercury Environmental- air analysis reports	Yes	**No**		
**	279	Mercury Environmental- air analysis reports 1-56 to 9-56; A4, A5, A2 (Box 19-8-15,19-8-16	Yes	**No**		
**	280	Mercury Environmental- air analysis reports 1-56 to 9-56; A4, A5, A2 (Box 19-8-15,19-8-16	Yes	**No**		
**	281	Air,urinalysis,personnel,1951-57,Hg paper 1951,monthly solvent reports,exposures-Hg de	Yes	**No**		
**	282	Mercury Environmental- air analysis reports 4-57 to 9-57 (Box 20-11-21,A5)	Yes	**No**		
**	283	Mercury Environmental- air analysis reports 10-55 to 3-56 (Box 19-1-11,A5)	Yes	**No**		
**	284	Mercury Environmental- air analysis reports 4-56 to 6-56; A5 (Box 19-1-12)	Yes	**No**		
**	285	Mercury Environmental- air analysis reports, 9202, Hg vacuum cleaner (Box 20-9-15?)	Yes	**No**		
X	286	Mercury Inventory- mercury balance sheets (1962-65)	Yes	**No**	H202	
X	287	Mercury Shipments- return transmittal slips (1975)	Yes	**No**	H203	
X	288	Mercury Inventory- pallets (1965-75)	Yes	**No**	H204	
X	289	Mercury Shipments- transfer receipts, storage (1968-75)	Yes	**No**	H205	
X	290	Mercury Shipments- transfer receipts, leakers (1965-72)	Yes	**No**	H206	
X	291	Mercury Shipments- transfer Building 9720-5 to A5 (1965)	Yes	**No**		
X	292	Mercury Shipments- shipping orders, public sale (1969-70)	Yes	**No**	H207	
X	293	Mercury Shipments- transfer receipts, Building 9720-26 (1965-73)	Yes	**No**	H208	
X	294	Mercury Shipments- transfer receipts (1964-65)	Yes	**No**		
X	295	Mercury Flasking- rebottling costs (1974)	Yes	**No**	H209	
X	296	Mercury Shipments- shipping orders, public sale (1965, 67-68)	Yes	**No**	H15	
X	297	Mercury Shipments- shipping orders, public sale (1974-75)	Yes	**No**	H210	
X	298	Mercury Shipments- shipping orders, public sale (1970-71)	Yes	**No**	H185	
X	299	Mercury Shipments- shipping orders, public sale (1971-72)	Yes	**No**	H220	
X	300	Mercury Shipments- shipping orders, public sale (1972-73)	Yes	**No**	H221	
X	301	Mercury Shipments- shipping orders, public sale (1974)	Yes	**No**	H223	
X	302	Mercury Shipments- shipping orders, public sale (1973-74)	Yes	**No**	H222	
X	303	Mercury Shipments- shipping orders, donated to state agencies (1964-65)	Yes	**No**	H225	
X	304	Mercury Shipments- shipping orders (1965)	Yes	**No**	H17	
X	305	Mercury Shipments- shipping orders (1964)	Yes	**No**	H18	
X	306	empty folder	Yes	**No**		
X	307	Mercury Inventory- mercury excess list recap (1973-82)	Yes	**No**		
X	308	Mercury Inventory- letter on mercury price (1978)	Yes	**No**		
X	309	Mercury Inventory- letter on adjusting mercury monetary value (1978)	Yes	**No**		
X	310	Mercury Inventory- accounting procedure for mercury sales (1980)	Yes	**No**		
X	311	Y-12 Production/Operations- reuse of A5 building (1964)	Yes	**No**		
X	312	Y-12 Production/Operations- mercury-contaminated parts (1980)	Yes	**No**		
X	313	Mercury Inventory- purity analysis results (1980)	Yes	**No**	H19	
X	314	Mercury Inventory- handling costs (1981)	Yes	**No**	H20	
X	315	Mercury Inventory- handling costs (1981)	Yes	**No**	H94	
X	316	Mercury Inventory- handling costs (1981)	Yes	**No**	H9	
X	317	Mercury Inventory- handling costs (1981)	Yes	**No**	H8	
X	318	Mercury Inventory- handling costs documentation (1977)	Yes	**No**	H9	
X	319	Mercury Flasking- instructions (1978)	Yes	**No**	H188	
X	320	Mercury Shipments- transfer receipts (1968-75)	Yes	**No**	H189	
X	321	Mercury Flasking- certificates of compliance for flasks (1977)	Yes	Yes	H228-233	
X	322	Mercury Flasking- synopsis (1978)	Yes	**No**	H268	Yes
X	323	Mercury Flasking- purity analysis (1977,80)	Yes	Yes	H226	
X	324	Mercury Flasking- A4 cost estimates (1975)	Yes	**No**	H13,266-68,272,369,489,491-97	Yes
X	325	Mercury Flasking- A4 (1969-75,76,77)	Yes	Yes		
X	326	Mercury Shipments- transfer receipts (1975)	Yes	Yes		
X	327	Mercury Shipments- shipping orders (1972-73)	Yes	Yes	H227	
X	328	Mercury Shipments (1971-74)	Yes	Yes	H235	
X	329	no folder	**No**	**No**		
X	330	no folder	**No**	**No**		
X	331	Mercury Shipments (1967-68)	Yes	Yes	H236	
X	332	Mercury Shipments (1966-67)	Yes	Yes	H237	

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X	333	Mercury Shipments (1965-66)	Yes	Yes	H238	
X	334	Y-12 Production/Operations- sale of A5 equipment bid information (1967)	Yes	**No**	H95	
X	335	Mercury Shipments- transfer receipts (1965)	Yes	Yes		
X	336	Mercury Flasking- 2 bottling logbooks (1977)	Yes	**No**		
X	337	empty folder	Yes	**No**		
X	338	Mercury Environmental- Little report on A5 ventilation study (1956)	Yes	**No**	H281	Yes
X	339	Mercury Environmental- Napier report on EFPC mercury concentrations (1952-77)	Yes	**No**	H98	Yes
X	340	Mercury Inventory- sale of GSA mercury (1980)	Yes	**No**	H11	
X	341	Mercury Inventory- sale of GSA mercury (1980)	Yes	**No**	H10	
X	342	Mercury Environmental- correspondence (1983)- local newspaper articles	Yes	**No**		
X	343	Mercury Flasking-safety analysis report (1976)	Yes	**No**		
X	344	Mercury Inventory- draining mercury from A4 (1975)	Yes	**No**	H13	Yes
X	345	Y-12 Production/Operations- maintenance work requests A5 (1976)	Yes	**No**		
X	346	Mercury Flasking- A4 stripping, mercury recovery from wastewater (1976,77)	Yes	**No**	H2,87,482,542-544	
X	347	Mercury Flasking- urine and A4 air data (1975-77); SAR (1976)	Yes	**No**	H146-150	
X	348	Mercury Flasking- SAR (1976,77); A4 fire survey report (1970)	Yes	Yes	H161	
X	349	Mercury Flasking- letter regarding flask tags (1979)	Yes	**No**		
X	350	Mercury Flasking- (1976-78); A4 fan list (1976); electrical system drawings (1954)	Yes	Yes	H21	
X	351	Mercury Shipments- correspondence (1979,83)	Yes	Yes	H180	
X	352	Mercury Environmental- GSA Occupational Health Guideline for Mercury (5-79)	Yes	**No**		
X	353	Mercury Inventory- flasks and pallets (1979)	Yes	**No**	H190	
X	354	Mercury Shipments- (1977-80); A4 mercury air analysis reports (1-25-74)	Yes	Yes	H186	
X	355	Mercury Shipments- folder checked out by D. Pitts (1981-82)	Yes	Yes		
X	356	Mercury Environmental- urines (1981); personnel air (1977); sump check card (no date)	Yes	**No**		
X	357	Mercury Environmental- air sample results for A4, 9720-26 (1977)	Yes	**No**	H177	
X	358	Mercury Shipments- transfer receipts (1975-77)	Yes	**No**		
X	359	Mercury Inventory- mercury excesses (1975-76) folder checked out by C. Doty	Yes	**No**	H1	
X	360	Hg Envir-air A4(8/61-8/62;6/72-6/78;5/71-9/80),sum sheets1/55-12/55;hazard literature(19	Yes	**No**		
X	361	Hg Envir-air A4(1978-83),81-10(1971-82);Hg haz literature(1979-80);Ashe(1952);urines(1	Yes	**No**	H57,153,182,248-251	
X	362	no folder	**No**	**No**		
X	363	Mercury Inventory- pallet shipping receipts to GSA (1975-77)	Yes	Yes		
X	364	no folder	**No**	**No**		
X	365	no folder	**No**	**No**		
X	366	no folder	**No**	**No**		
X	367	Mercury Inventory- pallet inventories (1965-79)	Yes	Yes	H239	
X	368	Mercury Shipments- transfer receipts (1977)	Yes	Yes		
X	369	Mercury Storage- (1981-83); mercury document recall letter (5-16-83)	Yes	**No**	H9	Yes
X	370	no folder	**No**	**No**		
X	371	Mercury Environmental- change notices (1965-70)	Yes	**No**		
X	372	Mercury Environmental- mercury urine results, participation, controls (1965-70)	Yes	**No**		
X	373	Lead urine results (1958-60, 1964-67)- no mercury	Yes	**No**		
X	374	Mercury Shipments- transfers (1974)	Yes	Yes		
X	375	Mercury Shipments- transfers (1975)	Yes	Yes		
X	376	Mercury Shipments- transfers (1978)	Yes	Yes		
X	377	Mercury Shipments- transfers (1979)	Yes	Yes		
X	378	Mercury Shipments- transfers (1980)	Yes	Yes	H192	
X	379	Mercury Shipments- transmittals (1977-82)	Yes	Yes		
X	380	Mercury Shipments- shipping orders (1980-81)	Yes	Yes	H193	
X	381	empty folder	Yes	**No**		
X	382	Mercury Storage- storage billing (1966-82)	Yes	**No**	H8	
X	383	no folder	**No**	**No**		
X	384	Mercury Shipments- transfers (1963-73)	Yes	**No**	H12, 481	
X	385	Mercury Shipments- transfers (1977)	Yes	Yes		
X	386	Mercury Inventory- mercury excess list (1962-65)	Yes	Yes	H176	
X	387	Mercury Shipments- GSA mercury quality control (1965-74)	Yes	Yes		
X	388	Mercury Inventory- mercury excesses (1964-70)	Yes	Yes		
X	389	Mercury Inventory- mercury excesses (1976, 1965-79)	Yes	**No**		
X	390	empty folder	Yes	**No**		
X	391	Mercury Storage- storage file (1974-79); 9720-26 mercury air analysis reports	Yes	**No**		
X	392	Mercury Inventory- A5 stripping (1965)	Yes	**No**	H246-247,485-486	
X	393	Mercury Inventory- excesses (1963-81); flasking A4 (1976), A5 (1965)	Yes	**No**	H1,8,13,94,139,474,484,501	
X	394	Mercury Shipments (1965-68,77)	Yes	Yes		
X	395	Mercury Shipments- property dispositions (1969-72)	Yes	Yes	H211	
X	396	Mercury Shipments- transfers (1968-71)	Yes	Yes	H213	
X	397	Mercury Inventory- 81-10 cleanup memo (1971); sale of Hg contaminated equipment (197	Yes	**No**	H187	
X	398	Mercury Shipments- shipping orders and property dispositions FY 69 (1968-69)	Yes	Yes	H212	
X	399	Mercury Shipments- shipping orders and property dispositions FY 68 (1967-68)	Yes	Yes	H219	
X	400	Mercury Shipments- shipping orders and property dispositions FY 67 (1966-68)	Yes	Yes	H218	
X	401	Mercury Shipments- shipping orders and property dispositions FY 66 (1965-66)	Yes	Yes	H217	
X	402	no folder	**No**	**No**		
X	403	Mercury Shipments- shipping orders and property dispositions (1963)	Yes	Yes		
X	404	no folder	**No**	**No**		
X	405	Mercury Inventory- pallet monthly (1965-67)	Yes	Yes		
X	406	Mercury Shipments- shipping orders and property dispositions (1964)	Yes	Yes		
X	407	Mercury Shipments- shipping orders (1962-63, 65)	Yes	Yes	H100,214	
X	408	no folder	**No**	**No**		
X	409	Mercury Flasking- SAR (8-77)	Yes	Yes	H2,13	
X	410	Mercury Flasking- costs (1966)	Yes	Yes	H139	
X	411	Mercury Shipments- property dispositions (1965)	Yes	**No**	H216	
X	412	no folder	**No**	**No**		
X	413	no folder	**No**	**No**		
X	414	no folder	**No**	**No**		
X	415	Mercury Flasking- costs (1964-66)	Yes	Yes		

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Review'd by Project Team	M File #	Description of File Contents	In 6/83 printout?	In HAI report?	Y-, Y/HG-, or Y /EXT- number	Copy?
X	416	Mercury Flasking- costs (1964-66)	Yes	Yes		
X	417	Mercury Environmental- Y-12 environmental monitoring report Y/UB-4 (1975)	Yes	Yes		
X	418	Mercury Environmental- Y-12 environmental monitoring report Y/UB-8 (1977)	Yes	Yes		
X	419	no folder	**No**	**No**		
X	420	Technical Report- Description of Y-12 lithium separation processes Y/DA- (2-68)	Yes	**No**		
X	421	Technical Memorandum- marble (Li7) study Y/AJ- (12-75)	Yes	Yes		
X	422	Mercury Storage- stores department (1976)	Yes	**No**	H1,2,8,13,94,139,156,523	
X	423	Mercury Storage- pallet purchase orders (1964)	Yes	Yes		
X	424	Mercury Shipments- transfer forms (1965)	Yes	Yes		
X	425	Mercury Inventory- A5 stripping (1965-67)	Yes	Yes		
X	426	Mercury Inventory- public sale (1965)	Yes	Yes		
X	427	Mercury Inventory- A5 stripping (1967)	Yes	Yes		
X	428	Mercury Inventory- public sale of scrap metal (1965)	Yes	Yes		
X	429	Y-12 Production/Operations- A5 equipment to ORNL (1965)	Yes	Yes		
X	430	Mercury Shipments- Mallory Battery (1971-73)	Yes	Yes	H215	
X	431	Mercury Inventory- excess property A5 (1965)	Yes	**No**		
X	432	Alloy Division Monthly Progress Report (10-55)- continues at M610	Yes	Yes		
X	433	Alloy Division Weekly Progress Reports compiled (1-55)	Yes	Yes		
X	434	Mercury Environmental- Reprint from Kirk-Othmer Encyclopedia (1981)	Yes	**No**		
X	435	Alloy Division Weekly Progress Reports compiled (2-55)	Yes	Yes		
X	436	Alloy Division Weekly Progress Reports compiled (3-55)- continues at M604	Yes	Yes		
X	437	Mercury Inventory- A4 stripping (1983)	Yes	**No**	H258	
X	438	Mercury Environmental- Y-12 environmental monitoring report Y/UB-10 (1978)	Yes	Yes		
X	439	Mercury Environmental- Y-12 environmental monitoring report Y/UB-15 (1980)	Yes	Yes		
X	440	Mercury Environmental- Y-12 environmental monitoring report Y/UB-8 (1977)	Yes	Yes		
X	441	Technical Report- Impurities in the Colex Process Y- (2-58)	Yes	Yes		
X	442	Technical Report- Colex Status FY 1953	Yes	Yes		
X	443	Technical Report- Electrical Maintenance Organization (8-57)	Yes	Yes		
X	444	Mercury Inventory (1955)	Yes	**No**	H252,538	
X	445	Mercury Inventory (1955)	Yes	**No**	H243,245,539,541	
X	446	Mercury Inventory	Yes	**No**		
X	447	Mercury Flasking- SAR (1976)	Yes	**No**		
X	448	Mercury Flasking- SAR correspondence (1976)	Yes	**No**		
X	449	Mercury Environmental- correspondence (1972)	Yes	**No**		
X	450	Technical Reports- Bureau of Mines Bulletin on Hg (1980); purification of Li hydroxide	Yes	**No**		
X	451	Mercury Storage- handling costs	Yes	**No**		
X	452	Technical Report- AIHA Mercury Guidelines	Yes	**No**		
X	453	Health Physics/ Industrial Hygiene Report (1-49)	Yes	Yes	H136	Yes
X	454	Mercury Flasking (1976)	Yes	**No**		
X	455	Mercury Environmental- declassification of Y-12 mercury health and safety data	Yes	**No**		
X	456	Mercury Environmental- Mercury conference (1972)	Yes	**No**		
X	457	Mercury Flasking (1976-77)	Yes	**No**		
X	458	Mercury Environmental- correspondence (1972)	Yes	**No**	H178,179,184	
X	459	Mercury Environmental- correspondence (1971)	Yes	**No**	H60-66,183,256-257	Yes
X	460	Mercury Environmental- Medical, Health and Safety correspondence (1974) Box 22-6-14	Yes	**No**	H103,195	
X	461	Technical Report- water treatment (1967) Box 13-1-19 18-10-4 ,19-7-6,14-1	Yes	**No**	H33	
X	462	Hg Envir corresp(1965-68);clean room design(1965);urines(1954-59) Box 20-9-16,-17	Yes	**No**	H35	
X	463	Mercury Environmental-1974 Worker Health and Mortality Study;Uranium exposure report	Yes	**No**	H34,151	
X	464	Mercury Environmental- waste water disposal practices, land burial	Yes	**No**	H300-303	
X	465	Mercury Environmental- urinalysis records (1974-83); cascade personnel list (1958-62)	Yes	Yes		
X	466	Mercury Environmental- urinalysis records (1977-83)	Yes	**No**		
X	467	Mercury Environmental- urinalysis records (1955, 71-83)	Yes	**No**		
X	468	Mercury Inventory- A5 stripping (1965); Y-12 Hazards accident list (1956)	Yes	**No**	H160,253-255,269,509	Yes
X	469	no folder	Yes	**No**		
X	470	Y-12 Production/Operations- A5 equipment list (1965)	Yes	Yes		
X	471	Mercury Inventory- A5 excess list ledger	Yes	Yes		
X	472	Y-12 Production/Operations- A5 equipment list (5-65)	Yes	Yes		
X	473	Mercury Inventory-Material Accountability Data:GSA Records Investigation(6-83)by H.McC	Yes	Yes	H449	
X	474	Mercury Inventory- A5 stripping cost analysis (1965)	Yes	Yes		
X	475	Mercury Inventory- A5 stripping cost analysis (1965)	Yes	Yes	H194	
X	476	Mercury Inventory- A5 stripping cost analysis (1965)	Yes	Yes	H6	
X	477	Mercury Environmental- Case Report (1977); Little(1956); Napier(1977); A4 flasking (1972	Yes	**No**	H2,96-99,281-283	Yes
X	478	Y-12 Production/Operations- Lithium Spill Accident Report ORO-125208 (1966)	Yes	**No**	H322,323	Yes
X	479	Mercury Inventory- A5 stripping (1965-66)	Yes	**No**	H160,274,279,280,419	Yes
X	480	Y-12 Production/Operations- A4 operations study (1962-66)	Yes	**No**	H275-278	
X	481	no folder	Yes	**No**		
X	482	Mercury Environmental- surface water sampling (1958)	Yes	**No**	H196	Yes
X	483	Alloy Division Monthly Progress Reports (1-57 through 12-57)	Yes	Yes		
X	484	Y-12 Production/Operations- Multi-Column Test and Pump Test Facility Procedures (no da	Yes	**No**	H317	
X	485	Alloy Division Weekly Progress Reports- compiled for 1957	Yes	Yes		
X	486	Alloy Division Weekly Progress Reports- compiled for 1958	Yes	Yes		
X	487	Mercury Environmental- Mercury Hazard Committee Meetings (1955-56)	Yes	Yes	H297,305	Yes
X	488	Mercury Environmental- Poplar Creek Analyses (1955)	Yes	Yes		
X	489	Mercury Environmental- Medical,Health and Safety Correspondence (1972)	Yes	Yes		
X	490	no folder	Yes	**No**		
X	491	Mercury Environmental- Losses to EFPC by Napier (1952-82)	Yes	Yes	H116	Yes
X	492	Mercury Environmental- Mercury Content in Fish, Water and Mud by Sanders (1970)	Yes	**No**	H91	Yes
X	493	Health Physics/ Industrial Hygiene Report (5-49)	Yes	Yes	H197	Yes
X	494	Health Physics/ Industrial Hygiene Report (11-50 to 12-50)	Yes	Yes	H68	Yes
X	495	Health Physics/ Industrial Hygiene Report (6-51 to 12-51)	Yes	Yes	H69	Yes
X	496	Health Physics/ Industrial Hygiene Report (1-52 to 7-52)	Yes	Yes	H198	Yes
X	497	Health Physics/ Industrial Hygiene Report (7-52 to 12-52)	Yes	Yes	H54	
X	498	Health Physics/ Industrial Hygiene Report (1-53 to 6-53)	Yes	Yes	H135	Yes

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X	499	Health Physics/ Industrial Hygiene Report (7-53 to 12-53)	Yes	Yes		
X	500	Y-12 Production/Operations- capital equipment and excess property A5 (1965-69)	Yes	Yes		
X	501	Y-12 Production/Operations- public sale of equipment (1958)	Yes	Yes		
X	502	Y-12 Production/Operations- capital equipment (2-65)	Yes	Yes		
X	503	Y-12 Production/Operations- A4 and A5 pump costs (1967)	Yes	Yes		
X	504	Y-12 Production/Operations- A5 electrical purchase orders, specs, A4 transformers (1954	Yes	Yes		
X	505	Mercury Shipments- transfer of mercury to GSA (1979)	Yes	**No**	H37	
X	506	Y-12 Production/Operations- A5 capital equipment (5-65)	Yes	Yes		
X	507	Y-12 Production/Operations- A5 equipment list (1-66)	Yes	Yes		
X	508	Mercury Shipments- transfers, purity (1962)	Yes	**No**	H36	
X	509	Mercury Inventory- B4 mercury (1956)	Yes	**No**	H326,521,540	Yes
X	510	Y-12 Production/Operations- A5 construction, optimization KOA- (1956)	Yes	**No**	H503	Yes
X	511	Mercury Environmental- urinalysis and quarterly water results (1973-82)	Yes	Yes		
X	512	Mercury Environmental- New Hope Pond dredging/sediments (10-72)	Yes	**No**	H38	Yes
X	513	Mercury Shipments (1954); Orex, Y-12 Stores Building (1953)	Yes	Yes	H39	
X	514	Mercury Environmental- Loar report ORNL/TM-6714 (10-81)	Yes	**No**		Yes
X	515	Technical Memorandum- Interlab comparisons of mean mercury concs in ERA water (1978	Yes	**No**	H40	
X	516	Mercury Environmental- New Hope Pond core samples (8-82)	Yes	**No**	H41	Yes
X	517	Mercury Environmental- Van Winkle study workplan correspondence (1972)	Yes	**No**		
X	518	Mercury Environmental- statistical analysis of fish mercury data (1977)	Yes	**No**		
X	519	Mercury Environmental- A4 Air mercury results (1982)	Yes	**No**		
X	520	Mercury Environmental-environmental Hg contamination summary (Sanders, Loar)(1970,8	Yes	**No**		
X	521	Mercury Environmental- mercury concentrations by McElhaney (1982)	Yes	**No**		
X	522	Mercury Environmental- VanWinkle study plans (1982)	Yes	**No**		
X	523	Mercury Environmental- mercury concentrations by USGS (1982)	Yes	**No**		
X	524	empty folder	Yes	**No**		
X	525	Mercury Environmental- VanWinkle study overheads (1982)	Yes	**No**		
X	526	Mercury Environmental- VanWinkle report (1982)	Yes	**No**		
X	527	Technical Memorandum- Waste Disposal at Y-12 (1-57)	Yes	**No**		
X	528	Mercury Environmental- A4 Air Hg concentrations (1983)	Yes	**No**		
X	529	Technical Memorandum- uranium extraction; no mention of mercury (1956)	Yes	Yes		
X	530	Technical Memorandum- amalgam stability (1956)	Yes	Yes		
X	531	Technical Memorandum- lithium hydroxide production (1955)	Yes	Yes		
X	532	Technical Memorandum- carbon dioxide in Colex extract (1956)	Yes	Yes		
X	533	Technical Memorandum- sodium and amalgam decomposition (1955)	Yes	Yes		
X	534	Technical Memorandum- lithium sodium separation (1956)	Yes	Yes		
X	535	Technical Memorandum- graphite for decomposers (1956)	Yes	Yes		
X	536	Technical Memorandum- purification of enriched lithium (1956)	Yes	Yes		
X	537	Technical Memorandum- tray voltage studies (1956)	Yes	Yes		
X	538	Technical Memorandum- lithium amalgam decomposition (1956)	Yes	Yes		
X	539	Technical Memorandum- amalgam stability (1956)	Yes	Yes	H519	
X	540	Technical Memorandum- sodium amalgam decomposition (1956)	Yes	Yes		
X	541	Technical Memorandum- graphite for decomposers (1956)	Yes	Yes	H518	
X	542	no folder- note says to see M603	Yes	**No**		
X	543	Technical Memorandum- lithium deuteride and lithium hydride densities (1956)	Yes	Yes		
X	544	Technical Memorandum- Colex pilot plant (1956)	Yes	Yes		
X	545	Technical Memorandum- pump design contract (1956)	Yes	Yes		
X	546	Technical Memorandum- feed material analysis (1955)	Yes	Yes		
X	547	Technical Memorandum- A5 flooding experiment (1955)	Yes	Yes		
X	548	Technical Memorandum- Colex process development (1955)	Yes	Yes	H532	
X	549	Technical Memorandum- Alloy Development Program tails storage (1955)	Yes	Yes		
X	550	Technical Memorandum- increased flow in A5 (1955)	Yes	Yes		
X	551	Technical Memorandum- uranium casting and rolling; no mention of mercury (1955)	Yes	**No**		
X	552	Technical Memorandum- ADP reaction rates (1953)	Yes	Yes		
X	553	Technical Memorandum- A5 flooding experiment (1955)	Yes	Yes		
X	554	Technical Memorandum- stage length calculation (1953)	Yes	Yes	H524	
X	555	Technical Memorandum- absorber anode study (1953)	Yes	Yes		
X	556	Technical Memorandum- Colex pilot plant runs (1954)	Yes	Yes		
X	557	Technical Memorandum- Aspen salvage meeting (1954)	Yes	Yes	H517	
X	558	Technical Memorandum- pump design meeting (1954)	Yes	Yes		
X	559	Technical Memorandum- Aspen salvage meeting #2 (1954)	Yes	Yes		
X	560	Technical Memorandum- Colex process development (1954)	Yes	Yes		
X	561	Technical Memorandum- Colex pilot plant runs (1954)	Yes	Yes		
X	562	Technical Memorandum- Colex pilot plant runs (1954) and addendum to Y-B65-36	Yes	Yes		
X	563	Technical Memorandum- Colex pilot plant runs in A2 (1954)	Yes	Yes		
X	564	Technical Memorandum- lithium deuteride impurities (1954)	Yes	Yes		
X	565	Technical Memorandum- A4 operation savings (1954)	Yes	Yes		
X	566	Technical Memorandum- multi-column test program outline (1954)	Yes	Yes		
X	567	Technical Memorandum- pressure vessel capacity (1954)	Yes	Yes		
X	568	Technical Memorandum- Colex pilot plant runs (1954)	Yes	Yes		
X	569	Technical Memorandum- column tests and sodium removal (1954)	Yes	Yes		
X	570	Technical Memorandum- Colex run summary (1953)	Yes	Yes		
X	571	Technical Memorandum- Colex run summary (1953)	Yes	Yes		
X	572	Technical Memorandum- Comparison of Y-12 operations with Olin-Mathieson (1953)	Yes	Yes		
X	573	Technical Memorandum- flooding studies (1953)	Yes	Yes		
X	574	Technical Memorandum- Elex pilot plant runs (1953)	Yes	Yes		
X	575	Technical Memorandum- Colex run summary (1953)	Yes	Yes		
X	576	Technical Memorandum- Colex run summary (1953)	Yes	Yes		
X	577	Technical Memorandum- purification studies (1953)	Yes	Yes		
X	578	Technical Memorandum- flooding studies (1953); GCEP document- no mercury (1983)	Yes	Yes		
X	579	Technical Memorandum- ADP pumps (1953)	Yes	Yes		
X	580	Technical Memorandum- Lithium Corporation trip report (1954)	Yes	Yes	H516	
X	581	Technical Memorandum- Colex run summary (1954)	Yes	Yes		

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X	582	Technical Memorandum- Colex run summary (1954)	Yes	Yes		
X	583	Technical Memorandum- Colex run summary (1954)	Yes	Yes		
X	584	Mercury Environmental- mercury analysis of fescue grass (1982)	Yes	Yes		
X	585	Y-12 Production/Operations- Colex data logbook Y/NB- (8-57 to 3-59)	Yes	Yes		
X	586	Y-12 Production/Operations- Colex feed and flow specs logbook Y/F42- (3-59 to 5-63)	Yes	**No**		
X	587	Y-12 Production/Operations- Colex data for reports Y/NB- (5-59 to 7-62)	Yes	Yes		
X	588	Y-12 Production/Operations- Colex data for reports Y/NB- (8-62 to 5-63)	Yes	Yes		
X	589	Y-12 Production/Operations- Colex 3", 8" data for reports Y/NB- (1-53 to 7-57)	Yes	Yes		
X	590	Technical Memorandum- mercury analysis of tails (1960)	Yes	**No**	H515	Yes
X	591	Y-12 Production/Operations- FY58 Colex ops memo and history 814 extract (1958)	Yes	Yes		
X	592	Y-12 Production/Operations- feed salt and tails status logbook (1-55 to 12-56)	Yes	Yes		
X	593	no folder	**No**	**No**		
X	594	Y-12 Production/Operations- Colex logbook (1958) air data,feed salt,engineering, mainten	Yes	**No**		
X	595	Y-12 Production/Operations- Colex feed logbook Y/F42- (1962-63) Box 18-3-14	Yes	**No**		
X	596	Y-12 Production/Operations- Colex feed logbook Y/F42- (1959)	Yes	**No**		
X	597	Y-12 Production/Operations- Colex feed logbooks(2) Y/F42- (1957)	Yes	**No**		
X	598	Y-12 Production/Operations- Colex feed logbook Y/F42- (1960,61) Box 18-3-14	Yes	**No**		
X	599	Technical Memorandum- lithium separation (1955)	Yes	**No**	H327,533,537	
X	600	no folder	**No**	**No**		
X	601	Technical Memoranda- B4 (1955)	Yes	**No**	H113,200,328-335,338,504	Yes
X	602	Mercury Inventory- Colex pilot, Elex and Orex mercury inventories (1952-53)	Yes	Yes	H341,490,511-513,534	Yes
X	603	Mercury Inventory- worksheets (1957); B4 shutdown (1956-57)	Yes	**No**		
X	604	Alloy Division Weekly Progress Reports compiled (5-55)	Yes	Yes	H201,339,340,535	
X	605	Alloy Division Weekly Progress Reports compiled (6-55)	Yes	Yes		
X	606	Alloy Division Weekly Progress Reports compiled (7-55)	Yes	Yes		
X	607	Alloy Division Weekly Progress Reports compiled (8-55)	Yes	Yes		
X	608	Alloy Division Weekly Progress Reports compiled (9-55)	Yes	**No**		
X	609	Alloy Division Weekly Progress Reports compiled (10-55)	Yes	Yes		
X	610	Alloy Division Monthly Progress Report (11-55)- see M432 for 10-55	Yes	Yes		
X	611	Alloy Division Monthly Progress Report (12-55)	Yes	Yes		
X	612	Alloy Division Weekly Progress Reports compiled (11-55)	Yes	Yes		
X	613	Alloy Division Weekly Progress Reports compiled (12-55)	Yes	Yes		
X	614	Alloy Division Weekly Progress Reports compiled (1-56)	Yes	Yes		
X	615	Alloy Division Monthly Progress Report (2-56)	Yes	Yes		
X	616	Alloy Division Monthly Progress Report (3-56)	Yes	Yes		
X	617	Alloy Division Monthly Progress Report (4-56)	Yes	Yes		
X	618	Technical Memorandum- Survey of Economy Measures FY56 (1956)	Yes	**No**		
X	619	Alloy Division Monthly Progress Report (5-56)	Yes	Yes		
X	620	Alloy Division Weekly Reports compiled (2-56)	Yes	Yes		
X	621	Alloy Division Weekly Progress Reports compiled (3-56)	Yes	Yes		
X	622	Alloy Division Weekly Progress Reports compiled (4-56)	Yes	Yes		
X	623	Alloy Division Weekly Progress Reports compiled (5-56)	Yes	Yes		
X	624	Alloy Division Monthly Progress Report (6-56)	Yes	Yes		
X	625	Alloy Division Monthly Progress Report (7-56)	Yes	Yes		
X	626	Alloy Division Weekly Progress Reports compiled (6-56)	Yes	Yes		
X	627	Alloy Division Weekly Progress Reports compiled (7-56)	Yes	Yes		
X	628	Alloy Division Monthly Progress Report (8-56)	Yes	Yes		
X	629	Alloy Division Monthly Progress Report (9-56)	Yes	Yes		
X	630	Alloy Division Monthly Progress Report (10-56)	Yes	Yes		
X	631	Alloy Division Monthly Progress Report (11-56)	Yes	Yes		
X	632	Alloy Division Weekly Progress Reports compiled (8-56)	Yes	Yes		
X	633	Alloy Division Weekly Progress Reports compiled (9-56)	Yes	Yes		
X	634	Alloy Division Weekly Progress Reports compiled (10-56)	Yes	Yes		
X	635	Alloy Division Weekly Progress Reports compiled (11-56)	Yes	Yes		
X	636	Alloy Division Monthly Progress Report (1-56)	Yes	Yes		
X	637	Alloy Division Monthly Progress Report (12-56)	Yes	Yes		
X	638	Alloy Division Weekly Progress Reports compiled (12-56)- see M483 for 1957	Yes	Yes		
X	639	Alloy Division Monthly Progress Report (1-58)	Yes	Yes		
X	640	Alloy Division Monthly Progress Report (2-58)	Yes	Yes		
X	641	Alloy Division Monthly Progress Report (3-58)	Yes	Yes		
X	642	Alloy Division Monthly Progress Report (4-58)	Yes	Yes		
X	643	Alloy Division Monthly Progress Report (5-58)	Yes	Yes		
X	644	Alloy Division Monthly Progress Report (6-58)	Yes	Yes		
X	645	Alloy Division Monthly Progress Report (7-58)	Yes	Yes		
X	646	Alloy Division Monthly Progress Report (8-58)	Yes	**No**		
X	647	Alloy Division Monthly Progress Report (9-58)	Yes	Yes		
X	648	Alloy Division Monthly Progress Report (10-58)	Yes	Yes		
X	649	Alloy Division Monthly Progress Report (11-58)	Yes	Yes		
X	650	Alloy Division Monthly Progress Report (12-58)	Yes	Yes		
X	651	Alloy Division Monthly Progress Report (1-59)	Yes	**No**		
X	652	Alloy Division Weekly Progress Reports compiled (1-59)	Yes	**No**		
X	653	Alloy Division Monthly Progress Report (2-59)	Yes	Yes		
X	654	Alloy Division Weekly Progress Reports compiled (2-59)	Yes	**No**		
X	655	Alloy Division Monthly Progress Report (3-59)	Yes	Yes		
X	656	Alloy Division Weekly Progress Reports compiled (3-59)	Yes	**No**		
X	657	Alloy Division Monthly Progress Report (4-59)	Yes	Yes		
X	658	Alloy Division Monthly Progress Report (5-59)	Yes	Yes		
X	659	Alloy Division Monthly Progress Report (6-59)	Yes	Yes		
X	660	Alloy Division Monthly Progress Report (7-59)	Yes	**No**		
X	661	Alloy Division Monthly Progress Report (8-59)	Yes	Yes		
X	662	Alloy Division Monthly Progress Report (9-59)	Yes	Yes		
X	663	Alloy Division Monthly Progress Report (10-59)	Yes	Yes		
X	664	Alloy Division Monthly Progress Report (11-59)	Yes	Yes		

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Review'd by Project Team	M File #	Description of File Contents	In 6/83 printout?	In HAI report?	Y-, Y/HG-, or Y /EXT- number	Copy?
X	665	Alloy Division Monthly Progress Report (12-59)	Yes	Yes		
X	666	Alloy Division Monthly Progress Report (1-60)	Yes	Yes		
X	667	Alloy Division Monthly Progress Report (2-60)	Yes	Yes		
X	668	Alloy Division Monthly Progress Report (3-60)	Yes	**No**		
X	669	Alloy Division Monthly Progress Report (4-60)	Yes	Yes		
X	670	Alloy Division Monthly Progress Report (5-60)	Yes	Yes		
X	671	Alloy Division Monthly Progress Report (6-60)	Yes	Yes		
X	672	Alloy Division Monthly Progress Report (7-60)	Yes	Yes		
X	673	Alloy Division Monthly Progress Report (8-60)	Yes	Yes		
X	674	Alloy Division Monthly Progress Report (9-60)	Yes	Yes		
X	675	Alloy Division Monthly Progress Report (10-60)	Yes	Yes		
X	676	Alloy Division Monthly Progress Report (11-60)	Yes	Yes		
X	677	Alloy Division Monthly Progress Report (12-60)	Yes	Yes		
X	678	Alloy Division Monthly Progress Report (1-61)	Yes	Yes		
X	679	Alloy Division Monthly Progress Report (2-61)	Yes	Yes		
X	680	Alloy Division Monthly Progress Report (3-61)	Yes	Yes		
X	681	Alloy Division Monthly Progress Report (4-61)	Yes	Yes		
X	682	Alloy Division Monthly Progress Report (5-61)	Yes	Yes		
X	683	Alloy Division Monthly Progress Report (6-61)	Yes	Yes		
X	684	Alloy Division Monthly Progress Report (7-61)	Yes	Yes		
X	685	Alloy Division Monthly Progress Report (8-61)	Yes	Yes		
X	686	Alloy Division Monthly Progress Report (9-61)	Yes	Yes		
X	687	Alloy Division Monthly Progress Report (10-61)	Yes	Yes		
X	688	Alloy Division Monthly Progress Report (11-61)	Yes	Yes		
X	689	Alloy Division Monthly Progress Report (12-61)	Yes	Yes		
X	690	Y-12 Plant Quarterly Report (3Q73)- see M197 for 4Q73	Yes	Yes		
X	691	Y-12 Plant Quarterly Report (1Q74)	Yes	Yes		
X	692	Y-12 Plant Quarterly Report (2Q74)	Yes	Yes		
X	693	Y-12 Plant Quarterly Report (3Q74)	Yes	Yes		
X	694	Y-12 Plant Quarterly Report (4Q74)	Yes	Yes		
X	695	Y-12 Plant Quarterly Report (1Q75)	Yes	Yes		
X	696	Y-12 Plant Quarterly Report (2Q75)	Yes	Yes		
X	697	Y-12 Plant Quarterly Report (3Q75)	Yes	Yes		
X	698	Y-12 Plant Quarterly Report (4Q75); Y/EX-21 The 1983 Mercury Task Force Report (8-83)	Yes	Yes		
X	699	Y-12 Plant Quarterly Report (1Q76)	Yes	Yes		
X	700	Y-12 Plant Quarterly Report (2Q76)	Yes	Yes		
X	701	Y-12 Plant Quarterly Report (3Q76)	Yes	Yes		
X	702	Y-12 Plant Quarterly Report (4Q76)	Yes	Yes		
X	703	Y-12 Plant Quarterly Report (1Q77)- see M232 for 2Q77	Yes	Yes		
X	704	Y-12 Plant Quarterly Report (3Q77)	Yes	Yes		
X	705	Y-12 Plant Quarterly Report (4Q77)	Yes	Yes		
X	706	Y-12 Plant Quarterly Report (1Q78)	Yes	Yes		
X	707	Y-12 Plant Quarterly Report (2Q78)	Yes	Yes		
X	708	Y-12 Plant Quarterly Report (3Q78)	Yes	Yes		
X	709	Y-12 Plant Quarterly Report (4Q78)	Yes	Yes		
X	710	Y-12 Plant Quarterly Report (1Q79)	Yes	Yes		
X	711	Y-12 Plant Quarterly Report (2Q79)	Yes	Yes		
X	712	Y-12 Plant Quarterly Report (3Q79)	Yes	Yes		
X	713	Y-12 Plant Quarterly Report (4Q79)	Yes	Yes		
X	714	Y-12 Plant Quarterly Report (1Q80)	Yes	Yes		
X	715	Y-12 Plant Quarterly Report (2Q80)	Yes	Yes		
X	716	Y-12 Plant Quarterly Report (3Q80)	Yes	Yes		
X	717	Y-12 Plant Quarterly Report (4Q80)	Yes	Yes		
X	718	Y-12 Plant Quarterly Report (1Q81)	Yes	Yes		
X	719	Y-12 Plant Quarterly Report (2Q81)	Yes	Yes		
X	720	Y-12 Plant Quarterly Report (3Q81)	Yes	Yes		
X	721	Y-12 Plant Quarterly Report (4Q81)	Yes	Yes		
X	722	Y-12 Production/Operations- A5 Production Data Logbook (1-55 to 12-56) Box 7-4-3	Yes	**No**		
X	723	Mercury Inventory- ADP long range planning (1956)	Yes	**No**		
X	724	Y-12 Plant Quarterly Report (3Q72)	Yes	**No**		
X	725	no folder	Yes	**No**		
X	726	no folder	Yes	**No**		
X	727	no folder	Yes	**No**		
X	728	Technical Report- The Industrial Hygiene and Toxicology of Mercury (1956)	Yes	**No**		
X	729	no folder	Yes	**No**		
X	730	no folder	Yes	**No**		
X	731	no folder	Yes	**No**		
X	732	no folder	Yes	**No**		
X	733	Technical Report-Prelim Analysis of Mortality Among Y-12 Workers Monitored for Mercury	Yes	**No**	H199	
X	734	no folder	Yes	**No**		
X	735	no folder	Yes	**No**		
X	736	Mercury Environmental- mercury air concentrations in A2 (1971-72)	Yes	**No**		
X	737	Technical Memoranda- Mercury Content of Fish Samples by Morrow (1976)	Yes	**No**	H121	
X	738	no folder	Yes	**No**		
X	739	no folder	Yes	**No**		
X	740	no folder	Yes	**No**		
X	741	no folder	Yes	**No**		
X	742	no folder	Yes	**No**		
X	743	no folder	Yes	**No**		
X	744	Mercury Environmental- Mercury Timeline 1950-1966 (6-83)	Yes	Yes	H71	Yes
X	745	Mercury Environmental- NPDES Compliance Monitoring (1976)	Yes	**No**		
X	746	empty folder- note says file returned to Googin, see M487 for same information	Yes	**No**		
X	747	Mercury Environmental-draft document regarding prevention of mercury air contam (1955)	Yes	**No**		

Guide to the Mercury Task Force Files

Review'd by Project Team	M File #	Description of File Contents	In 6/83 printout?	In HAI report?	Y-, Y/HG-, or Y /EXT- number	Copy?
X	748	Mercury Environmental- Advances in Water Pollution conference proceedings (1966)	Yes	**No**		
X	749	no folder	**No**	**No**		
X	750	Mercury Inventory- mercury excesses (1976)	Yes	**No**		
X	751	Y-12 Production/Operations- Standard Procedures for A4 and A5 - Book 1 of 2 (1956-57)	Yes	Yes		
X	752	Y-12 Production/Operations- Standard Procedures for A4 and A5 - Book 2 of 2 (1956-57)	Yes	**No**		
X	753	Colex Losses- note says checked out to D. Smith	Yes	**No**		
X	754	Mercury Flasking- note says see documents in M40 and M73	Yes	**No**		
X	755	Technical Memorandum- furnace specification for 81-10 furnace (7-56)	Yes	Yes	H59	Yes
X	756	Mercury Environmental- Task Force Interview of Dr. Utidjan (1983)- checked out to L.McCa	Yes	**No**		
X	757	no folder	Yes	**No**		
X	758	empty folder	**No**	**No**		
X	759	no folder	Yes	**No**		
X	760	Mercury Environmental- 1966 mercury spill, mercury in Poplar and Clinch by Elwood (1977	Yes	**No**	H91,108,109	
X	761	Mercury Environmental- SIC code 2812 (alkali and chlorine) search printout (no date)	Yes	**No**		
X	762	Y-12 Production/Operations- Elex related correspondence (1955-57)	Yes	**No**	H390-394,396,399-407	
X	763	Mercury Environmental- Federal Regulations for Environmental Control (8-79)	Yes	Yes		
X	764	Mercury Environmental- correspondence on mercury air concentrations in A5 (1955)	Yes	**No**	H408,409	
X	765	no folder	Yes	**No**		
X	766	no folder	Yes	**No**		
X	767	no folder	Yes	**No**		
X	768	empty folder- note says checked out to J. Arendt	Yes	**No**		
X	769	empty folder- note says checked out to J. Arendt	Yes	**No**		
X	770	no folder	Yes	**No**		
X	771	no folder	Yes	**No**		
X	772	no folder	Yes	**No**		
X	773	no folder	Yes	**No**		
X	774	no folder	Yes	**No**		
X	775	no folder	Yes	**No**		
X	776	Y-12 Production/Operations- ADP Program study, target feed salt usage (1956) Box 19-6-	Yes	**No**	H505,525	
X	777	no folder	Yes	**No**		
X	778	Y-12 Production/Operations- pump specs (1955)	Yes	**No**		
X	779	Mercury Environmental- SIC code 2812 (alkali and chlorine) search printout (no date)	Yes	**No**		
X	780	Mercury Inventory- Mercury Accountability Data by H. McCollum (6-83)	Yes	**No**	H389	
X	781	Mercury Inventory- A5 stripping correspondence (1965)	Yes	**No**	H51,70,95,271,443,444,483	
X	782	empty folder	Yes	**No**		
X	783	empty folder- note says see M325,M602	Yes	**No**		
X	784	Mercury Inventory- A4 and A5 (1968, 1976); A2 (1958)	Yes	**No**	H107,429-434,445-448	
X	785	no folder	Yes	**No**		
X	786	Mercury Environmental- Task Force Interview transcripts of L. LaFrance, D. Polley (1983)	Yes	**No**		Yes
X	787	empty folder- note says see same information in M73,M80,M509	Yes	**No**		
X	788	Y-12 Production/Operations-ADP correspondence(1952-55)-note says checked out to D.S	Yes	**No**		
X	789	Y-12 Production/Operations- A5 operations study (1956)	Yes	**No**		
X	790	Y-12 Production/Operations- A5 alloy (lithium) production processes (5-53)	Yes	**No**		
X	791	Y-12 Production/Operations- A5 alloy (lithium) production processes (9-53)	Yes	**No**		
X	792	no folder	**No**	**No**		
X	793	Mercury Environmental- Industrial Hygiene and Toxicology of Mercury (11-56)	Yes	**No**		
X	794	Y-12 Production/Operations- Colex development notes (1954)	Yes	**No**		
X	795	Y-12 Production/Operations- Colex development notes (1954)	Yes	**No**		
X	796	Mercury Environmental- urine and air monitoring program for worker Hg exposure (1953-5	Yes	**No**	H101,522	
X	797	Y-12 Production/Operations- Correspondence- Elex (1954)	Yes	**No**		
X	798	Mercury Environmental- mercury loss from B4 tray vent system (1953)	Yes	**No**		
X	799	Technical Report- Classification Guide for Colex/Lithium Separation (1973)	Yes	Yes		
X	800	no folder	Yes	**No**		
X	801	no folder	Yes	**No**		
X	802	no folder	Yes	**No**		
X	803	no folder	Yes	**No**		
X	804	no folder	Yes	**No**		
X	805	no folder	Yes	**No**		
X	806	Mercury Environmental- correspondence on alloy (lithium) air sampling (1956)	Yes	**No**		
X	807	Mercury Environmental- mercury air analysis reports A4 and A5 (1956-57)	Yes	**No**		
X	808	Mercury Environmental- mercury and lithium air analysis reports A4 (1956)	Yes	**No**		
X	809	Mercury Environmental- lithium air analysis reports (1955-57)	Yes	**No**		
X	810	Technical Memoranda- B4 Chemical Recovery Area Progress Reports (1953)	Yes	Yes	H413,440	Yes
X	811	no folder	Yes	**No**		
X	812	Technical Memorandum- Colex development Facility scope (PTF,STF,MCT) (1954)	Yes	Yes	H159	
X	813	Mercury Environmental- mercury change notices (1956-58)	Yes	**No**		
X	814	Technical Report- History of Colex in A4 and A5 (5-63) Box 40-14-2	Yes	Yes		
X	815	no folder	Yes	**No**		
X	816	no folder	Yes	**No**		
X	817	no folder	Yes	**No**		
X	818	no folder	Yes	**No**		
X	819	Mercury Environmental-Hg inspection trip reports(1963,74); Hg in bryophytes by Gough (1	Yes	**No**	H165,166	
X	820	Mercury Environmental- Hg contamination in the US (1983); Hg in hydrogen vent gas (196	Yes	**No**	H117,154	
X	821	no folder	Yes	**No**		
X	822	no folder	Yes	**No**		
X	823	Mercury Environmental- Hg data results (1953-58) Boxes 19-7-6, 14-12-11, 20-9-16, 20-9	Yes	**No**		
X	824	Mercury Environmental- mercury special urinalysis results (1956)	Yes	**No**		
X	825	Mercury Environmental- EFPC water flow data (1955)	Yes	**No**	H77	Yes
X	826	Mercury Environmental- EFPC water flow data (1956)	Yes	**No**	H79	Yes
X	827	Quarterly Health Physics Reports B4 (1954)	Yes	**No**	H80	Yes
X	828	no folder	**No**	**No**		
X	829	Mercury Environmental- mercury air sampling data A5- % above MAC (1958)	Yes	**No**	H162	
X	830	Mercury Environmental- mercury air sampling data A5- % above MAC (1957)	Yes	**No**	H163	

Guide to the Mercury Task Force Files

Review'd by Project Team	M File #	Description of File Contents	In 6/83 printout?	In HAI report?	Y-, Y/HG-, or Y /EXT- number	Copy?
X	831	Mercury Environmental- mercury air sampling data A4- % above MAC (1957)	Yes	**No**	H164	
X	832	no folder	Yes	**No**		
X	833	no folder	**No**	**No**		
X	834	Mercury Environmental- monthly mercury reports B4 (1954-55); weekly reports B4 (1954)	Yes	**No**	H49,81	Yes
X	835	Mercury Environmental- monthly mercury reports A2, Building 9202 (1954)	Yes	**No**	H67,82	Yes
X	836	Mercury Environmental- Hg air results, uncertainty 81-10, B4, A4,A5, 9929-3 storage(1953	Yes	**No**	H169,170,172-175,191	Yes
X	837	Mercury Environmental- mercury air data A5 (1955)	Yes	**No**	H528	
X	838	Mercury Environmental- air ventilation A5 (1955)	Yes	**No**	H526	
X	839	Mercury Environmental- mercury in A5 air by Sanders (2-56)	Yes	**No**		
X	840	Mercury Environmental- mercury concentrations and flow rates in EFPC (1954-60)	Yes	**No**	H436,437	
X	841	no folder	**No**	**No**		
X	842	no folder	**No**	**No**		
X	843	Mercury Environmental- Elwood Report correspondence (1977)	Yes	**No**	H91,110,126-132	Yes
X	844	Mercury Environmental- mercury in EFPC by Blaylock (1983)	Yes	**No**	H123	
X	845	Mercury Environmental- Y-12 compliance inspection (1983)	Yes	**No**	H90	
X	846	Mercury Environmental- Mercury in EFPC (1976-82); environmental committee meeting (1	Yes	**No**		
X	847	no folder	**No**	**No**		
X	848	Mercury Environmental- Elwood's sample collection points (1976)	Yes	**No**		
X	849	Mercury Environmental- Clinch and Poplar Cr fish sampling by Morrow (9-77)- more detail	Yes	**No**		
X	850	no folder	**No**	**No**		
X	851	Mercury Environmental- Clinch and Poplar Creek fish sampling by Morrow (9-77)	Yes	**No**		
X	852	Mercury Environmental- Clinch and Poplar Creek fish sampling by Morrow (11-77)	Yes	**No**		
X	853	Mercury Environmental- Clinch and Poplar Creek fish sampling by Morrow (3-78)	Yes	**No**		

**There are no folders for M255-285.

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APPENDIX E

PUBLICLY AVAILABLE DOCUMENTS FROM THE MERCURY TASK FORCE FILES AS OF AUGUST 14, 1995

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APPENDIX E

PUBLICLY AVAILABLE DOCUMENTS FROM THE MERCURY TASK FORCE FILES AS OF AUGUST 14, 1995

This appendix provides a listing of Mercury Task Force Files released to the DOE Public Reading Room in Oak Ridge, including:

- A listing of the documents released during the 1994 DOE Large-Scale Review Project, originally compiled by the Y-12 Health Studies Agreement (HSA) Coordinator, and

- Extracts of classified reports (designated by Y/EXT-###) that were requested by two members of the Oak Ridge Health Agreement Steering Panel (ORHASP) during their initial review of the Mercury Task Force Files and/or by the project team as part of the Dose Reconstruction Study.

The document descriptions in the original list were taken directly from the Information Control Forms (ICF) attached to each document. However, the ICF descriptions were often vague and did not always contain dates or authors. The project team revised the original list by adding notes and/or missing dates (in italics) for documents that contained information relevant to mercury releases and of potential use to dose reconstruction. Documents that did not appear to be useful to dose reconstruction were briefly reviewed, but additional notes were typically not added.

Copies of the documents can be reviewed in the Public Reading Room if more information on them is desired.

PUBLICALLY RELEASED DOCUMENTS FROM THE LARGE-SCALE REVIEW

© = a copy of the document was requested
T = document has been reviewed
= the information control form for the document has been reviewed
italics = notes made in addition to information control form document descriptions

TY/HG-0001 Excessing of Mercury *for flasking and shipment from Alpha-4*: Correspondence with attachments (1975-76) *#6 discusses cracks in 9720-26*

TY/HG-0002 Mercury Flasking *in Alpha-4*: Correspondence with attachments (1974-77)

TY/HG-0003 Solvent Capitalization and Write Off (1956-62) *#1 is A4 usage; #2 is A4,A5 losses; #11 is A2 loss*

TY/HG-0004 Monthly Mercury Inventory Reports Mercury Storage Inventory & Adjustment Balance Sheets (1975-79)

©TY/HG-0005 Solvent Recovery Facility Log Sheets (4/57 to 5/62 incomplete) *from M-65; these are typed versions of logsheets compared to Y/HG-0023; November 1957 and May through Dec. 1961 are missing,*

TY/HG-0006 Building 9201-5 - Stripping Progress Report (3/65 to 1/66)

©TY/HG-0007 MCT (multi-column) Solvent *recovered from MCT cooling towers (1955) / lost at A2 (1959); several accounting letters, such as -0007/6 ($337K covers loss of solvent in A-2).*

TY/HG-0008 Mercury Loading *(storage)* and Related Costs (1966-82)

TY/HG-0009 Information Related to Mercury *storage and handling* (1980-83)

TY/HG-0010 DOE Owned Mercury for Sale by GSA (2/80)

TY/HG-0011 DOE-Owned Mercury for Sale by GSA (3/80)

TY/HG-0012 Mercury Storage and Transfers (1963-73)

©TY/HG-0013 General Mercury Correspondence Including Letters, Memos, and Attachments *for Alpha-4* (1973-83); *1975-76 A-4 flasking; 1983 clean up plan*

TY/HG-0014 Safety analysis report - Mercury Flasking *in Alpha-4* (1976); *see M-347,-348,-409,-447*

TY/HG-0015 AEC Mercury Shipment *Orders* (1965-68)

©TY/HG-0016 Mercury Recovery from *LiOH* Extract *report from MIT, document no. KT-542* (10-18-60)

TY/HG-0017 Mercury Public Sale FY 1965- *shipping orders to companies*

TY/HG-0018 Mercury Shipments, 1964- *shipping orders to companies*

TY/HG-0019 Request for *Purity* Analyses - 45,000 Flasks of Mercury (2/80)- < *LODs except for silver*

TY/HG-0020 Mercury Costs (Amendment #13 to memorandum of Agreement #GS-000-23195/SCM) (4/81)

TY/HG-0021 Mercury Flasking Data 9211-4 *flasking station* (5/76 to 1/78)

Y/HG-0022 Proposed Mercury Storage Building *9720-26* (2/63)

©TY/HG-0023 Solvent Recovery *Log Sheets* (1957-62) *from M-68; 1/58 through 10/62, mostly handwritten logsheets compared to Y/HG-0005.*

©TY/HG-0024 Alpha-5 H2 SO4 Task Inspection Demineralized Water Line Drawing and Alpha-4 Auxiliary Inventory Sheet (5/62)

TY/HG-0025 Alpha-4 Mercury Inventory Procedure, Flask Shipping Correspondence (date not given)

TY/HG-0026 Mercury Physical Properties (8-20-57) *includes specific gravity, solubility of alloy in solvent*

TY/HG-0027 Alpha-4 Mercury Bottling Logbook (1969)

TY/HG-0028 Alpha-4 Solvent Bottling Logbook (1968-69)

TY/HG-0029 Mercury Bottling Log Books (2nd quarter 1965, 2nd quarter 1971)

Y/HG-0030 A Study of Mercury as Charge to Determine Factors Affecting Output (6/47)

Y/HG-0031 Electromagnetic Concentration of the Stable Isotopes of Mercury (8/51)

Y/HG-0032 Refrigeration System Used in mercury Isotope Collections (12/49)

TY/HG-0033 Water Treatment Correspondence (1966-1968) *water supply*

TY/HG-0034 Mercury *urine* bioassay data, Beryllium worker surveillance, radiation exposure monitoring correspondence (date not given)

TY/HG-0035 Construction Project Data Sheet, Air and Water Pollution Control (6/67) *no mention of mercury*

TY/HG-0036 Mercury transfers, purity correspondence, 1962

TY/HG-0037 Excessing of Mercury for Disposal by GSA (5/79)

©TY/HG-0038 New Hope Pond Dredging Operation (10/72) *by M. Sanders*

TY/HG-0039 Warehousing and Storage Survey, Y-12 Plant, Mercury Shipment receipts, requirements (1954)

TY/HG-0040 Lab Comparisons for ERA Water Batch Mercury (1978-82)

TY/HG-0041 Additional Data on Core Samples from New Hope Pond (8-18-82)

TY/HG-0042 ORNL Report No. CF-82/257 "Mercury Contamination East Fork Poplar Creek and Bear Creek" (9-7-82) *by Van Winkle*

TY/HG-0043 Statistical Analysis of Fish, *Sediment, Vegetation* Data by unknown author (date not given but after Elwood's 1977 report)- *mercury concentration proportional to size of fish*

Y/HG-0044 Mercury Analyses of Air Samples - Buildings 9201-4, Letter: Johnson to Bean (2-9-83)

Y/HG-0045 Mercury Analysis - Poplar Creek (5/82 to 1/83)

TY/HG-0046	Mercury Contamination Study - Meeting Notes/Task Plans/*Data* (1982)
Y/HG-0047	Notes on Mercury Sampling Medium and Locations *for foliage and plants, Bear Creek and EFPC 1.3 and 5 RM* (5/82)
TY/HG-0048	Mercury Contamination in New Hope Pond, East Fork Poplar Creek and Bear Creek *by Van Winkle* (6-2-82 briefing) *good map on p. 24*
©TY/HG-0049	Monthly Solvent *(Air Samples)* Report Building 9204-4 (9/54 to 1/55) *from M-834*
Y/HG-0050	EMCR QA Technical Meeting No 31; and Air Samples, Building 9201-4 (3/83)
TY/HG-0051	Health and Safety precautions to Alpha-5 stripping; letters meeting ,minutes, bid & acceptance-scrap sales, 1965 *(pre-stripping)*
Y/HG-0052	NPDES Compliance Monitoring of Oak Ridge Facilities by Tennessee Division Water Quality Control Personnel (7/76)
TY/HG-0053	Notebook Numbers for Alpha-4 Losses (5/58 to 3/61)
Y/HG-0054	Health Physics Progress Report, July 1952 through December 1952
©TY/HG-0055	Results of Poplar Creek Water Analyses (12/54 to 12/55) *by M. Sanders from M-488; 8 months of monthly avgs and 4 months of weekly avgs*
Y/HG-0056	Industrial Hygiene Mercury Sampling Correspondence and Data *for Alpha-4* (1978-83)
©TY/HG-0057	Industrial Hygiene Mercury Sampling Correspondence and Data *for 81-10 and miscellaneous 9000 buildings* (1971-82); *IH field reports, A-4 stripping in 1982, #28 copied.*
Y/HG-0058	Provision of Clothing to Workers Potentially Exposed to Mercury (10/54)
©TY/HG-0059	Specifications for Multiple Hearth Furnace and Excess Report (10/56)
TY/HG-0060	Applications for Liquid Waste Discharge Permits from the Corps of Engineers (6/71)
©TY/HG-0061	Characterization of Water Treatment Plant Sludge (3/71)
TY/HG-0062	Application for Liquid Waste Discharge Permits from the Corps of Engineers (6/71)
TY/HG-0063	FY 1971 Annual Progress Report on Air and Water Pollution Abatement Projects (5/71)
TY/HG-0064	Water Effluent Data (9/71)
TY/HG-0065	Applications for Liquid Waste Discharge Permits from the Corps of Engineers (6/71)
TY/HG-0066	Funding for Selected Environmental Activities; letter - Hibbs to Sapirie (12/71)
©TY/HG-0067	Solvent Monthly *Air Sample* Reports *for Alpha-2* (9/54 to 12/54) *from M-835*
©TY/HG-0068	Progress Report - Health Physics (11/50 to 12/50) *from M-494*
©*TY/HG-0069*	*Health Physics Progress Report, July 1-December 31, 1951*

©TY/HG-0070 Internal Correspondence on Stripping of Alpha-5 (1965) *#10*

©TY/HG-0071 Activities Related to Mercury *Timeline 1950-66* (6/83*) by H. Stoner*

©TY/HG-0072 Report of *the USAEC* Investigating Committee - Loss of Mercury at the Y-12 Plant *on May 28, 1966* (5-13-66)

TY/HG-0074 Letter requesting Y-12 Personnel to visit Olin Mathieson facilities, dated January 3, 1956

Y/ HG-0075 Solvent Urine Program for Alloy Division (8/53)

Y/HG-0076 Solvent Urine Program for Maintenance Personnel (1/54)

©TY/HG-0077 Water Flow for East Fork Poplar Creek *for 6-13-55 to 12-30-55 (weekly reports with daily numbers) from M-825*

Y/HG-0078 Information Transmittal Civil and Architectural Engineering, Y-12 Plant; Title: Sewer Flow Meter at Midway Guard Station (9/55)

©TY/HG-0079 Water Flow in East Fork Poplar Creek for Period 12/26/55 through 9/9/56 *(weekly reports with daily numbers)* from M-826

©TY/HG-0080 Health Physics Reports on Solvent for Building 9204-4 (1954) *from M-827*

©TY/HG-0081 Weekly Solvent Reports Building 9204-4 (1954) *from M-834*

©TY/HG-0082 Weekly Solvent Reports *Buildings 9201-2 and 9202* (1-54 to 8-54) *from M-835*

©TY/HG-0083 Correspondence: Solvent Usage, Losses, Transfers, Shipping Orders (1953-57); *X-10 solvent transfer (10-27-54)*

TY/HG-0084 Correspondence: Solvent Shipments, Transfers, and Loans (1956-63)

Y/HG-0085 Notes on Mercury Contamination in Fish in East Fork Poplar Creek (1970-81) *handwritten notes*

©TY/HG-0086 Notes on Solvent Problem (1955) *for 1956 crash program to reduce mercury levels in Colex buildings; includes ventilation information for A4 and A5 same as in Y/HG-284*

TY/HG-0087 Letters: "9201-4 Stripping Estimates" *(8/74)* and "Removal of Mercury from Waste Waters" *(7/77)*

Y/HG-0088 Mercury Bottling Estimate Comments (5/75)

Y/HG-0089 Correspondence and notes regarding attendance by Y-12'ers and ORNL persons at the Conference entitled "Mercury in the Industrial Environment" at Pacific Grove California (1/72)

TY/HG-0090 Notice of Non-Compliance, Y-12 Plant Compliance Evaluation Inspection (3/83)

©TY/HG-0091 Correspondence: Letters regarding Mercury Analysis, Contamination, Monitoring Data, reports, 1970 and 1977- *#1 is fish, mud and water mercury concentrations in 1971 by M. Sanders*

TY/HG-0092 Correspondence, Mercury Transfers, Shipping Order and Spillage (1959, 61, 65)

Y/HG-0093 Miscellaneous Correspondence on Mercury Bottling *for Alpha-4* (1974,75)

TY/HG-0094 Miscellaneous Letters and Worksheets on Mercury Bottling and Disposal (1971-83)

TY/HG-0095 Invitation, Bid and Acceptance of Mercury Contaminated Materials (1965-78)

TY/HG-0096 Letter, "Declassification of Health and Safety Data Related to Mercury Exposures in Y-12" *for NIOSH* (6/72)

TY/HG-0097 Letter, "Declassification of Health and Safety Data Related to Mercury" (7/72)

©TY/HG-0098 Letter, "Estimated Mercury Losses in Creek Waters - 1955 through 1975 *from Napier to Smith* (5/77) - *one of 2 attachments to 1977 Case report from M-477; the source of the 235,000 lb. number*

TY/HG-0099 Letter "Health and Safety Data Related to Mercury" (11/72)

TY/HG-0100 Shipping Orders No. Y-39918 through Y-56085 and Letter, Harris to Terry (1962,63)

©TY/HG-0101 Letter, "Suggested Studies for Development Division" *from J.S. Reece to R.A. Walker* (10/57) - *see section on mercury losses*

TY/HG-0103 Y-12 Urinary Mercury Bioassay Data (12/74)

©TY/HG-0104 Letter, "Analysis of Cow Tissue for Total Mercury" (1/83)

©TY/HG-0105 Letter, "Analysis of Tissue from Control Animals" (1/83)

©TY/HG-0106 Report, "Preliminary Report on Personnel Exposure to Mercury in the Colex Plants" *for 1/55 to 3/57* (5/57) - *air and urine mercury concentrations from M-243*

TY/HG-0107 Letter, "Accidental loss of Mercury at Y-12" (6/66) *write-off request*

TY/HG-0108 Letter, "Loss of Mercury at Y-12 Plant" (7/66)

TY/HG-0109 Letter, "Loss of Mercury at Y-12 Plant" (7/66)

©TY/HG-0110 Letter, "Report on Contamination in Poplar Creek and the Clinch River" (4/77) *from M-843*; *#4 says Elwood report should be interim and business confidential*

©TY/HG-0111 Letter, "Request for Interpretive Assistance: Mercury in Sediments" (5/83) *to Clarkson at Univ. Rochester*

Y/HG-0112 Memorandum of Understanding Between DOE and EPA and Tennessee Department of Public Health (5/83)

©TY/HG-0113 Letter, "Additional Ventilation for the Beta-4 Cascade" (7/54)

Y/HG-0114 Poplar Creek Fish Analysis Program for the Determination of Methylmercury, Polychlorinated Biphenyls, and Uranium (10/82)

©TY/HG-0115 Letter, "Determination of Organic Mercury in *New Hope Pond* Sediments" (8/82) *has analytical information*

©TY/HG-0116 Letter, "Mercury Losses to East Fork Poplar Creek" *1955-82* (5/83) *from M-491; information is duplicated from Y/HG-0098 dated 5/77; this copy contains notes on analytical question of soluble vs. total*

TY/HG-0117 Informal Report, "Comparison of Sediments, Waters and Plants in the Oak Ridge Areas of High Mercury Concentrations" (6/83)

©TY/HG-0118 Letter, "Estimate of Amount of Mercury in the New Hope Pond Sediments" (5/83)

©TY/HG-0119 Letter, "Submission of DOE Acquired Data Relating to Metals and Organics Levels in Local Fishery and Sediments" (10/82)

TY/HG-0120 Letter, "Mercury in Fish in Poplar Creek" (9/76)- *2 letters similar to data letters in Y/HG-121* and "Meeting with TVA's Division of Environmental Planning (5/77)"- *letter from Wing to ERDA says they are pulling in TVA rather than publish Elwood's report, both from M-744*

©TY/HG-0121 Letters, "Mercury content of fish samples - 1976" (8/76)- *3 letters from Morrow to Elwood, one describes method from M-737*

Y/HG-0122 Letter, "Groundwater Monitoring Data" (5/83)

TY/HG-0123 Report, "Preliminary Report of the Concentrations of Hg, PCBs, and U in Aquatic Organisms from Upper East Fork of Poplar Creek and Environs" (6/83)

©TY/HG-0124 Letter, "Literature Information on Mercury" (5/83)- *has mercury toxicity information*

Y/HG-0125 Letter, "Literature Survey of Population Density Data for Selected Species of Sport Fish in Streams, Reservoirs, and Lakes (11/82)

TY/HG-0126 Letter/Abstract of Report, "Mercury Contamination of Poplar Creek and the Clinch River" (3-22-77) *by Elwood says total mercury was measured from M-843*

©TY/HG-0127 Letter on draft Report, "Report on Mercury Contamination in Poplar Creek and Clinch River" (3-22-77)

©TY/HG-0128 Letter (distribution) of "Report on Mercury Contamination in the Poplar Creek - Clinch River Drainage" (3-22-77)

©TY/HG-0129 Letter, "Report on Mercury Contamination in Poplar Creek and the Clinch River" (4-77)

©TY/HG-0130 Letter, "Notes on Meeting in R. G. Jordan's office in April 12, 1977" (4-77) and Comments on Elwood's report by Richmond (3-22-77) *mentions recent potential releases of mercury from Y12, K25*

TY/HG-0131 Letter, "Comments on Jerry Elwood's Report" (4/77)

©TY/HG-0132 *Cover* Letter, "Revised Report on Mercury Contamination in Poplar Creek and the Clinch River" *by Elwood* (5/77)

©TY/HG-0133 Letter, "Solvent Loss from Tray Vent System, 9204-4 (10/53)

TY/HG-0134 Letter, "Classification of Mercury" (11/75)

©TY/HG-0135 Report, "Health Physics Progress Report, Jan.-1953"

©TY/HG-0136 Report, "Health Physics - Hygiene Progress Report, January 1-31, 1949"

©TY/HG-0137 Report, "The Industrial Hygiene and Toxicology & Mercury" (1/57) by Univ. Rochester

TY/HG-0138 Letter "Loan of 988 pounds of mercury to NBS" (3/60)

TY/HG-0139 Mercury Handling, Flasking, Shipping, Accounting, etc. correspondence (3/63 to 11/81)

Y/HG-0140 Clinch River and Poplar Creek Fish Sampling Data - Special Sampling Program 1977 Only/"Analysis of Fish Samples" (9/77)

Y/HG-0141 Correspondence, "Sampling Locations and Identification of Fish Samples Collected for Total Mercury Analysis" by Elwood (8/76)

Y/HG-0142 Correspondence on "Fish and Sediment Sampling" (8/77, 3/78)

Y/HG-0143 Correspondence "Analysis of Fish Samples" (3/78)

Y/HG-0144 Correspondence "Analyses of Fish Samples" (11/77)

Y/HG-0145 Correspondence, "Analyses of Fish Samples" (9/77)

TY/HG-0146 Correspondence, "Waste Water Treatment Experiment, Building 9201-4, Work Order No. S-2059-61" (2/77)

TY/HG-0147 Correspondence, "Purchase Order 30Y-07726V, Mercury Storage Flasks" (12/76)

TY/HG-0148 Reports "Industrial Hygiene Field Sampling Reports: 9201-4" (1/77 to 4/77)

TY/HG-0149 Correspondence, "Eagle Picher Planning for Lithium - 7 Production" and "Equipment Strip-Out Building 9201-4" (12/75)

TY/HG-0150 Correspondence Notes on Mercury Flasks, Flasking, Sampling, and Shipping (3/75 to 12/76)

TY/HG-0151 Annual Report of Radiation Exposures - CY 1972

Y/HG-0152 Correspondence regarding Mercury Flask Procurement Program (1976)

TY/HG-0153 Industrial Hygiene Mercury Sampling, 1981-1982

TY/HG-0154 Correspondence "Colex Hydrogen Vent Gas Analysis" (6/62)

TY/HG-0155 Correspondence regarding "Excess Mercury Bottling Sales, Cost Transfers, etc." (6/58 to 9/69)

TY/HG-0156 Correspondence notes on Mercury Bottling, Handling, Tagging, Storing, Accountability, etc. (5/83)

TY/HG-0157 Correspondence, Draft Letter "Mercury Spill, March 28, 1966" *from Alpha-5 stripping; see Y/HG-0072*

Y/HG-0158 Correspondence "The Chemical and Radiological Characterization of S-3 Ponds" (7/83)

TY/HG-0159 Correspondence, Early Colex Training, Staffing, Machine Ship Facilities, Equipment Problems (1st 1/2 1954)

©TY/HG-0160 Correspondence on Abandonment/Stripping of Alpha-5 Facilities (10/64 to 6/65)

TY/HG-0161 Fire Engineering Survey, Building 9201-4 (6/70)

TY/HG-0162 Notes on "Solvent Air Sampling Data - Alpha-5" (for months of 1958)*; no monthly avgs, only if avg <.1 or >.1; does give number of values in each range of 0-.1, .1-.2, .2-.3, etc. from M-829*

TY/HG-0163 Notes on "Solvent Air Sampling Data, Alpha-5" (for 1957) *from M-830*

TY/HG-0164 Notes on "Solvent Air Sampling Data, Alpha-4" (for 1957) *from M-831*

TY/HG-0165 Trip Reports on Mercury Condition, Flask Conditions, etc. (9/53)

TY/HG-0166 Notes on Analyses for Total Hg in Samples of Aquatic Bryophytes Along Bear Creek and East Fork Poplar Creek (12/81)

Y/HG-0167 Compilation of Notes Draft Procedures, Lab Analyses, Training Duties, Purchase Order, H&S Training, etc. for Mercury Flasking Program (1976-77)

Y/HG-0168 Mercury Flasking Program: Cost Reports (1976-77)

©TY/HG-0169 Correspondence regarding "Sludge Burner Loss of Solvent and Analysis of Sludge Burner Water" (6/57)*; calculations, air samples for 1957, water samples for 1957*

TY/HG-0170 Memo "Proposals for Reduction of Solvent Leak Contamination for Buildings 9201-4 and 9201-5" *mainly about wrapping plastic around valves, etc.*

TY/HG-0171 Correspondence "Mercury Hazard Buildings 9201-4 and 9201-5" (11/55) *by Little; a "to do" list*; *also in minutes of one of the SHC Meetings*

©TY/HG-0172 Correspondence, "Recommendations for Sludge Burner from Health Standpoint" (8/57) *includes air sample results for 31 locations, 1959 monthly sheets, not many >2x the MAC.*

©TY/HG-0173 Air Concentrations in Stacks 9204-4 (10/53)

TY/HG-0174 Correspondence on Solvent Air and Water Sampling and Frequency, Confidence Levels, etc. (9/56 to 9/59)*; #3 discusses 2 analytical instruments (AC and DC); proposed reduction in sampling program*

TY/HG-0175 Correspondence on Solvent Flask Storage *in Bldg. 9929-3 (1953)*

TY/HG-0176 "List No. 2567" Listing Mercury Recipients 3-11-63 through 5-15-65 and Various Shipping Memos, Reports, etc. (3/63 to 3/65)

TY/HG-0177 Industrial Hygiene Field Sampling Reports Building 9201-4 (1/77 to 10/77)

TY/HG-0178 Correspondence on "EPA Proposed National Emission Standards for Hazardous Air Pollutants" (1/72)

TY/HG-0179 Correspondence on Environmental Monitoring/Committee, Impact Statements, Proposed Standards, Etc. (1972)

TY/HG-0180 Correspondence on Mercury Transfers Shipping Orders Confirmations, Inventory, etc. (8/79, 5/83)

TY/HG-0181 Building 9201-5 Stripping: Accounts, Purchase Orders, Bid Acceptance Sheets on Materials Sold, Etc. (2/65 to 4/68)

TY/HG-0182 "GSA & ERDA Mercury: Broken Pallets" (5/77 to 8/82)

©TY/HG-0183 Correspondence, Metallic Mercury Vapor in Building 9201-2, *Elex* (1/71) and Mercury Contamination Survey (12/70)

TY/HG-0184 Correspondence on Mercury Usage Survey/Questionnaire (6/72)

TY/HG-0185 GSA Mercury Shipments FY 71

TY/HG-0186 Mercury Shipments FY 1977 - FY 1980

TY/HG-0187 Contaminated Mercury Sales (6/71 to 5/72)

TY/HG-0188 Mercury Flasking: Daily Start-up Instructions, Check Weight Instructions, Operating Instructions, Full Flask Weight Checking Instructions, Sampling Instructions, Mercury Shipments, Daily Shut-Down Instructions, and Transfer (1976)

TY/HG-0189 Mercury Bottling (3/68 to 3/75)

TY/HG-0190 Correspondence on Excess Mercury Flasking (7000 Flasks) for GSA Stockpile Storage (1/79) and Memo, "Mercury Warehouse Inspection" (9/80)

TY/HG-0191 Solvent Air Analyses (5/57) *is a letter discussing statistical reasons for not taking daily air measurements because mercury concentrations have fallen since 11/56 from M-836*

TY/HG-0192 DOE Mercury Shipping Orders FY 80

TY/HG-0193 DOE Mercury Shipping Orders FY 81: Material Dispositions, etc.

TY/HG-0194 Summary Cost Analysis; Profit and Loss Statement (Building 9201-5 Stripping) 5/65 to 1/66

TY/HG-0195 Correspondence on Computer Evaluations of Death Causes for Oak Ridge, UCND Population (10/74)

TY/HG-0196 Surface Water Sampling: Jan-Dec 1958*; weekly results with one month per page; EFPC mercury concentrations and total flow; 1260 lbs/week would be 60,370 lbs/yr, compared to Y/HG-0098 1958 number of 66,069; from M-482*

©TY/HG-0197 Health Physics - Hygiene Progress Report, May 1-31, 1949

©TY/HG-0198 Health Physics Progress Report, Jan. 1, 1952 to July 1, 1952

TY/HG-0199 Preliminary Analysis of Mortality Among Y-12 Workers Monitored for Mercury (6/83)

TY/HG-0200 Building 9204-4 Operations: Procurement Specifications Emergency Procedures, Correspondence, etc. July 2, 1953 through August 18, 1955

TY/HG-0201 Correspondence on Beta-4 Shutdown and Dismantling (3-29-56 to 7-1-57)

TY/HG-0202 Excess List Recap/Excess List No. 2567 Hg Flasks (12/62 to 6/65)

TY/HG-0203 Mercury Return Transmittals, No 7501 and No 7502 (2-5-75)

TY/HG-0204 Monthly Mercury Pallet Inventory (5/65 - 7/75)

TY/HG-0205 Transfers from Cascade *filling facility* to Storage (3/68 to 12/75)

TY/HG-0206 Return of Leaking Flasks (5/65 to 8/72)

TY/HG-0207 GSA Mercury Stockpile Shipping Orders (7/69 to 5/70)

TY/HG-0208 Transfers From Mercury Storage Facility (9720-26) to Shipping Department (5/65 to 5/73)

TY/HG-0209 GSA FY 75 Mercury Bottling Costs

TY/HG-0210 FY 75 AEC Mercury Shipping Orders

TY/HG-0211 AEC Mercury Shipments FY 1969, 1970, 1971, and 1972

TY/HG-0212 "Shipping Orders" and Property Disposition Instructions and/or Transfer Requests for Mercury (7/68 to 6/69)

TY/HG-0213 GSA Mercury Shipments - Transfers for Mercury Storage Facility (9720-26) to the Receiving and Shipping Department, and Transfer of Flasks from Filling Facility to Excess Storage Area (6/68 to 6/71)

TY/HG-0214 List 2567 Mercury Shipments FY 1965 (1/65 to 5/65)

TY/HG-0215 Contaminated Mercury, Building 81-10, Mallory Battery Co. (4/71 to 7/73)*; mostly shipping orders; #2 has % Hg in various wastes, such as process filter sludge; ranges from 5, 7, 9 to 32, 45% for the filter sludge*.

TY/HG-0216 AEC Mercury - Public Sale FY 1966 (6/65 to 11/65)

TY/HG-0217 Mercury GSA Stockpile FY 1996 (7/65 to 12/66)

TY/HG-0218 Mercury GSA Stockpile FY 1967 (7/66 to 6/67)

TY/HG-0219 Mercury GSA Stockpile FY 1968 (7/67 to 6/68)

TY/HG-0220 GSA Mercury Shipments FY 72 (8/71 to 10/72)

TY/HG-0221 GSA Mercury Shipments Shipping Orders, FY 73 (12/72 to 6/73)

TY/HG-0222 GSA Mercury Shipping Orders, FY 74 (7/73 to 6/74)

TY/HG-0223 GSA Mercury Shipping Orders, FY 75 (6/74 to 11/74)

©**TY**/HG-0224 Summary of Behavior of Mercury in Suspended Solids and Bottom Sediments (7-26-76) *by Univ. TN; has information on chemical forms of mercury*

TY/HG-0225 Mercury Donations Shipped; 10,000 Flasks to State Agencies (12/64 to 4/65)

TY/HG-0226 Hg Bottling Lab Analysis with Pallet Card (10/77 to 1/80)

TY/HG-0227 AEC Mercury Shipments - Shipping Orders FY 73 (8/72 to 12/73)

TY/HG-0228 Certification of Compliance (Mercury Flasks fabricated by Norris Industries for Y-12) 5/77 to 9/77

TY/HG-0229 Certification of Compliance (Mercury Flasks fabricated by Norris Industries for Y-12) 3/77 to 4/77

TY/HG-0230 Certification of Compliance (Mercury Flasks fabricated by Norris Industries for Y-12) 1/77

TY/HG-0231 Certification of Compliance (Mercury Flasks fabricated by Norris Industries for Y-12) 11/76 to 12/76

TY/HG-0232 Certification of Compliance (Mercury Flasks fabricated by Norris Industries for Y-12) 2/77

TY/HG-0233 Notices of Inspection *of mercury flasks* (6/76 to 11/76)

TY/HG-0235 Mercury Shipments (Transfer requests for Mercury flasks to be moved from the Mercury Storage Facility to the Shipping and Receiving Department) 1/71 to 11/74

TY/HG-0236 Mercury Shipments (Requests for flasks to be moved from the Mercury Storage Facility to the Shipping and Receiving Department) 2/67 to 6/68

TY/HG-0237 Mercury Shipments (Requests for flasks to be moved from the Mercury Storage Facility to the Shipping and Receiving Department) 7/66 to 1/67

TY/HG-0238 Mercury GSA Shipments Transmittal #1 (Requests for flasks to be moved from Mercury Storage Facility to Receiving and Shipping Department) 7/65 to 6/66

TY/HG-0239 GSA Monthly Pallet Inventory 8/65 to 2/79

©TY/HG-0241 Correspondence on "Mercury Vapor in Building 9201-2"*; 5 letters from 1971,72,76*

TY/HG-0243 Correspondence "Reclassification of ADP *(Alloy Development Program)* Mercury" 4/56, 5/56*; change classification from' current use stores' to 'other special materials*'

TY/HG-0244 Correspondence "Research Conference on Mercury and Mercurials (3/56); *one letter*

TY/HG-0245 Correspondence "Research Conference on Mercury and Mercurials" (1955); *4 letters*

©TY/HG-0246 Correspondence "Stripping of Building 9201-5 Personal Protections and Scrap Disposal" (2/65 to 7/65)

TY/HG-0247 Request for KT-542 *document, Purification of Mercury Contaminated LiOH (11/61); see also Y/HG-0016*

TY/HG-0248 Development - Fabrication Divisions Safety Meeting Minutes, July 10, 1979

TY/HG-0249 Mercury Sampling Program; Building 9201-4

TY/HG-0250 Demolition and Construction Activities on Machine Cleaning Area...Building 9201-4 (1982)

TY/HG-0251 Industrial Hygiene Sampling of 9204-2E Operation (1983)

TY/HG-0252 Correspondence regarding "*Financial* Depreciation of ADP Solvent" (7/55)

TY/HG-0253	Adequacy of AEC Evaluation of Y-12 Hazards (6/56)*; about a 5-14-56 zirconium explosion when 2 were killed; accident summary mentioned is not attached; see also Y/HG-509*
TY/HG-0254	Correspondence, "Evaluation of Y-12 Hazards" (7/56)
TY/HG-0255	Letter Emlet to Murray on "Y-12 Hazards"
©*T*Y/HG-0256	Radioactive Effluent Monitoring and Control
©*TY/HG-0264*	*Mercury Purchases and Sales; annual receipts of mercury in hundreds of thousands of flasks*
TY/HG-0265	*Mercury Adjustment; costs (9-22-78)*
TY/HG-0269	Y-12 Hazards (7/56)
TY/HG-0271	Alpha-5 Stripping Maintenance Activities and Statistics (4/65 to 8/65)
TY/HG-0272	Industrial Hygiene monitoring at 2nd floor office areas Building 9201-4 (3/78)
©TY/HG-0274	Removal of Equipment and Abandonment of Building 9201-5 (5/64 to 9/67); *discusses stopping D&D operations for the summer due to high air concentrations of mercury*
TY/HG-0275	Program Cost Changes Resulting from Proposed Alpha-4 Shutdown (9/62)
©TY/HG-0276	Shutdown of Alpha-4 Plant (10/62)
TY/HG-0277	Alpha-4 Operation Study (6/65)
©TY/HG-0281	Solvent Losses Through Ventilation Exhaust Systems, Building 9201-5 (3-14-56)*; The Little Report, one of the 2 attachments to the 1977 Case report*
TY/HG-0283	Mercury Correspondence, Surveys, Removal Storage, and Studies (6/72 to 12/77)
©TY/HG-0284	Solvent Hazards Committee Meeting, No. 5 (12-19-55)*; are attachments and drawings on ventilation air changes for A4 and A5*
©TY/HG-0285	Decontamination Memo No. 1 - Rubber Overshoes *from M-487*
©TY/HG-0286	Decontamination Memo No. 2 - Flange Gaskets
©TY/HG-0287	Decontamination Memo No. 3 - Use of Tobacco
©TY/HG-0288	Decontamination Memo No., 4A - Supersedes Decontamination Memo No. 4 - Revised Solvex and Raffinate Pump Replacement Procedure
©TY/HG-0289	Decontamination Memo No. 5 - Kinney, Pump Drain Valve
©TY/HG-0290	Decontamination Memo No. 6 - Field Replacement of Alpha-4 Raffinate Pump Stators
©TY/HG-0291	Decontamination Memo No. 7 - Leak Collection Buckets
©TY/HG-0292	Decontamination Memo No. 8 - Cleaning of Rubber Shoes and Overshoes
©TY/HG-0293	Decontamination Memo No. 9 - Dismantling Recommendations for Solvex and Raffinate Pumps

©TY/HG-0294 Decontamination Memo No. 10 - Recommended Use of Mersorb Respirators

©TY/HG-0295 Decontamination Memo No. 11 - Recommended Housekeeping Procedure

TY/HG-0296 Test at 9201-5 to Determine Effect of Temperature on Air Contamination (12-23-55)

TY/HG-0298 Specification for Mercury Vapor Respirators

TY/HG-0299 The Use of Floor Sealers and Waxes in the ADP Buildings *from M-487*

TY/HG-0300 Waste Water Disposal Practices (2/64)

TY/HG-0301 Waste Water Disposal Practices (2/64)

TY/HG-0302 Waste Water Disposal Practices (4/66)

TY/HG-0303 Inspection by USPHS of Union Carbide Facilities in Oak Ridge--Review of Waste Water Treatment and Radioactivity in Effluents (9/65)

Y/HG-0304 General Urine Excretion Averages for the Alloy Division in 1955

©TY/HG-0305 DEL REV Mercury Hazard Committee Meeting, *pre SHCM No.1* (11-21-55)

TY/HG-0306 Solvent Hazard Committee Meeting - No. 1 (<11-30-55)*; should be an attached report on all ventilation system changes*

TY/HG-0307 Solvent Hazard Committee Meeting - No. 2 (11-28-55)

TY/HG-0309 Solvent Hazard Committee Meeting - No. 4 (12-12-55)

TY/HG-0310 Solvent Hazard Committee Meeting - No. 7 (1-16-56)*; says cold weather experiment isn't working*

TY/HG-0312 Solvent Hazard Committee Meeting - No. 9 (1-30-56)

©TY/HG-0314 Solvent Inventory, Building 9201-2 (12/57)

Y/HG-0315 Solvent (3/58)

Y/HG-0316 Solvent (6/58)

Y/HG-0318 Effluent Reduction Program - Phase II "Statistical Data on Costs of Solid Waste Burial" and "Updating of Waste Management Plans" (1972)

TY/HG-0319 Telephone Conversation with Dr. W. C. Gardiner of Olin Mathieson (12/55)

TY/HG-0320 Specification and Usage Requirements for Mercury Vapor Respirators (5/56)

TY/HG-0321 Use and Decontamination of Mercury Vapor Respirators (6/56)

TY/HG-0322 Committee to investigate apparent loss of mercury at the Y-12 Plant (3/66)

©TY/HG-0323 Report of investigating committee; loss of special nuclear material (lithium) at Y-12 Plant on January 15, 1965*; contains only Part 2, Recommendations and Conclusion,but not Part 1 , ORO-125208, which discusses incident of spill loss of lithium hydroxide from an open pipe; from M-478*

TY/HG-0327 Review of the ADP Program (7/55)

TY/HG-0328 ADP Area, Building 9204-4 (8/53)

TY/HG-0329 Separate Process Ventilation System for Vertical Strippers

TY/HG-0330 Spare Absorber Rectifier Stacks (9/53)

TY/HG-0331 Resume of Beta-4 Accountability Meeting (7-15-54)

TY/HG-0332 Test of Nitrogen in Beta-4 (8/54)

TY/HG-0335 New Pumps for Make-up Process Water System, Building 9204-4 (9/53)

©TY/HG-0338 Summary of Changes in Auxiliary Systems for Beta-4 Expansion (9/53)

©TY/HG-0341 Solvent Inventory Material Balance (6/53 to 9/53); see Y/HG-530, -534 from M-602

TY/HG-0346 AEC Audit Report No. 1-2-2, Management of Capital Assets (5/62)

©TY/HG-0347 DEL Sump Study

TY/HG-0360 Removal of Mercury from Nitric Acid Wash Solutions

©*TY/HG-0362 Solvent Roaster Procedure (date unknown)*

TY/HG-0365 Disposal of Mercury and Equipment, Building 9201-4*; mentions 1965 spill of 50,000 lbs. of Hg*

TY/HG-0366 Basis for March 1972 Mercury Bottling Estimate

TY/HG-0367 Hg Bottling Cost (2/72)

TY/HG-0368 Mercury Storage *Space Requirements (3/72)*

TY/HG-0370 Mercury Bottling *Costs (2/74)*

©*TY/HG-0372 History of Handling Excess Mercury by the Y-12 Materials Dept. in Building 9720-26 (>1976)*

TY/HG-0374 Purity of Mercury in the Colex System (2/60)

TY/HG-0383 Classification of Process Material

TY/HG-0386 Mercury Inventory: September 1976 in dollars

TY/HG-0396 Results of Vent Gas Filter Tests (for alloy/lithium)-Beta-4 Elex Plant (10-13-54)

Y/HG-0397 Chemical Analysis and Hardness of Bolts Used in Buildings 9201-4 and 9201-5 (1/57)

TY/HG-0398 Graphite for Decomposers (12/56)

TY/HG-0399 Failure of Bolts on Solvex Valve (11/56)

TY/HG-0400 Purchase of Acetylene Generator (9/54)

TY/HG-0401	Materials of Construction Rubber and Plastics - U. S. Rubber Co. Types 5023 and 5352 (?)
TY/HG-0402	Alpha-5 Decomposer Graphite Sizing Tests (8/54)
TY/HG-0403	Preparation of Dicyclohexylamine Caprylate Solution (6/54)
TY/HG-0404	Tests of Cameron Valve Seats (date not given)
TY/HG-0405	Descaling Acid Inhibitors (6/54)
TY/HG-0406	Report on U.S. Rubber Co., Providence Plant (Rubber Type 5872) 4/54
TY/HG-0408	Test at Building 9201-5 to Determine Effect of Temperature on Air Conditioning in Operating Area; *winter and summer ventilation cycles*
©TY/HG-0413	Chemical Recovery Progress Report Week Ending August 8, 1953*; 5 to 7/53 from M-810; 1009 lb. of solvent recovered from B-4.*
©TY/HG-0414	Chemical Recovery Progress Report Week Ending August 2, 1953*; 8/53 from M-810; alloy recovery in B-4.*
©TY/HG-0418	Solvent Recovery Process Drawings (7/53); *B-4 from M-810; (no drawings in this folder).*
***T**Y/HG-0430*	*Alpha-4 Mercury Inventory (3-6-68)*
TY/HG-0431	Mercury Inventory Loss by J.M. Case
TY/HG-0432	Mercury Inventory Loss (8-22-68)
TY/HG-0433	Mercury Inventory Loss
TY/HG-0434	Mercury Inventory Loss (11-14-68)
TY/HG-0435	Results of Vent Gas Filter Tests - Beta 4 Elex Plant (10/54)
©TY/HG-0437	Poplar Creek Contaminants (12/56)*; contains EFPC mercury concentrations and EFPC flow rates for 3rd quarter 1954 through 4th quarter 1956 that are not cited in Y/EX-24*
Y/HG-0439	Progress Report for the Week Ending July 19, 1953
©TY/HG-0440	Progress Report for May 25 to July 11, 1953 for Beta-4 Chemical Recovery Area; *7/53 mentions existence of a solvent roaster procedure; from M-810.*
TY/HG-0441	Progress Report for the week of July 6 to July 12, 1953 for Beta-4 Chemical Recovery Area*; 7/53 on B-4 alloy recovery; from M-810.*
TY/HG-0442	Chemical Recovery Salvage (8/54); *B-4 alloy recovery; from M-810.*
*©**T**Y/HG-0445*	*Solvent (3-13-58)*
TY/HG-0446	Charge-Off of Pilot Plant Solvent Loss to Prior Years' Cost (3/58)
*©**T**Y/HG-0447*	*Solvent (6-27-58)*

©TY/HG-0453 Building 9204-4 Solvent (10/53)

©TY/HG-0454 Solvent Inventory (11/53)

©TY/HG-0455 Feed Salt and Solvent Status (9-1-54)

TY/HG-0456 Feed Salt and Solvent Status (10-1-54)

TY/HG-0457 Raw Materials, Special Materials, and Solvent Inventory, Account 2692, October 1, 1954

TY/HG-0458 Raw Materials, Special Materials, and Solvent Inventory, Account 2692, November 1, 1954

TY/HG-0459 Feed Salt and Solvent Status (no date)

TY/HG-0460 Raw Materials, Special Materials, and Solvent Inventory, Account 2692, December 1, 1954

TY/HG-0461 Raw Materials, Special Materials, and Solvent Inventory, Account 2692, January , 1955

TY/HG-0462 Raw Materials, Special Materials, and Solvent Inventory, Account 2692, February 1, 1955

TY/HG-0463 Raw Materials, Special Materials, and Solvent Inventory, Account 2692, March 1, 1955

TY/HG-0464 Raw Materials, Special Materials, and Solvent Inventory, Account 2692, April 1, 1955

TY/HG-0465 Raw Materials, Special Materials, and Solvent Inventory, Account 2692, May 1, 1955

TY/HG-0466 Raw Materials, Special Materials, and Solvent Inventory, Account 2692, June 1, 1955

TY/HG-0467 Raw Materials, Special Materials, and Solvent Inventory, Account 2692, July 1, 1955

TY/HG-0468 Raw Materials, Special Materials, and Solvent Inventory, Account 2692, August 1, 1955

TY/HG-0469 Raw Materials, Special Materials, and Solvent Inventory, Account 2692, September 1, 1955

TY/HG-0470 Raw Materials, Special Materials, and Solvent Inventory, Account 2692, October 1, 1955

TY/HG-0471 Raw Materials, Special Materials, and Solvent Inventory, Account 2692, November 1, 1955

TY/HG-0475 Mercury Packaging Procedure (1/65)

TY/HG-0479 Mercury Containers; 9201-1, *a fabrication estimate*

TY/HG-0482 Stripping Alpha-4; Estimate

©TY/HG-0489 Correspondence on mercury bottle filling and contamination; *1977 bottling overage- uncertainty; 1979 A-4 ventilation; from M-324*

©TY/HG-0490 Solvent inventory and transfer (2-12-53); *CTF and B-4; from M-602*

©TY/HG-0499 *81-10* Operations on solvent contaminated dirt (5/59)

TY/HG-0500 Purified feed chemical analysis 1960-1962

TY/HG-0501 Request for certified purity analyses - 45,000 flasks of mercury (2/80)

Y/HG-0502 Bottling and handling costs related to excess mercury (3/66)

©TY/HG-0503 Alpha-5 operations correspondence (1956)

TY/HG-0504 Beta-4 operations correspondence (1953,54)

TY/HG-0505 ADP program study (5/56)

TY/HG-0506 Solvent bottling and storage (1959-63)

©TY/HG-0509 Adequacy of AEC Evaluation of Y-12 Hazards (3/56) *contains accident summary for 1956; see also Y/HG-0253 and 0269*

©TY/HG-0511 Mercury for *Elex* Alloy Development Plant *(4-25-52)*

©TY/HG-0512 Mercury for *Elex* Alloy Development Plant *(9-5-52)*

©TY/HG-0513 Mercury for Orex ADP Process Development *(10-10-52)*

©TY/HG-0514 Mercury for *Orex* Alloy Development Plant *(3-18-53)*

©TY/HG-0515 Test for Mercury Vapor Concentration and CO_2 Absorption of LiOH

TY/HG-0516 Visit to the Lithium Corporation of America, Minneapolis, Minnesota (12-11-53)

TY/HG-0517 Summary of Aspen Salvage Meeting

TY/HG-0518 Graphite for Colex Decomposers

Y/HG-0520 Purification of uranium by secondary carbetol extraction

TY/HG-0521 Solvent available

***T**Y/HG-0522 Shower Study (1-9-56); from Leo LaFrance to W.K.Whitson*

TY/HG-0523 Building 9201-4 Ventilation Equipment Survey (4/76)

TY/HG-0524 Calculation of Stage Length from Batch Exchange Data (2/53)

TY/HG-0525 Estimate of Target Feed Salt Usage (11/56)

*©**T**Y/HG-0526 Alpha-5 Ventilation Data/Drawings (1955)*

Y/HG-0527 Alloy Stack Samples (1955-57)

*©**T**Y/HG-0528 Alpha-5 Solvent Air Data Sheets*

Y/HG-0529 Draft Safety Analysis Report for Mercury Flasking

©TY/HG-0530 Future ADP Solvent Requirements (6-18-53); *ORO-33295; from M-602; see Y/HG-0534, -0341*

***T**Y/HG-0531 Costing and Transferring of Solvent in dollars; 1956-57 correspondence file*

***T**Y/HG-0532 Economic Evaluation of ADP Tails (LiOH.H2O) Storage (3-17-55)*

©***T****Y/HG-0534* *Future ADP Solvent Requirements (7-14-53); KB-421; from M-602; see Y/HG-0530, -0341*

©***T****Y/HG-0535* *Shutdown of Beta-4 Plant (3-21-56)*

T*Y/HG-0537* *Methods for Separating Lithium Isotopes (that don't use a lot of Hg); no descriptions (5-24-55)*

T*Y/HG-0538* *Shipments of Mercury for ADP Program (12-27-55)*

T*Y/HG-0539* *Mercury Procurement (7-10-56)*

T*Y/HG-0540* *Beta-4 Plant Dismantlement (10-4-56)*

©***T****Y/HG-0541* *Mercury Shipment to INEL for ANP Program (6-21-56)*

©***T****Y/HG-0542* *Decontamination of Bldg 9201-4, Rev. 2 (3-3-77); limit proposed for Hg in effluent is .002 ppm*

T*Y/HG-0543* *Decontamination of Bldg 9201-4, Rev.1 (8-19-76); limit proposed for Hg in effluent is .002 ppm*

T*Y/HG-0544* *Decontamination of Building 9201-4 (4-22-76); limit proposed for mercury in effluent is .005 ppm; by J. Napier*

EXTRACTED PAGES FROM REPORT SERIES REQUESTED BY THE PROJECT TEAM

Y/EXT-00005	Selected Pages From Y-12 Plant Quarterly Report M-24 for October 1-December 31, 1952
Y/EXT-00030	Selected Pages From Y-12 Plant Quarterly Report M-25 for January 1-March 31, 1953
Y/EXT-00003	Selected Pages From Y-12 Plant Quarterly Report M-26 for April 1-June 30, 1953
Y/EXT-00004	Selected Pages From Y-12 Plant Quarterly Report M-27 for July 1-September 30, 1953
Y/EXT-00006	Selected Pages From Y-12 Plant Quarterly Report M-28 for October 1-December 31, 1953
Y/EXT-00027	Selected Pages From Y-12 Plant Quarterly Report M-29 for January 1-March 31, 1954
Y/EXT-00014	Selected Pages From Y-12 Plant Quarterly Report M-30 for April 1-June 30, 1954
Y/EXT-00007	Selected Pages From Y-12 Plant Quarterly Report M-31 for July 1-September 30, 1954
Y/EXT-00008	Selected Pages From Y-12 Plant Quarterly Report M-32 for October 1-December 31, 1954
Y/EXT-00009	Selected Pages From Y-12 Plant Quarterly Report M-33 for January 1-March 31, 1955
Y/EXT-00010	Selected Pages From Y-12 Plant Quarterly Report M-34 for April 1-June 30, 1955
Y/EXT-00011	Selected Pages From Y-12 Plant Quarterly Report M-35 for July 1-September 30, 1955
Y/EXT-00012	Selected Pages From Y-12 Plant Quarterly Report M-36 for October 1-December 31, 1955
Y/EXT-00034	Selected Pages From Y-12 Plant Quarterly Report M-37 for January 1-March 31, 1956
Y/EXT-00035	Selected Pages From Y-12 Plant Quarterly Report M-38 for April 1-June 30, 1956
Y/EXT-00013	Selected Pages From Y-12 Plant Quarterly Report M-19 for July 1-September 30, 1956
Y/EXT-00036	Selected Pages From Y-12 Plant Quarterly Report M-39 for October 1-December 31, 1956
Y/EXT-00037	Selected Pages From Y-12 Plant Quarterly Report M-86 for January 1-March 31, 1957
Y/EXT-00038	Selected Pages From Y-12 Plant Quarterly Report M-87 for April 1-June 30, 1957
Y/EXT-00039	Selected Pages From Y-12 Plant Quarterly Report M-88 for July 1-September 30, 1957
Y/EXT-00040	Selected Pages From Y-12 Plant Quarterly Report M-89 for October 1-December 31, 1957
Y/EXT-00041	Selected Pages From Y-12 Plant Quarterly Report M-121 for January 1-March 31, 1958
Y/EXT-00042	Selected Pages From Y-12 Plant Quarterly Report M-122 for April 1-June 30, 1958
Y/EXT-00043	Selected Pages From Y-12 Plant Quarterly Report M-123 for July 1-September 30, 1958
Y/EXT-00044	Selected Pages From Y-12 Plant Quarterly Report M-124 for October 1-December 31, 1958
Y/EXT-00045	Selected Pages From Y-12 Plant Quarterly Report M-125 for January 1-March 31, 1959

Y/EXT-00046 Selected Pages From Y-12 Plant Quarterly Report M-126 for April 1-June 30, 1959

Y/EXT-00047 Selected Pages From Y-12 Plant Quarterly Report M-127 for July 1-September 30, 1959

Y/EXT-00048 Selected Pages From Y-12 Plant Quarterly Report M-128 for October 1-December 31, 1959

Y/EXT-00049 Selected Pages From Y-12 Plant Quarterly Report M-129 for January 1-March 31, 1960

Y/EXT-00050 Selected Pages From Y-12 Plant Quarterly Report M-130 for April 1-June 30, 1960

Y/EXT-00051 Selected Pages From Y-12 Plant Quarterly Report M-131 for July 1-September 30, 1960

Y/EXT-00052 Selected Pages From Y-12 Plant Quarterly Report M-132 for October 1-December 31, 1960

Y/EXT-00053 Selected Pages From Y-12 Plant Quarterly Report M-133 for January 1-March 31, 1961

Y/EXT-00054 Selected Pages From Y-12 Plant Quarterly Report M-134 for April 1-June 30, 1961

Y/EXT-00055 Selected Pages From Y-12 Plant Quarterly Report M-135 for July 1-September 30, 1961

Y/EXT-00056 Selected Pages From Y-12 Plant Quarterly Report M-136 for October 1-December 31, 1961

Y/EXT-00057 Selected Pages From Y-12 Plant Quarterly Report M-137 for January 1-March 31, 1962

Y/EXT-00058 Selected Pages From Y-12 Plant Quarterly Report M-138 for April 1-June 30, 1962

Y/EXT-00059 Selected Pages From Y-12 Plant Quarterly Report M-139 for July 1-September 30, 1962

Y/EXT-00060 Selected Pages From Y-12 Plant Quarterly Report M-140 for October 1-December 31, 1962

Y/EXT-00061 Selected Pages From Y-12 Plant Quarterly Report M-141 for January 1-March 31, 1963

[Quarterly report extract series continued through 1962; series has ***quarterly average EFPC Hg concentrations*** *and* ***quarterly and monthly average building air Hg concentrations*** *for buildings A5 from 7-55 until 9-60, A4 from 7-55 until 10-61,* ***% above MAC*** *for 81-10 from 7-57 until 10-61,* ***quarterly and monthly averages*** *for 9808 from 1-58 until 10-61. Note that A5 was restarted and A4 was shutdown in 10-62, and 81-10 was restarted in 1-62 and curtailed for the summer of 1962.]*

Y/EXT-00023 Selected Pages From Technical Division Monthly Progress Report M-1 for January 1955 (Pages 70-75) M-1

Y/EXT-00022 Selected Pages From Technical Division Monthly Progress Report for February 1955 (Pages 88-90) M-2

Y/EXT-00015 Selected Pages From Technical Division Monthly Progress Report for March 1955 (Pages 89-95) M-3

Y/EXT-00021 Selected Pages From Technical Division Monthly Progress Report for April 1955 (Pages 29; 79-85) M-4

Y/EXT-00016 Selected Pages From Technical Division Monthly Progress Report for May 1955 (Pages 28-29; 37-38; 73-79) M-5

Y/EXT-00017	Selected Pages From Technical Division Monthly Progress Report for June 1955 (Pages 36-40; 51-52; 85-91) M-6
Y/EXT-00018	Selected Pages From Technical Division Monthly Progress Report for July 1955 (Pages 37; 49; 85-91) M-7
Y/EXT-00019	Selected Pages From Technical Division Monthly Progress Report for August 1955 (Pages 42-43; 54-55; 56; 93-100) M-8
Y/EXT-00020	Selected Pages From Technical Division Monthly Progress Report for September 1955 (Pages 42; 45-46; 95-102) M-9
Y/EXT-00024	Selected Pages From Technical Division Monthly Progress Report for October 1955 (Pages 57-58; 95-102) M-10
Y/EXT-00025	Selected Pages From Technical Division Monthly Progress Report for November 1955 (Pages 22; 48-49; 55; 94-102) M-11
Y/EXT-00026	Selected Pages From Technical Division Monthly Progress Report for December 1955 (Pages 18; 20; 52-53; 62; 64; 102-111) M-12
Y/EXT-00028	Selected Pages From Technical Division Monthly Progress Report for January 1956 (Pages 24-26; 56-58; 69-71; 109-117) M-13
Y/EXT-00075	Selected Pages From Technical Division Monthly Progress Report for February 1956, M-94
Y/EXT-00076	Selected Pages From Technical Division Monthly Progress Report for March 1956, M-95
Y/EXT-00077	Selected Pages From Technical Division Monthly Progress Report for April 1956, M-96
Y/EXT-00078	Selected Pages From Technical Division Monthly Progress Report for May 1956, M-97
Y/EXT-00079	Selected Pages From Technical Division Monthly Progress Report for June 1956, M-98
Y/EXT-00080	Selected Pages From Technical Division Monthly Progress Report for July 1956, M-99
Y/EXT-00081	Selected Pages From Technical Division Monthly Progress Report for August 1956, M-100
Y/EXT-00082	Selected Pages From Technical Division Monthly Progress Report for September 1956, M-101
Y/EXT-00083	Selected Pages From Technical Division Monthly Progress Report for October 1956, M-102
Y/EXT-00084	Selected Pages From Technical Division Monthly Progress Report for June 1957, M-111
Y/EXT-00085	Selected Pages From Technical Division Monthly Progress Report for July 1958, M-148
Y/EXT-00086	Selected Pages From Technical Division Monthly Progress Report for August 1958, M-149
Y/EXT-00087	Selected Pages From Technical Division Monthly Progress Report for September 1958, M-150
Y/EXT-00088	Selected Pages From Technical Division Monthly Progress Report for October 1958, M-151
Y/EXT-00089	Selected Pages From Technical Division Monthly Progress Report for November 1958, M-152

Y/EXT-00090 Selected Pages From Technical Division Monthly Progress Report for December 1958, M-153

*[1955 Monthly Technical Progress Report series has **monthly EFPC Hg concentrations** for 1955; monthly series became quarterly in 1959 and EFPC concentrations were not reported*]

Y/EXT-00031 Selected Pages From Y-12 Technical Progress Report for the first quarter, FY 1960 (July-September, 1959) (Pages D-5 - D-8) M-14

Y/EXT-00029 Selected Pages From Y-12 Technical Progress Report, Part D-Laboratory for May-July 1963 (pages D-48/D-54) M-15

[2 1949 Health Physics-Hygiene Progress Reports (Y/HG-136 and Y/HG-197) have monthly average building air Hg concentrations for miscellaneous 9000 buildings, e.g., 9733-3 and 9720-5]

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APPENDIX F

Y-12 RECORDS CENTER BOXES CONTAINING MERCURY BUILDING AIR AND LIQUID EFFLUENT MONITORING DATA

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Table F-1: Locations of Mercury Building Air Data in Boxes at the Y-12 Record Center

Name of Operation	Building	Dates of Operation	Record Date	Box Number(s) *
Colex	9201-4	Jun 55- Dec 62	6/55-9/55	11-10-3
			10/55-5/56	19-1-10
			6/56	20-2-8
			7/56-9/56	19-8-16
			10/56-3/57	20-2-8
			4/57-10/57	20-11-20
			11/57-12/57	20-9-19
			1/58-5/58	14-4-13
			6/58-12/58	14-4-14
			1/59-12/59	20-4-5
			1960	19-7-8, 14-4-8
			1955-60	19-7-7
			1961	14-11-4
			1/61-6/61	19-7-10
			7/61-8/63	14-11-2
Colex	9201-5	Jan 55-Feb 59, Dec 62-May 63, 1965-66	1/55-9/55	12-11-3
			10/55-3/56	19-1-11
			4/56-6/56	19-1-12
			7/56	18-8-16
			8/56-10/56	19-8-15
			11/56-3/57	20-2-7
			4/57-9/57	20-11-21
			10/57-12/57	20-9-19
			1/58-8/58	14-4-12
			9/58-12/58	14-4-13
			1/59-12/59	20-4-6
			1955-60	19-7-7
			1960	19-7-8, 14-4-8
			1961	14-11-4
			1/61-6/61	19-7-10
			7/61-8/63	14-11-2
Orex Pilot Plant	9202	Apr 53-May 54	1953	20-9-16
			1954	20-9-15, 20-6-16
Li Ops Machine Shop	9204-2		1955	20-9-17
			1956	20-9-17
			6/55-5/57	14-4-14
			1958	14-11-1
			1959	19-7-6
Rubber Shop	9404-9		1959	19-7-6
			1960	19-7-8
			1961	14-11-4
			1/61-6/61	19-7-10
			1962	14-11-4
Changehouse	9723-18		8/55-12/57	14-4-14
			1958	14-11-1
			1959	19-7-6
Changehouse	9723-19		4/55-9/57	14-4-14
			1958	14-11-1
			1959	19-7-6
Hydrogen Burner	9727-3		1958	14-11-1
			1960	19-7-8
			1961	14-11-4

Table F-1: Locations of Mercury Building Air Data in Boxes at the Y-12 Record Center

Name of Operation	Building	Dates of Operation	Record Date	Box Number(s) *
Laundry	9728		5/55-8/57	14-4-14
Pump Repair	9808		1958	14-11-1
			1959	19-7-6
			1960	19-7-8
			1961	14-11-4
			1/61-6/61	19-7-10
			1962	14-11-4
Flasks	9929-3			20-9-16
Hg Recovery Furnace	81-10	Mar 57-May 62	4/57-12/58	14-4-15
			1959	19-7-6
			1960	19-7-8
			1961	14-11-4
			1/61-6/61	19-7-10
			1962	14-11-4, 14-11-1
			7/61-8/63	14-11-2

* Boxes can be removed permanently or moved. The box number is a location only. In the event that a box is removed, a record of the transfer is retained.

Table F-2: Miscellaneous Mercury Air Data

	Box No.	Date
Solvent Change Notices- IBM (urine)	18-4-10	1957,58
" "	12-10-18	1965-71
Solvent Reports, I.B.M. computer program (urine)	20-11-17	1961-62
Mercury Air Analysis Reports- weekly	11-7-19	1/52-6/52
Solvent Air Survey Summary Sheets (daily avg to weekly,monthly avg)	19-7-8	1960
" "	14-11-4	1961, 1962
Solvent- Special Studies (e.g. stack, source, SAARs)	20-9-16	1953
" "	20-9-17	
" "	14-4-14	1955-56

Table F-3: Miscellaneous Mercury Water Data

	Box No.	Date
Water (EF) Poplar Creek Flows	20-9-18	1955,56
(EF) Poplar Creek- Analysis for Flow	19-7-6	1959
Surface Water- (EF) Poplar Creek Analysis (pH only)	14-11-3	1962-63
(EF) Poplar Creek Sample Results (pH & spectral only)	19-7-8	1960
Surface Water Sampling	18-10-1	1956
"	12-1-23	1957
"	11-8-8	1958
Water Sample Analysis cards (daily)	14-4-8	1957-60
Water Analysis	19-7-11	1961
(EF) Poplar Creek Water Sample Analysis	19-7-19	1961
Water Sampling- Potable	19-7-6	1959-60
Potable Water Sampling	14-11-3	1960-61
Potable Water Analysis (weekly)	19-7-11	1961

Source: Health Physics Departmental Retired Records Listing (10-6-81) obtained from J.B. Hunt (Title: Radiation Safety Records on Storage in the Y-12 Records Center- A Manual), 36 pages.

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APPENDIX G

DESCRIPTIONS OF BUILDING VENTILATION SYSTEMS

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August 8, 1996

Ventilation Systems of Building 9201-5
as Existed in 1956
by
E. E. Choat

Building Description

Building 9201-5 is a large process building at Y-12 with an overall size of 543 feet x 350 feet. It has 3 floors and a total volume 9,471,300 ft^3. The building has seven operating bays- the East Crane Bay, West Crane Bay, four control bays, and one service bay.

Figure 1 is a plan of the 3rd floor of the Colex Production Plant, 9201-5, as it was in 1956. Figure 2 is a sectional view of the building. These plans are included here to provide dimensional information on the structure and pertinent building elevations, and to show the location of various building processes and major ventilation exhaust points. As seen here, “absorbers” (a major process step) occupied the entire 3rd floor of three bays and “cascades” occupied the entire three floors of two large bays.

All building areas were contaminated with mercury except the Service/Maintenance and the Motor Generator (MG) Set areas.

Ventilation

The initial design of the ventilation systems for this building was done by an architect engineering company, Catalytic Construction Company. Supervision of this design was done by Union Carbide Y-12 Plant Engineering personnel. The Y-12 Design Department was responsible for review and approval of all heating, ventilating, and air conditioning (HVAC) plans and consequently, were intimately familiar with the details of these systems. Mr. J.C. Little was head of the Y-12 Design Department in the mid 1950s. At that time I worked in Jim Little’s department as an HVAC Design Engineer. Construction of this design was completed in 1955, but did not provide sufficient ventilation to maintain acceptable mercury contamination levels.

In this building, large surface areas of mercury were exposed to the ambient air. As air temperatures increased from winter to summer operation, more mercury vaporized and entered the ambient air. Therefore, mercury contamination levels tended to increase during

Figure 1
3rd Floor Plan – Building 9201-5

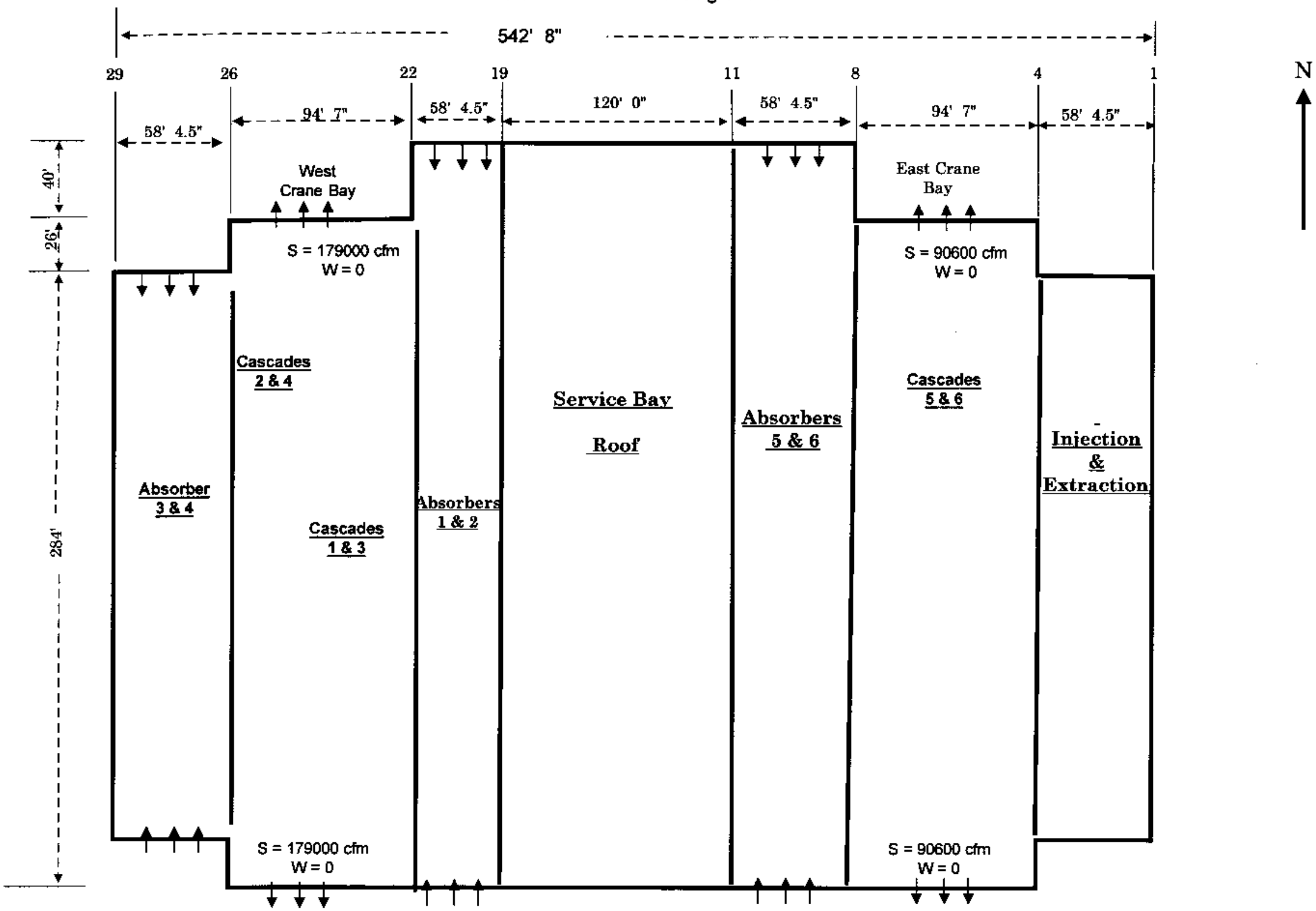
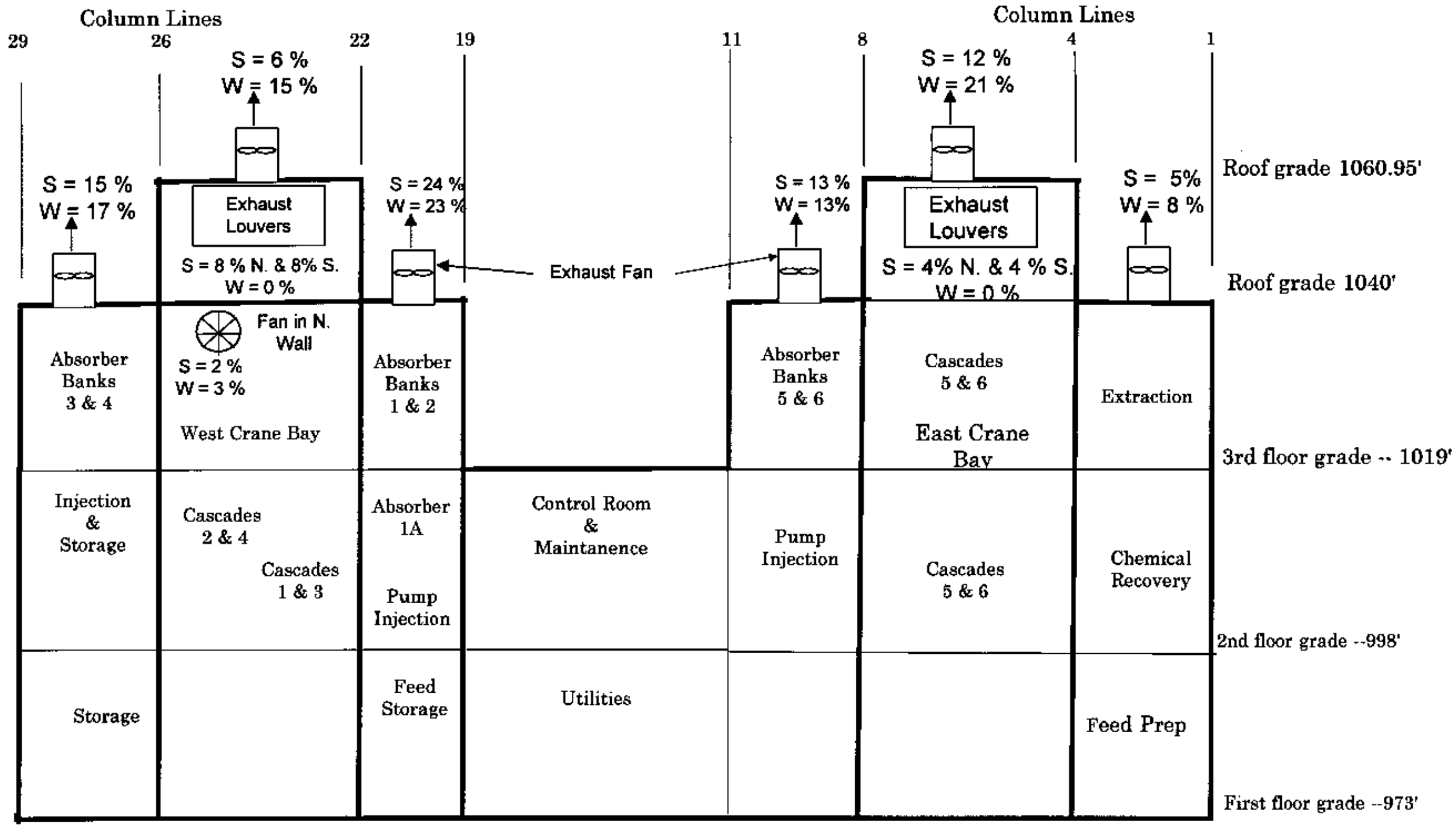


Figure 2
Section A - A ---- Building 9201-5



the summer months. To better control the mercury contamination level, higher ventilation rates were planned for summer. These ventilation systems were modified and upgraded in 1956 in an effort to reduce mercury contamination levels. The design was done by Y-12 HVAC Design Department personnel. J.C. Little was a major influence in making these modifications.

Subsequent to the shutdown of the Colex Production Plant in 9201-5, the building was stripped of all process equipment so that new and different processes could be installed. Ventilation systems were then modified as necessary to accommodate the requirements of the new process. During these modifications, drawings of the building ventilation systems were changed according to the new design, and consequently, no longer reflected conditions that existed in 1956.

For this study it has been necessary to search through existing drawings and documentation for sufficient information to reconstruct a model of the ventilation systems which existed in 1956. The most significant document located in this search is a flow sheet identified as General Ventilation - 9201-5 (it has no drawing number). This document is significant for the following reasons:

1. It is a diagram of all ventilation systems of Building 9201-5 as of 8/12/55.
2. Was drawn by Don McAlister, a man who worked for the Y-12 HVAC Design Department.
3. It shows three designs (the original Catalytic Construction design; an upgraded ventilation design for winter operation; and an upgraded ventilation design for summer operation).

The following table reflects the total ventilation provided by the original design and the upgraded design. The increases in ventilation shown here seem to be consistent with operating problems that were experienced and with documented evidence of modifications that were made for improving mrecury contamination levels.

	Contaminated Exhaust (cfm)		Building Air changes/hr (based on Summer design)
	Winter	Summer	
Initial Design	1308545	1308545	8.3
Upgraded Design-W	1526610		10.7
Upgraded Design- S		2357755	15.9

Details of the upgraded design for winter operation are summarized in Table 1. All major operations have been located with respect to building column lines and building floors. Air supplied and exhausted is given along with volumes of spaces and air change rates.

Table 1
Winter Ventilation Rates for 9201-5 Operations

Col	System	Floor	Room Volume	Fresh Air Supply cfm	Air From Floor Below cfm	Room Exhaust cfm	Chgs per Hour (1)	Contaminated Building Exhaust cfm
4-8	Cascade 5 & 6	1	661,000	108000	0	108000	9.8	34000
4-8	Cascade 5 & 6	2	402,500	184200	74000	258200	27.5	108000
4-8	Cascade 5 & 6	3	1,209,000	130200	150200	280400	6.5	280400
1-4	Feed Prep	1	297,000	10000	0	10000	2.0	10000
1-4	Chem Recovery	2	248,500	25000	0	25000	6.0	25000
1-4	Extr/Injection	3	311,000	25000	0	25000	4.8	25000
8-11	Storage	1	297,000	18000	0	18000	3.6	18000
8-11	Hang G & Inject	2	248,500	20000	0	20000	4.8	20000
8-11	Absorbers 5 & 6	3	374,000	115000	0	115000	18.4	115000
11-19	Maintenance	1	842,000	80000	0	80000	5.7	
11-19	Service	2	561,500	77800	0	77800	8.3	
19-22	Feed Storage	1	297,000	50000	0	50000	10.1	50000
19-22	Hang G & Inject	2	219,800	71000	0	71000	19.4	71000
19-22	Absorbers 1 & 2	3	374,000	120000	0	120000	19.3	120000
22-26	Cascades 1,2,3,4	1	661,000	108000	0	108000	9.8	108000
22-26	Cascades 1,2,3,4	2	402,500	96000	0	96000	14.3	120000
22-26	Cascades 1,2,3,4	3	1,209,000	236400	-24000	236400	11.7	212400
26-29	Storage	1	297,000	18000	0	18000	3.6	1200
26-29	Hang G & Inject	2	248,000	40000	16800	56800	9.7	56800
26-29	Absorbers 3 & 4	3	311,000	151810	0	151810	29.3	151810
			9471300	1684410			10.7	**1526610**

Notes: (1) Air Changes based upon fresh air supplied.

Details of the upgraded design for summer operation are summarized in Table 2. From this, it is concluded that almost all of the building exhaust is from the 3rd floor. In fact, all air is exhausted via roof fans except for 539,200 cfm that is exhausted via louvers in the East and West Crane Bays.

Table 2
Summer Ventilation Rates for 9201-5 Operations

Col	System	Floor	Room Volume	Fresh Air Supply cfm	Air From Floor Below cfm	Room Exhaust Cfm	Chgs per Hour	Contaminated Building Exhaust cfm
4-8	Cascades 5 & 6	1	661,000	108000	0	108000	9.8	34000
4-8	Cascades 5 & 6	2	402,500	184755	74000	258755	27.5	36000
4-8	Cascades 5 & 6	3	1,209,000	263000	222755	485755	13.1	485755
1-4	Feed Prep	1	297,000	10000	0	10000	2.0	10000
1-4	Chem Recovery	2	248,500	25000	0	25000	6.0	25000
1-4	Extr/Injection	3	311,000	25000	0	25000	4.8	25000
8-11	Storage	1	297,000	18000	0	18000	3.6	5000
8-11	Hang G & Inject	2	248,500	20000	13000	33000	4.8	25600
8-11	Absorbers 5 & 6	3	374,000	275000	7400	282400	44.1	282400
11-19	Maintenance	1	842,000	80000	0	80000	5.7	
11-19	Service	2	561,500	77800	0	77800	8.3	
19-22	Feed Storage	1	297,000	50000	0	50000	10.1	50000
19-22	Hang G & Inject	2	219,800	76000	0	76000	20.7	76000
19-22	Absorbers 1 & 2	3	374,000	290000	0	290000	46.5	290000
22-26	Cascades 1,2,3,4	1	661,000	108000	0	108000	9.8	88000
22-26	Cascades 1,2 3,4	2	402,500	96000	20000	116000	14.3	120000
22-26	Cascades 1,2 3,4	3	1,209,000	502000	-4000	498000	24.9	498000
26-29	Storage	1	297,000	18000	0	18000	3.6	1200
26-29	Hang G & Inject	2	248,000	40000	16800	56800	9.7	24000
26-29	Absorbers 3 & 4	3	311,000	249000	32800	281800	48.0	281800
			9471300	2515555			15.9	**2357755**

Table 3 shows exhaust fan locations, design air volumes for summer, and the percentages of total building exhaust.

Table 3
Fan Locations, Summer Air Volumes, and Percent of Total for Building Exhaust Points

Location	grade (ft)	cfm	% of total	Orientation	Exit Point
West Crane Bay Roof exh	1061	140000	6%	up	roof
East Crane Bay Roof exh	1061	280000	12%	up	roof
Absorbers 3 & 4	1040	210510	9%	up	roof
From Floors Below	1040	138500	6%	up	roof
Absorbers 1 & 2	1040	334875	14%	up	roof
From Floors Below	1040	237160	10%	up	roof
Absorbers 5 & 6	1040	211470	9%	up	roof
From Floors Below	1040	99040	4%		roof
Extraction	1040	127000	5%	up	roof
W. Crane Bay-- North wall	1050	179000	8%	horizontal	wall
E. Crane Bay -- South wall	1050	179000	8%	horizontal	wall
W. Crane Bay-- North wall	1050	90600	4%	horizontal	wall
E. Crane Bay -- South wall	1050	90600	4%	horizontal	wall
North Wall -- 2nd Floor	1010	40000	2%	horizontal	wall
		2357755	100%		

Table 4 contains the same data as shown in Table 3, except for winter operation. The percentages that were calculated in both Table 3 and Table 4 are also included in Figure 2 .

Table 4
Fan Locations, Winter Air Volumes, and Percent of Total for Building Exhaust Points

Location	grade	cfm	% of total	Orientation	Exit Point
West Crane Bay Roof exh	1061	232400	15%	up	roof
East Crane Bay Roof exh	1061	328000	21%	up	roof
Absorbers 3 & 4	1040	115330	8%	up	roof
From Floors Below	1040	138500	9%	up	roof
Absorbers 1 & 2	1040	104590	7%	up	roof
From Floors Below	1040	237160	16%	up	roof
Absorbers 5 & 6	1040	104590	7%	up	roof
From Floors Below	1040	99040	6%		roof
Extraction	1040	127000	8%	up	roof
W. Crane Bay-- North wall	1050	0	0%	horizontal	wall
E. Crane Bay -- South wall	1050	0	0%	horizontal	wall
North Wall -- 2nd Floor	1010	40000	3%	horizontal	wall
		1526610	100%		

Table 5 is a comparison of the Catalytic design, the upgraded design, and ventilation rates as reported by J.C. Little, March 14, 1956. This comparison indicates that Little was using summer ventilation rates for his study. In view of a fairly close agreement between Little's estimate and flow sheet data, this comparison indicates that both were applicable to the same period of time.

Table 5
Comparison of Flow Sheet Ventilation Rates with Little (1956)

Col	Operation	Floor	Exhaust Air Flow (cfm)			
			From Ventln. Flow Sheet			From Little Report
			Catalytic design	Winter upgrade	Summer upgrade	
1-4	Storage	1				
1-4	Feed Prep & Extraction	2	35000	35000	35000	35000
1-4	Chemical Recovery	3	25000	25000	25000	25000
4-8	Cascades 5 & 6					
4-8	All Floors	1,2&3	376400	388000	555755	545000
8-11	Stores	1				
8-11	Injection Pumps 5 & 6	2	0	25600	25600	25600
8-11	Absorbers 5 & 6	3	99600	130000	290000	292000
19-22	Feed Storage	1	0	50000	50000	50000
19-22	Absorbers & Injection 1A	2	70325	71000	76000	50000
19-22	Injection Pumps 1 & 2	2	15000	50000	50000	24000
19-22	Absorbers 1 & 2	3	107110	120000	290000	292000
22-24	Cascades 1 & 3					
22-24	1st Floor		36000	44000	44000	54000
22-24	2nd Floor		8000	40000	40000	60000
22-24	3rd & 4th Floor		202000	220200	249000	257000
24-26	Cascades 2 & 4					
24-26	1st Floor		36000	44000	44000	54000
24-26	2nd Floor		8000	80000	80000	60000
24-26	3rd & 4th Floor		202000	220200	249000	257000
26-29	Absorbers 3 & 4	3	88110	131850	281110	292000
26-29	Injection Pumps 3 & 4	2	0	24000	24000	24000
	Totals		1308545	1698850	**2408465**	**2396600**

Table 6 is a repetition of Little's arithmetic. Input to this calculation are air flow rates and concentration rates from Table 1 of Little's report (Little, 1956). The calculations for lbs/day of mercury in exhaust air reported in Little (1956) were verified in Table 6.

Table 6
Validation of Little's Arithmetic

	Bldg Col Lines	Exhaust cfm	m^3/day	Exhaust Concentration			
				mg/m^3	mg/day	grams/day	lbs/day
Absorbers 1 & 2	19 - 22	292000	11907994	0.18	2143439	2143.439	4.73
Absorbers 3 & 4	26 - 29	292000	11907994	0.18	2143439	2143.439	4.73
Absorbers 5 & 6	8 - 11	292000	11907994	0.12	1428959	1428.959	3.15
Absorbers & Injection 1A	19 - 22	50000	2039040	0.28	570931.2	570.9312	1.26
Injection Pumps 1 & 2	22 - 26	24000	978739	0.3	293621.8	293.6218	0.65
Injection Pumps 3 & 4	26 - 29	24000	978739	0.25	244684.8	244.6848	0.54
Injection Pumps 5 & 6	8 - 11	25600	1043988	0.53	553313.9	553.3139	1.22
Chemical Recovery	1 - 4	25000	1019520	0.19	193708.8	193.7088	0.43
Feed Storage	19 - 22	50000	2039040	0.25	509760	509.76	1.12
Feed Prep & Extraction	1 - 4	35000	1427328	0.1	142732.8	142.7328	0.31
Cascades 1 & 3	22 - 24						
1st Floor		54000	2202163	0.2	440432.6	440.4326	0.97
2nd Floor		60000	2446848	0.26	636180.5	636.1805	1.40
3rd & 4th Floor		257000	10480666	0.21	2200940	2200.94	4.85
Cascades 2 & 4	24 - 26						
1st Floor		54000	2202163	0.21	462454.3	462.4543	1.02
2nd Floor		60000	2446848	0.26	636180.5	636.1805	1.40
3rd & 4th Floor		257000	10480666	0.18	1886520	1886.52	4.16
Cascades 5 & 6	4 - 8						
All Floors		545000	22225536	0.13	2889320	2889.32	6.37
		2396600	97735265				38.31

Table 7 shows the calculation of mercury released to the atmosphere from Building 9201-5 operations between 1955 and 1960. The total mercury released is estimated to be 19923 pounds is very close to the 1983 Mercury Task Force estimate of 19473 pounds.

Table 7
Calculation for Mercury Exhausted to Atmosphere from Building 9201-5

Year	Qtr.	Exhaust		Conc.	Effluent				Wilcox Report
		Cfm	m^3/day	mg/m^3	mg/day	grams/day	lbs/day	lbs/qtr	1bs/qtr
1955	1	1308545	53363512	0.20	10672702	10672.7	23.53	2117.6	1716
	2	1308545	53363512	0.15	8004527	8004.5	17.65	1588.2	1287
	3	1308545	53363512	0.31	16542689	16542.7	36.47	3282.3	2573
	4	1308545	53363512	0.21	11206338	11206.3	24.71	2223.5	3603
							Annual Total	**9212**	9179
1956	1	1526610	62256377	0.12	7470765	7470.8	16.47	1482.3	1888
	2	2357755	96151135	0.10	9615114	9615.1	21.20	1907.8	1716
	3	2357755	96151135	0.09	8653602	8653.6	19.08	1717.0	1544
	4	1526610	62256377	0.06	3735383	3735.4	8.23	741.1	1029
							Annual Total	**5848**	6177
1957	1	1526610	62256377	0.04	2490255	2490.3	5.49	494.1	686
	2	2357755	96151135	0.04	3846045	3846.0	8.48	763.1	686
	3	2357755	96151135	0.03	2884534	2884.5	6.36	572.3	515
	4	1526610	62256377	0.02	1245128	1245.1	2.74	247.0	343
							Annual Total	**2077**	2230
1958	1	1526610	62256377	0.02	1245128	1245.1	2.74	247.0	343
	2	2357755	96151135	0.02	1923023	1923.0	4.24	381.6	343
	3	2357755	96151135	0.02	1923023	1923.0	4.24	381.6	343
	4	1526610	62256377	0.03	1867691	1867.7	4.12	370.6	343
							Annual Total	**1381**	1372
1959	1	1526610	62256377	0.04	2490255	2490.3	5.49	494.1	515
	2	471551	19230227	0.05	961511	961.5	2.12	190.8	
	3	471551	19230227	0.04	769209	769.2	1.70	152.6	
	4	305322	12451275	0.03	373538	373.5	0.82	74.1	
							Annual Total	**912**	--
1960	1	305322	12451275	0.03	373538	373.5	0.82	74.1	
	2	471551	19230227	0.04	769209	769.2	1.70	152.6	
	3	471551	19230227	0.05	961511	961.5	2.12	190.8	
	4	305322	12451275	0.03	373538	373.5	0.82	74.1	
							Annual Total	**492**	--
							Total for all years	**19923**	19473

References

1. Solvent Losses Through Ventilation Exhaust Systems, Building 9201-5. J.C. Little. March 14, 1956.
2. General Ventilation - 9201-5. Y-12 Drawing by D. McAlister. August 12, 1955.
3. Y/EX-21/del rev, Mercury at Y-12 by the 1983 Mercury Task Force. August 18, 1983. (UCCND 1983a).
4. Catalytic Construction drawings and design notes.

July 30, 1996

Ventilation Systems of Building 9201-4 as Existed in 1956

by

E. E. Choat

Building Description

Building 9201-4 is a large process building with an overall size of 543 feet x 312 feet. It has 3 floors and a total volume 9,471,300 ft^3. The building has seven operating bays- the East Crane Bay, West Crane Bay, four control bays, and one service bay.

In the Colex Production Plant, the two major steps of process operations were identified as "cascades" and "absorbers". Cascades occupied all three floors of the East and West Crane Bays. Absorbers were located on the third floor of all four control bays. All building areas were contaminated with mercury except for the Service/Maintenance Area and Motor Generator (MG) Set areas.

For this study, a set of simplified building plans have been reconstructed for the purpose of describing characteristics of the building and to illustrate the ventilation systems that were installed in 1956. These plans are included in this report as:

Figure 1 – 1st Floor Plan
Figure 2 – 2nd Floor Plan
Figure 3 – 3rd Floor Plan
Figure 4 -- Section A - A – Building 9201-4

The plans are intended to show the location of various building processes and major exhaust systems, and to provide dimensional information on the structure, including pertinent elevations.

Ventilation

Initial design was done by an architect engineering company, the Catalytic Construction Company. In general, 100% outside air was supplied from the basement and exhausted via the 3rd floor walls and roof. Construction of this design was completed in 1955 but did not provide sufficient ventilation to maintain acceptable mercury contamination levels.

Figure 1
"1st Floor Plan" -- Building 9201-4

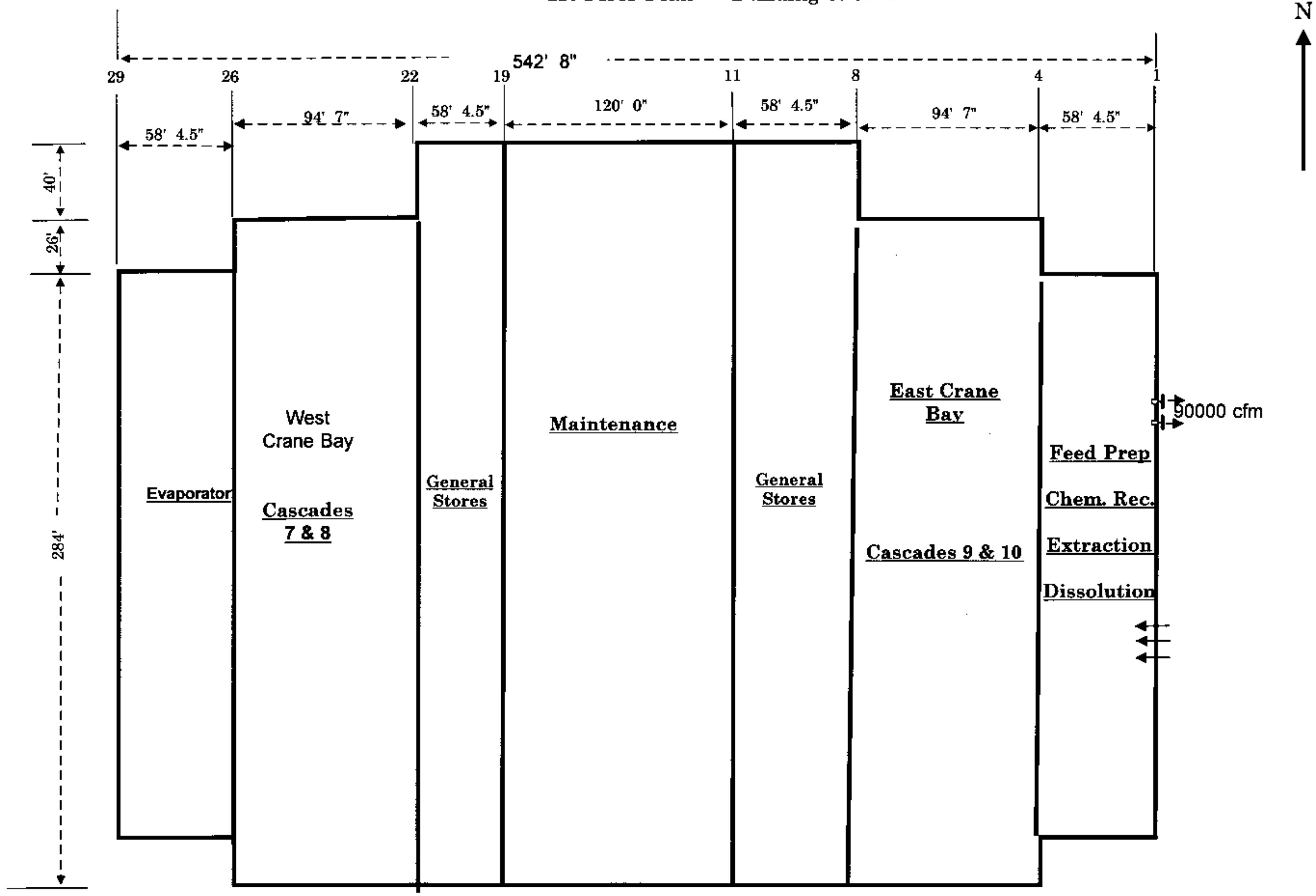


Figure 2
"2nd Floor Plan" -- Building 9201-4

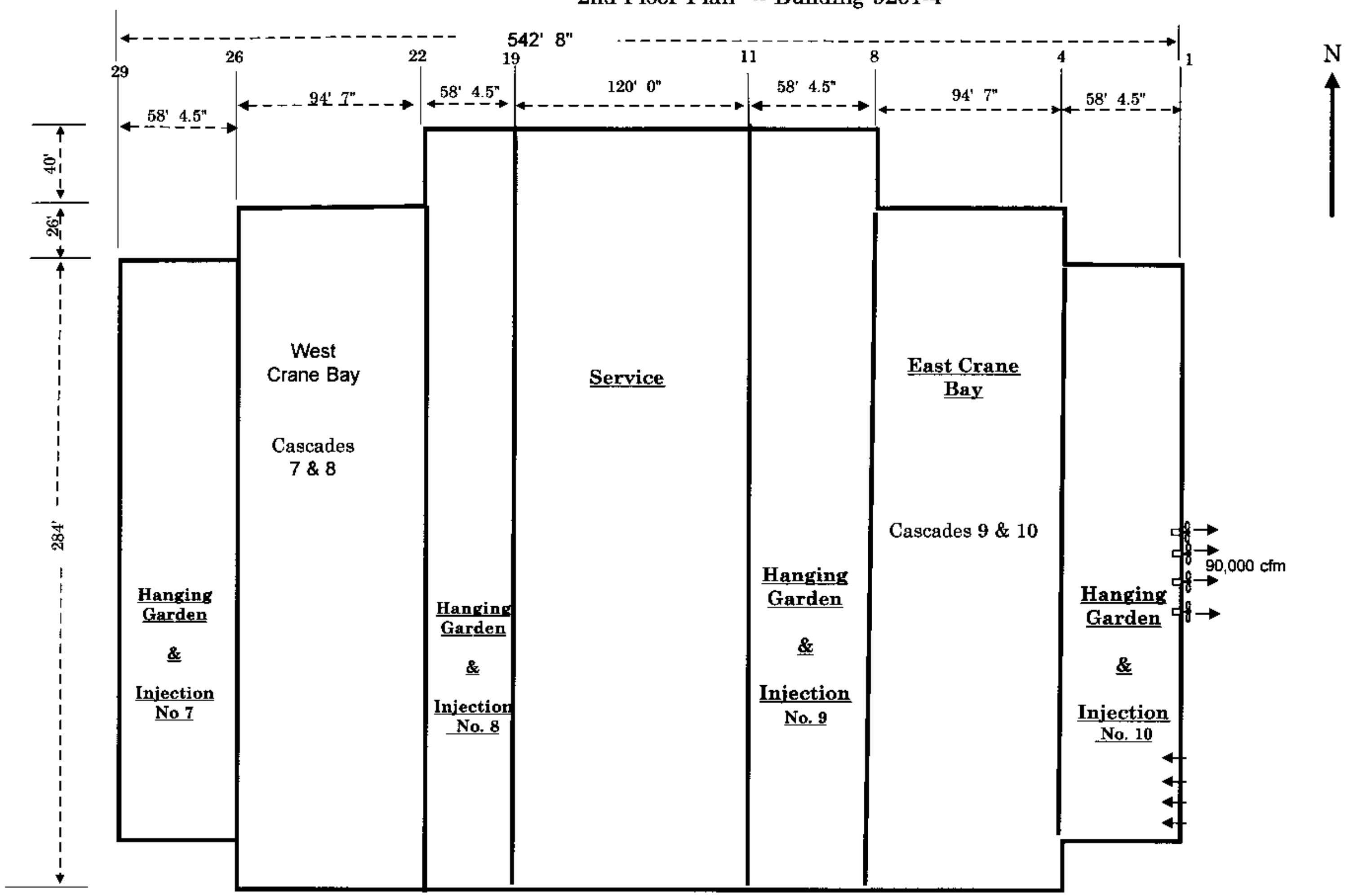


Figure 3
"3rd Floor Plan" -- Building 9201-4

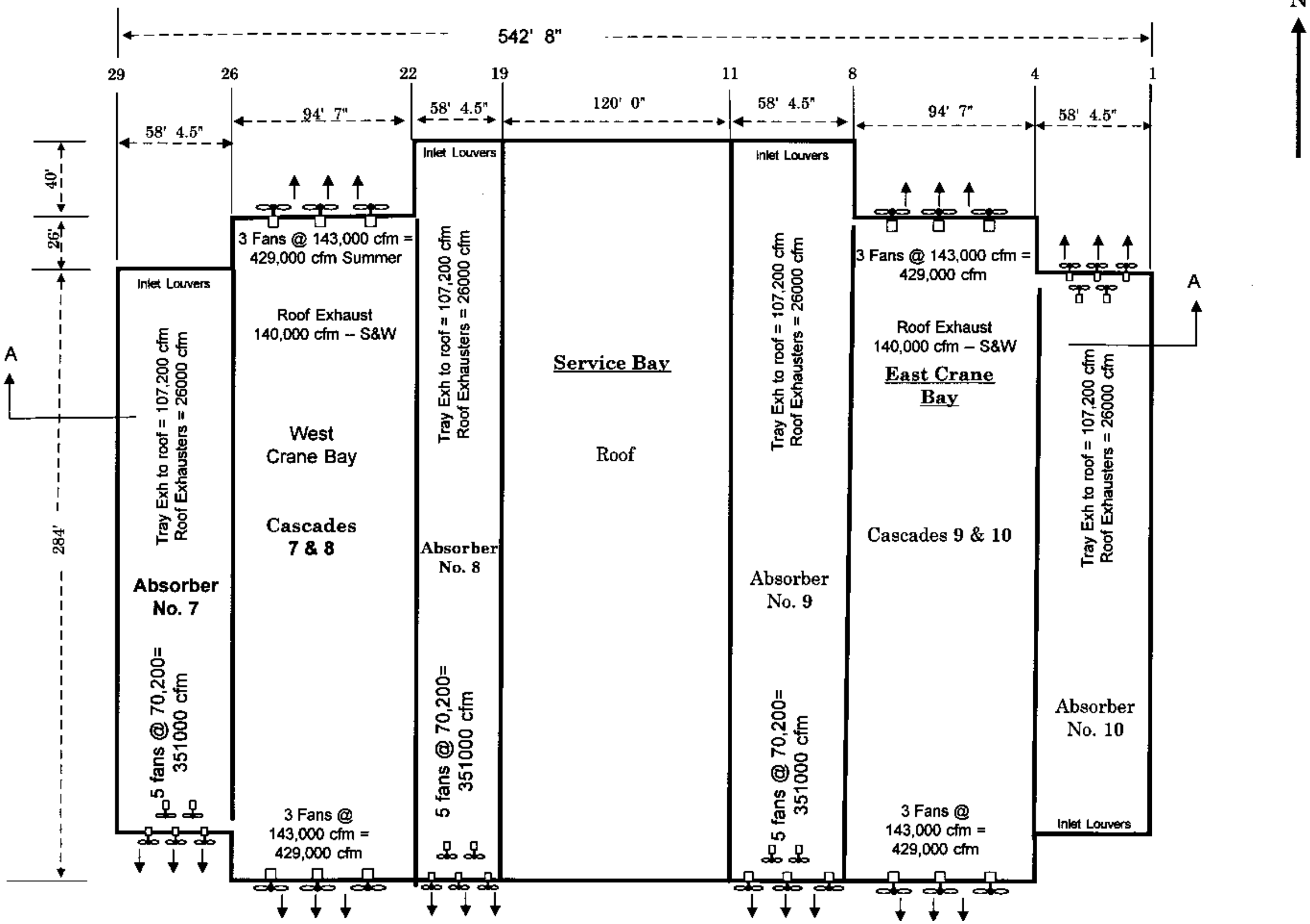
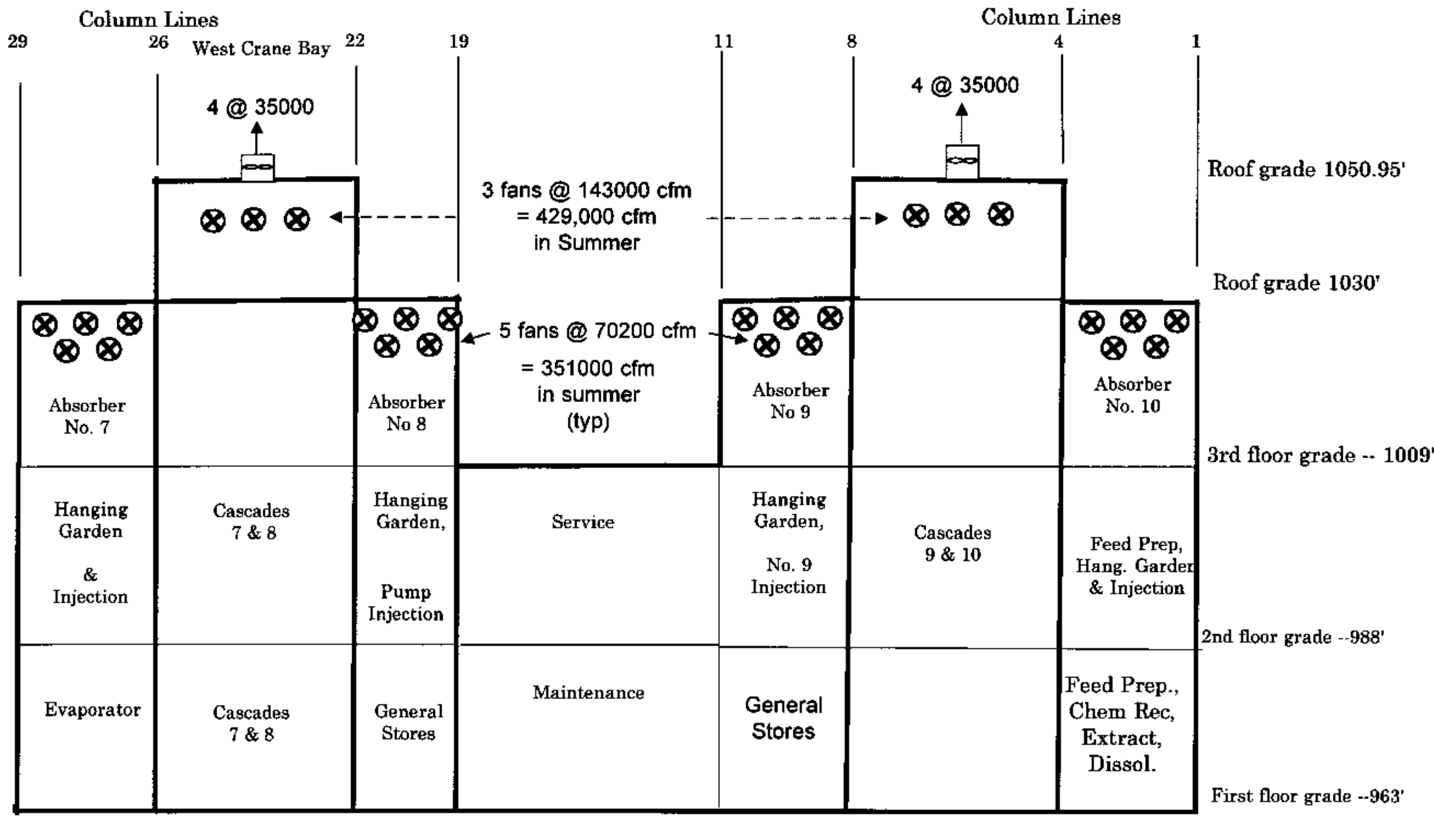


Figure 4
Section A - A (Looking North)---- Building 9201-4



These systems were then modified and upgraded in 1956 in an effort to reduce mercury contamination levels. The design was done by the Catalytic Construction Company. Because of an increased vaporization of mercury as temperature increased, more ventilation was provided in summer than in winter. Consequently, design documents and this report often refer to both.

Table 1 is a summary of the findings of this study regarding the winter ventilation design for Building 9201-4. Included in the table are:

1. Identities of all process areas of the Building 9201-4 Colex Production Plant.

2. Location of all process areas within the building. For example, cascades 9 and 10 occupied all three floors between column lines 4 and 8.

3. Room volume of all process compartments.

4. Fresh air supplied to each compartment.

5. Air transferred between floors.

6. Total room exhaust- the sum of air supplied and air transferred from another floor.

7. Changes per hour- a term to describe ventilation rates. Mathematically, it is equal to cfm x 60= cubic feet per hour, divided by the room volume. For this design, fresh air volumes were used for calculations.

8. Contaminated exhaust from the building- the air volume exhausted directly to outside. In this design, this air stream was sometimes exhausted via a duct system to the roof. In other instances is was exhausted via propeller fans mounted in the wall at the upper floor elevation.

It should be noted that the ventilation systems for the Motor Generator (MG) Sets are not included in this table as these areas are not considered to be contaminated by mercury vapor. For the same reason, air exhausted from the Maintenance and Service areas is also not included in the total contaminated exhaust from the building.

Table 1
Winter Ventilation Design for 9201-4

Col	System	Floor	Room Volume	Fresh Air Supply cfm	Air From Floor Below cfm	Room Exhaust cfm	Chgs per hour	Contaminated Building Exhaust cfm
4-8	Cascades 9 & 10	1	661000	270510	0	270510	24.6	52000
4-8	Cascades 9 & 10	2	402500	181400	218510	399910	27.0	48000
4-8	Cascades 9 & 10	3	1209000	275000	351910	626910	13.6	626910
1-4	Chem Rec, Feed Prep	1	297000	93500	0	93500	18.9	93500
1-4	Hang G & Inj 10	2	248500	129990	0	129990	31.4	129990
1-4	Absorber No. 10	3	311000	151810	0	151810	29.3	151810
8-11	General Stores	1	297000	27000	0	27000	5.5	5110
8-11	Hang G & Inj 9	2	248500	34410	21890	56300	8.3	56300
8-11	Absorber No. 9	3	374000	151810	0	151810	24.4	151810
11-19	Maintenance	1	842000	80000	0	80000	5.7	
11-19	Service	2	561500	77800	0	77800	8.3	
19-22	General Stores	1	297000	27000	0	27000	5.5	940
19-22	Hang G & Inj 8	2	219800	34410	26060	60470	9.4	60470
19-22	Absorber No. 8	3	374000	151810	0	151810	24.4	151810
22-26	Cascades 7 & 8	1	661000	270510	0	270510	24.6	52000
22-26	Cascades 7 & 8	2	402500	181400	218510	399910	27.0	48000
22-26	Cascades 7 & 8	3	1209000	275000	351910	626910	13.6	626910
26 -29	Evaporator	1	297000	38010	0	38010	7.7	38010
26-29	Hang G & Inj 7	2	248000	32000	0	32000	7.7	32000
26-29	Absorber No. 7	3	311000	151810	0	151810	29.3	151810
			9471300	2635180	1188790		16.7	2477380

Table 2 is a summary of the ventilation design for summer operation.

Table 2
Summer Ventilation Design for 9201-4

Col	System	Floor	Room Volume	Fresh Air Supply cfm	Air From Floor Below cfm	Room Exhaust cfm	Chgs per hour	Contaminated Building Exhaust cfm
4-8	Cascades 9 & 10	1	661000	297560	0	297560	27.0	48000
4-8	Cascades 9 & 10	2	402500	199540	249560	449100	29.7	48000
4-8	Cascades 9 & 10	3	1209000	591775	401100	992875	29.4	992875
1-4	Chem Rec, Feed Prep	1	297000	154350	0	154350	31.2	154350
1-4	Hang G & Inj 10	2	248500	189990	0	189990	45.9	189990
1-4	Absorber No. 10	3	311000	478210	0	478210	92.3	478210
8-11	General Stores	1	297000	29700	0	29700	6.0	5620
8-11	Hang G & Inj 9	2	248500	37850	24080	61930	9.1	61930
8-11	Absorber No. 9	3	374000	478210	0	478210	76.7	478210
11-19	Maintenance	1	842000	80000	0	80000	5.7	
11-19	Service	2	561500	77800	0	77800	8.3	
19-22	General Stores	1	297000	29700	0	29700	6.0	1040
19-22	Hang G & Inj 8	2	219800	37850	28660	66510	10.3	66510
19-22	Absorber No. 8	3	374000	478210	0	478210	76.7	478210
22-26	Cascades 7 & 8	1	661000	297560	0	297560	27.0	48000
22-26	Cascades 7 & 8	2	402500	199540	249560	449100	29.7	48000
22-26	Cascades 7 & 8	3	1209000	591775	401100	992875	29.4	992875
26-29	Evaporator	1	297000	97810	0	97810	19.8	97810
26-29	Hang G & Inj 7	2	248000	35200	0	35200	8.5	35200
26-29	Absorber No. 7	3	311000	478210	0	478210	92.3	478210
			9471300	4860840	1354060		30.8	4703040

Conclusions

1. Contrary to assumptions of previous studies (Case, 1977; UCCND, 1983a), the ventilation systems for Building 9201-4 are not the same as Building 9201-5. The results from this study show that the total contaminated air exhausted from both these buildings was:

	Winter		Summer	
Building	cfm	air changes/hr	cfm	air changes/hr
9201-5	1526610	10.7	2357755	15.9
9201-4	2477380	16.7	4703040	30.8

Previous reports of mercury loss to the atmosphere via the building exhaust systems were based upon the assumption that ventilation systems in Building 9201-4 were essentially the same as in Building 9201-5. This study has indicated a considerable difference in contaminated air exhausted from the two buildings. Therefore, a new estimate of mercury loss to the atmosphere for the period of the 2nd quarter of 1955 through the 4th quarter of 1962 is presented in Table 3. Assumptions in this estimate are:

1. Winter ventilation rates apply for the 1st and 4th quarters.
2. Summer ventilation rates apply for the 2nd and 3rd quarters.
3. Mercury air concentrations are reported in UCCND (1983a), page 111.

Mercury losses reported in UCCND (1983a) are included in Table 3 for comparison. Since actual exhaust air flows in 9201-4 were much higher than previously assumed, total mercury losses may have been closer to 32382 pounds rather than 18447 pounds.

Table 3
Pounds of Mercury Exhausted to Atmosphere from 9201-4

Year	Qtr	Exhaust cfm	Exhaust m^3/day	Conc mg/m^3	Effluent mg/day	Effluent grams/day	Effluent lbs/day	Effluent lbs/qtr	Wilcox Report lbs/qtr
1955	2	2050740	83630818	0.1	1087201	10872.0	23.97	2157	858
	3	2050740	83630818	0.25	2174401	21744.0	47.94	4314	2144
	4	1446429	58986532	0.25	1415677	14156.8	31.21	2809	2144
							Total	**9280**	5146
1956	1	1446429	58986532	0.12	7078384	7078.4	15.60	1404	2059
	2	4703040	191793734	0.05	9589687	9589.7	21.14	1903	858
	3	4703040	191793734	0.05	9589687	9589.7	21.14	1903	858
	4	2477380	101029538	0.04	4041182	4041.2	8.91	802	686
							Total	**6012**	4461
1957	1	2477380	101029538	0.04	4041182	4041.2	8.91	802	686
	2	4703040	191793734	0.03	5753812	5753.8	12.68	1142	515
	3	4703040	191793734	0.03	5753812	5753.8	12.68	1142	515
	4	2477380	101029538	0.02	2020591	2020.6	4.45	401	343
							Total	**3487**	2059
1958	1	2477380	101029538	0.02	2020591	2020.6	4.45	401	343
	2	4703040	191793734	0.03	5753812	5753.8	12.68	1142	515
	3	4703040	191793734	0.04	7671749	7671.7	16.91	1522	686
	4	2477380	101029538	0.02	2020591	2020.6	4.45	401	343
							Total	**3466**	1887
1959	1	2477380	101029538	0.03	3030886	3030.9	6.68	601	258
	2	4703040	191793734	0.03	5753812	5753.8	12.68	1142	515
	3	4703040	191793734	0.03	5753812	5753.8	12.68	1142	515
	4	2477380	101029538	0.02	2020591	2020.6	4.45	401	172
							Total	**3286**	1460
1960	1	2477380	58986532	0.02	1179731	1179.7	2.60	234	172
	2	4703040	191793734	0.03	5753812	5753.8	12.68	1142	515
	3	4703040	191793734	0.03	5753812	5753.8	12.68	1142	515
	4	2477380	101029538	0.02	2020591	2020.6	4.45	401	172
							Total	**2919**	1374
1961	1	2477380	101029538	0.02	2020591	2020.6	4.45	401	172
	2	4703040	191793734	0.02	3835875	3835.9	8.46	761	343
	3	4703040	191793734	0.02	3835875	3835.9	8.46	761	172
	4	2477380	101029538	0.02	2020591	2020.6	4.45	401	343
							Total	**2324**	1030
1962	1	2477380	101029538	0.02	2020591	2020.6	4.45	401	172
	2	4703040	191793734	0.02	3835875	3835.9	8.46	761	343
	3	4703040	191793734	0.02	3835875	3835.9	8.46	761	343
	4	2477380	101029538	0.02	2020591	2020.6	4.45	401	172
							Total	**2324**	1030
					Totals for all years			**32382**	18447

Table 4 is a summary of all contaminated air exhaust systems of Building 9201-4 for summer operation. The table includes exhaust fans, fan sizes, fan capacity in cfm, outlet velocities, orientation, and elevations.

Table 4
A Building Exhaust System Summary for Summer

Exhaust Location	No	Fan Diam in	Area sq. ft.	Cfm Each	Velocity fpm	Direct ion	Elev ft	Total cfm	%
Cascade Roof Exh.	8	54	15.90	35000	2200	up	1051	280000	6%
Tray Exhaust	4	- -	-	107200	2200	up	1051	428800	9%
Roof Exhausters	4	--	--	26000	2200	up	1051	104000	2%
From 1st & 2nd Floor	8	--	--		2200	up	1051	590240	13%
Roof Total								1403040	30%
South Wall- Absorbers	15	72	28.27	70200	2483	horiz	1020	1053000	22%
South Wall - Cascades	6	108	63.62	143000	2248	horiz	1020	858000	18%
South Wall Total								1911000	41%
North Wall- Absorbers	5	72	28.27	70200	2483	horiz	1020	351000	7%
North Wall - Cascades	6	108	63.62	143000	2248	horiz	1020	858000	18%
North Wall Total								1209000	26%
2nd Floor -- East	4	42	9.62	22500	2339	horiz	1000	90000	2%
1st Floor -- East	2	60	19.64	45000	2292	horiz	980	90000	2%
1st & 2nd Floor Total								180000	4%
Total of All Exhaust								4703040	100%

Table 5 is a summary of winter operation of ventilation exhaust systems in 9201-4. Here exhaust air volumes were reduced by turning off certain fans. In Table 5, the number of fans has been reduced as compared to those given in Table 4 to simulate the winter operation.

Table 5
A Building Exhaust System Summary for Winter

Exhaust Location	No	Fan Diam in	Area sq. ft.	Cfm Each	Velocity fpm	Direct ion	Elev	Total cfm	%
Cascade Roof Exh	8	54	15.90	35000	2200	up	1051	280000	11%
Tray Exhaust	4	- -	-	107200	2200	up	1051	428800	17%
Roof Exhausters	4	--	--	26000	2200	up	1051	104000	4%
From 1 & 2nd Floor	--	--	--		2200	up	1051	591380	24%
Roof Total								1404180	57%
South Wall- Absorbers	4	72	28.27	70200	2483	horiz	1020	280800	11%
South Wall - Cascades	2	108	63.62	143000	2248	horiz	1020	286000	12%
South Wall Total								566800	23%
North Wall- Absorbers	2	72	28.27	70200	2483	horiz	1020	140400	6%
North Wall - Cascades	2	108	63.62	143000	2248	horiz	1020	286000	11%
North Wall Total								426400	17%
2nd Floor -- East	2	42	9.62	22500	2339	horiz	1000	40000	2%
1st Floor -- East	1	60	19.64	45000	2292	horiz	980	40000	2%
1st & 2nd Floor Total									4%
Total of All Exhaust								2477380	100%

As shown in Tables 4 and 5, contaminated building exhaust was predominantly from the roof fans and through the walls at the 3rd floor level. In summary,

	Direction	Elevation	Summer		Winter	
			Cfm	%	Cfm	%
Roof	up	1051	1403040	30	1404180	57%
S. Wall-3rd Floor	horiz S	1020	1911000	41	566800	23%
N. Wall-3rd Floor	horiz N	1020	1209000	26	426400	17%
E. Wall-2nd Floor	horiz E	1000	90000	2	40000	2%
E. Wall-1st Floor	horiz E	980	90000	2	40000	2%

References:

1. General Ventilation Study Bldg. 9201-4 design notes.
2. Building 9201-4 Tray Rooms design sketch.

3. Proposed Cascade Ventilation design sketch.
4. Proposed Absorber Ventilation design sketch.
5. McAlister, Don. General Ventilation Bldg. 9201-4 design sketch. August 15, 1955.
6. Master Plan Drawings (1970). EM-708 through EM-729. These are believed to represent as built conditions for 9201-4.
7. Catalytic Construction Company Ventilation Flow Sheets.
8. Catalytic Construction Company Construction Drawings.

July 27, 1996

Ventilation Systems of Building 9204-4 as Existed in 1953

by

E. E. Choat

Building Description

Figure 1 is a partial plan of the 2nd floor and a sectional view of Building 9204-4 that was the space occupied by the Elex Production Plant during the early 1950's. Elex occupied essentially all of the space between column lines 1 - 43, and F - J. The area represents 34,226 ft^2 and a volume of 1,745,550 ft^3.

Subsequent to the shutdown of the Elex Production Plant in 1956, the building was stripped of all process equipment so that different processes could be installed. Ventilation systems were modified as necessary to accommodate the requirements of the new process. During these modifications, drawings of the building ventilation systems were changed according to the new design, and consequently, no longer reflected conditions that existed between 1953 and 1956.

For this study, it was necessary to search through existing drawings and documentation for sufficient information to reconstruct a model of the ventilation systems which existed in early 1950s.

Phase I Ventilation

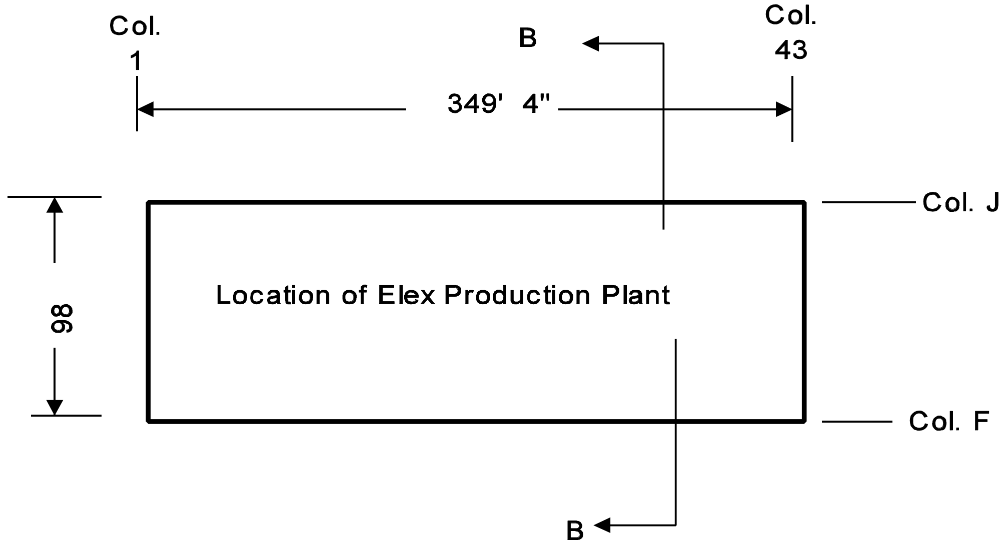
The initial ventilation design for this plant was done by the Vitro Corporation and provided for 554,400 cfm of exhaust. This volume of air in the space occupied by the Elex Plant resulted in an air change rate of 19 changes per hour.

Building 9204-4 air was exhausted by three modes as follows:

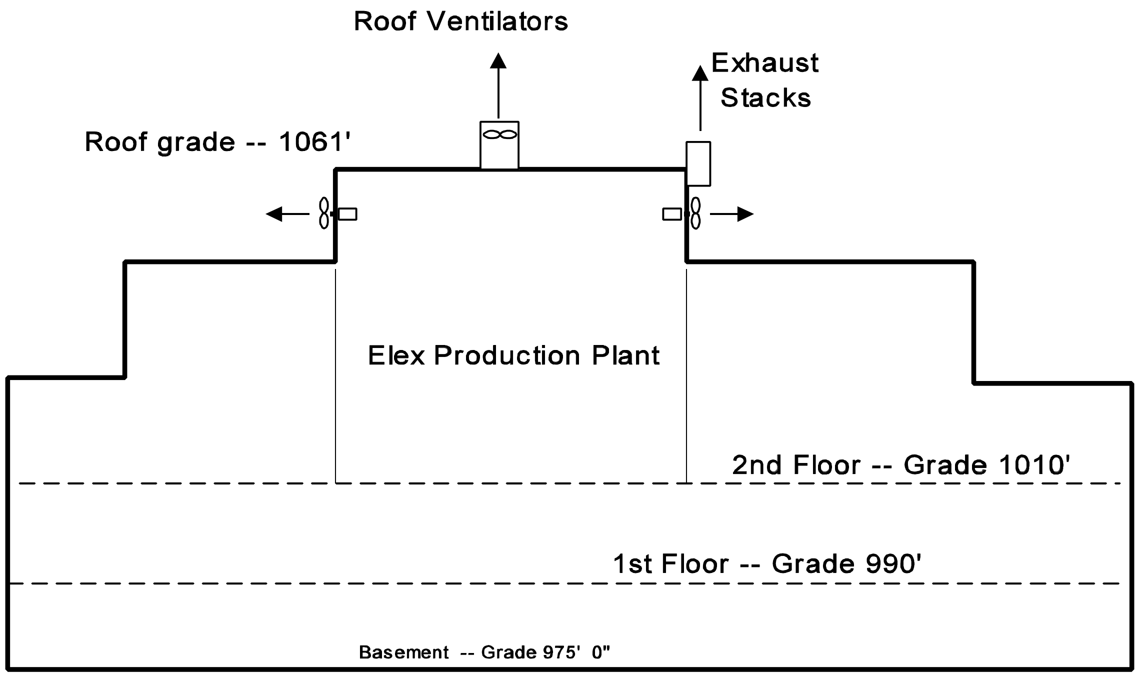
1. Nine roof ventilators (194,400 cfm).
2. Two exhaust stacks (120,000 cfm).
3. Six propeller fans mounted in the walls (240,000 cfm).

The location of these exhaust points is illustrated in Section B - B of Figure 1. These exhaust points are shown on Vitro drawing 50-K2-10. The Vitro drawing has been superseded by subsequent design changes and is now identified as Catalytic drawing B-32147. Master Plans of this building, completed in 1985, show these fans as still existing at that time.

Figure 1
Plan and Sectional View of Elex Production Plant in Building 9204-4



Partial Plan of 2nd Floor
Building 9204-4 -- grade 1010



Section B-B

Except for the two fans that exhausted to the stacks, the sizes, air volume capacity, and outlet diameters are summarized in Table 1. The two unidentified fans are believed to have been two centrifugal fans located in the 1st floor fan room on the north side of the building. These fans exhausted to stacks which extended up the outside wall to an elevation above the roof.

Table 1
Exhaust Fans for Building 9204-4 Elex Production Plant – Phase I

System		Air Volume cfm	Fan size inches	Outlet Area ft^2	Outlet Velocity fpm	References
10	Roof Ventilator	20000	36	7.07	2829	
11	Roof Ventilator	20000	36	7.07	2829	
12	Roof Ventilator	24800	36	7.07	3508	Calalytic drawing B-32147.
13	Roof Ventilator	20000	36	7.07	2829	Issue date 11/6/53. Includes
14	Roof Ventilator	24800	36	7.07	3508	as built work under contract 40011.
15	Roof Ventilator	20000	36	7.07	2829	Supersedes Vitro Dwg. 50-K2-10.
16	Roof Ventilator	24800	36	7.07	3508	
17	Roof Ventilator	20000	36	7.07	2829	
18	Roof Ventilator	20000	36	7.07	2829	
	Exh. to Stack	60000	72 x 72	36.00	1667	Believed to be systems cited in W.
	Exh. to Stack	60000	72 x 72	36.00	1667	Brumann report to W. K. Whitson,
K-10905-1	Prop Fan - wall	40000	60	19.64	2037	10/28/53.
K-10905-2	Prop Fan - wall	40000	60	19.64	2037	
K-10905-3	Prop Fan - wall	40000	60	19.64	2037	
K-10905-4	Prop Fan - wall	40000	60	19.64	2037	See Vitro dwg. 86-K2-5
K-10905-5	Prop Fan - wall	40000	60	19.64	2037	CFC 1953 - Jasny.
K-10905-6	Prop Fan - wall	40000	60	19.64	2037	
		554400				
				A total exhaust of 554,400 cfm correlates well with 538,453		
				from Brumann (1953).		
6/2/96						
E. E. Choat						

The magnitude of exhaust ventilation provided in the initial design may also be extracted from W. Brumann's report to W. K. Whitson[1]. In this report, air sampling was done for two exhaust systems having a capacity of 60000 cfm. At the concentrations reported for the North Plant, this volume of air would result in 0.86 pounds of mercury per day being delivered to the environment. But, the report stated that 3.8 pounds were lost. Therefore,

[1] W. Brumann, Industrial Hygiene Section, to W. K. Whitson, 10/28/53.

60000 cfm must have been only a part of the total air exhausted. The total air volume required to deliver 3.8 pounds to atmosphere at the concentrations given is 264,167 cfm. This calculation along with air flows and concentrations from the Brumann report is shown in Table 2.

Table 2
Estimated Elex Exhaust from Brumann Report [1]

	Exhaust	Concentration						
Sample	cfm	m^3/day	mg/m^3	mg/day	grams/day	lbs/day		
1	7500	305856	0.14	42819.84	42.81984	0.09		
2	7500	305856	0.14	42819.84	42.81984	0.09		
3	7500	305856	0.12	36702.72	36.70272	0.08		
4	7500	305856	0.15	45878.4	45.8784	0.10		
5	7500	305856	0.22	67288.32	67.28832	0.15		
6	7500	305856	0.2	61171.2	61.1712	0.13		
7	7500	305856	0.15	45878.4	45.8784	0.10		
8	7500	305856	0.16	48936.96	48.93696	0.11		
Total	60000	2446848		391495.7	391.4957	0.86		
Reported Average Concentration = 0.16 mg/m^3 Total Reported Solvent Loss from the North Plant = 3.8 lbs. For this total loss, air flow must be 3.8/ 0.86309 higher. Then, cfm = 60000*3.8/0.86309 = 264167 cfm.								
North Plant Total	265000	10806912	0.16	1729106	1729.106	3.81 agrees with report		
9	7500	305856	0.22	67288.32	67.28832	0.15		
10	7500	305856	0.22	67288.32	67.28832	0.15		
11	7500	305856	0.21	64229.76	64.22976	0.14		
12	7500	305856	0.21	64229.76	64.22976	0.14		
13	7500	305856	0.19	58112.64	58.11264	0.13		
14	7500	305856	0.17	51995.52	51.99552	0.11		
15	7500	305856	0.16	48936.96	48.93696	0.11		
16	7500	305856	0.18	55054.08	55.05408	0.12		
	60000					1.05		
Reported Average Concentration = 0.20 mg/m^3. Total Reported Solvent Loss from the South Plant = 4.8 lbs. For this total loss, air flow must be 4.8/ 1.05 higher. Then, cfm = 60000*4.8/ 1.05 = 274286 cfm.								
South Plant Total	265000	10806912	0.2	2161382	2161	4.76 agrees with report		
Total Building Exhaust is estimated to be = 274,286 + 264,167 = **538,453** cfm.								
5/8/96 - Talked with Bill Whitson, Y-12 Production. He thinks that the wall fans proposed in 1954 were								
5/14/96 - Talked to Glenn Kitchings, draftsman on B-4 master plans. Agrees with Whitson.								

[1] W. Brumann, Industrial Hygiene Section, to W. K. Whitson, 10/28/53.

In the same manner, total air flow from the South Plant was calculated as being 274,286 cfm. The sum of North plant exhaust and South plant exhaust is equal to 538,453 cfm, which is only 3% less than values shown on the drawings.

Phase II Ventilation

Additional ventilation in the Building 9204-4 Elex Plant is believed to have been installed in the later months of 1954. In a July 15, 1954 letter to R.C. Armstrong, USAEC, from J.P. Murray, Y-12 Plant Superintendent, it was noted that mercury contamination levels were too high. This letter also recommended 500,000 cfm of additional ventilation. This was to be accomplished with the installation of additional propeller fans in the walls around the cascades.

I believe that this recommendation was implemented for the following reasons:

1. I have talked to two people who were employees in the 9204-4 building during the time of Elex, and they both think that this plan was implemented (Whitson, 1996; Kitchings, 1996).

2. Martin Marietta drawings H2E002078MP and H2E002079MP show 16 fans installed in the walls along columns F and J. These drawings are from the Master Plan series dated 5/8/85. Six of these fans are the same as those shown in the original design by Vitro Corp. The other ten fans are believed to be those referenced in the Armstrong letter. Ten fans of a moderate size could have easily provided the 500,000 cfm cited. I believe this air volume to be near that installed, as it was noted that the fans were available at Y-12.

With an additional exhaust of 500,000 cfm, the air change rate during the summer operation of the Elex Production Plant in Building 9204-4 would have been 36 changes per hour.

References

1. Vitro Corporation Drawing 50-K2-10 for Building 9204-4.
2. Catalytic Construction drawing B-32147 for Building 9204-4. November 6, 1953.
3. Martin Marietta Master Plan drawing series for Building 9204-4. May 8, 1985.
4. Letter from W. Brumann, Industrial Hygiene, to W.K. Whitson, Y-12 Production Manager. October 28, 1953.
5. Letter from J.P. Murray, Y-12 Plant Manager, to R.C. Armstrong, USAEC. July 12, 1954.
6. Personal communication between E.E. Choat of the project team and W.K. Whitson, former Y-12 Production Manger. May 8, 1996.
7. Personal communication between E.E. Choat of the project team and Glenn Kitchings, former Y-12 HVAC engineer. May 14, 1996.

July 28, 1996

Ventilation Systems of Building 9201-2
as Existed in 1955
by
E. E. Choat

Building Description

Building 9201-2 was built in the early 1940's to house a portion of the electromagnetic uranium separation process. It was shut down in about 1947 but the building was not stripped. At the time of the Colex Pilot Plant, which occupied only a small portion of the building, most of the previous process equipment was still in place.

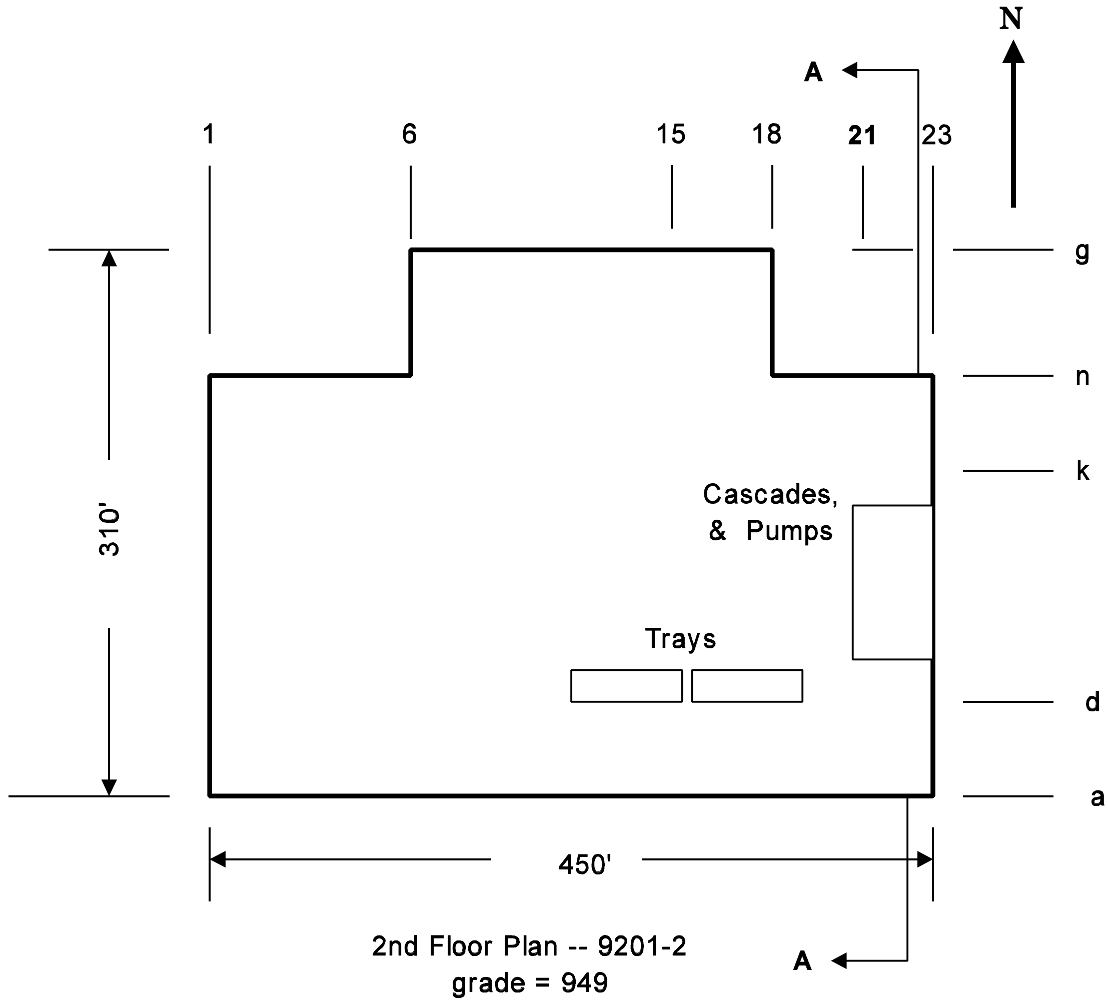
Figure 1 is a 2nd floor plan and a sectional elevation of Building 9201-2. It is provided here to show the location of the Colex Pilot Plant that existed there in the early 1950's. As shown in Figure 1, two absorber trays were located along column line d between column lines 15 and 20. Floor area occupied by this equipment was approximately 20 x 90 feet, or 1800 ft^2. These two trays are shown on drawing E-HV-20238. A third tray was documented in an Industrial Hygiene air sampling report dated 12/19/54. I assume it was in the same vicinity and occupied about 1200 ft^2. Other components of the Colex Pilot Plant, consisting of columns, pumps, etc., were installed along the east end of the building between column lines d and k. They occupied a floor area of approximately 4000 ft^2 on three floors. The total building volume that was occupied by the Colex Pilot Plant is estimated to be 525,000 ft^3.

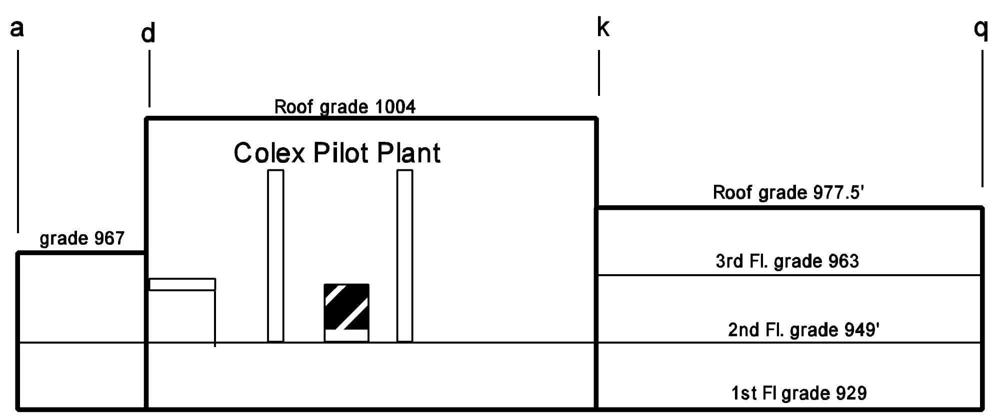
Supporting services, such as Maintenance, Development offices, Engineering offices, and DC power supply were located in adjacent areas. A major portion of the building was unoccupied, but did house the remnants of the former electromagnetic separation process.

Subsequent to shutdown of the Colex Pilot Plant in1955, the building was stripped of the Colex process equipment so that different processes could be installed. Ventilation systems were then modified as necessary to accommodate the requirements of the new process. During these modifications, drawings of the building ventilation systems were changed according to the new design, and consequently, no longer reflect conditions that existed between 1952 and 1955.

For this study, it has been necessary to search through existing drawings and documentation for sufficient information to reconstruct a model of the ventilation systems which existed in early fifties. Also considered in this study are the professional opinions of one of the design engineers (E. E. Choat) who was a part of the engineering team for the Colex Pilot Plant project.

Figure 1
Plan and Sectional View of Colex Pilot Plant in Building 9201-2





Section A - A

Process Ventilation

Process ventilation for this plant consisted of an exhaust system from each of the absorber trays. The details of one of these exhaust systems are shown on drawing E-HV-20238-Absorber Tray Ventilation, 1955. An air volume of 1500 cfm was exhausted by this system to six feet above the roof south of column line d. The elevation of this roof is 967 feet above sea level.

A portion of the exhaust system for the second tray is also shown on drawing E-HV-20238. However, it does not show the volume of air exhausted nor the point of exit. Since it does have slightly larger ducts, the exhaust volume is estimated to be 2000 cfm. It was also exhausted six feet above the roof elevation of 967 feet.

Since no drawing was located for the third tray cited in the 1954 Industrial Hygiene air sampling report, it is assumed to have been similar to trays 1 and 2. The exhaust system for the third tray is assumed to be 2000 cfm exhausted to six feet above the low roof south of column line d.

General Ventilation

General ventilation for the Colex Pilot Plant was almost non-existent. It consisted of systems that were installed for the previous process and that were still operable. These systems were not equipped with heating coils, because the previous process was a terrific heat generator and no additional heating was required. Also, supply was introduced toward the center of the building due to the requirements of the previous process. The general ventilation system was therefore not very effective in ventilating the area occupied by the Colex Pilot Plant. Supply air could have been as much as 64000 cfm in summer. It was probably half of this in winter.

General exhaust for the building was via roof ventilators located on the high roof at elevation 1004 feet. An unknown number of these fans were operable and running during the Colex Pilot Plant operation. It is assumed that two fans were operated in summer and that only one was used in winter. Consequently, building general exhaust would be 32000 cfm in winter and 64000 cfm in summer.

Based upon the above assumptions, air change rates for this plant are estimated to be 8 changes per hour for summer and 4 changes per hour for winter operation.

Mercury introduced into the atmosphere from the Colex Pilot Plant is estimated to be 1.21 pounds per day during the summer and 0.65 pounds per day during the winter. Calculations for these releases are shown in Tables 1 and 2 that follow.

Table 1
Mercury Loss to Atmosphere for Building 9201-2 Summer Operation

	Exhaust cfm (1,2)	m^3/day	Concentration (3)		grams/day	lbs/day
			mg/m^3	mg/day		
Tray Exhaust	5500	224296	0.18	40373.19	40.37319	0.09
General Ventilation	64000	2609971	0.194	506334.4	506.3344	1.12
Total	68500	2793485		539366.9	539.3669	1.21

Table 2
Mercury Loss to Atmosphere for Building 9201-2 Winter Operation

	Exhaust cfm (1,2)	m^3/day	Concentration (3)		grams/day	lbs/day
			mg/m^3	mg/day		
Tray Exhaust	5500	224296	0.18	40373.19	40.37319	0.09
General Ventilation	32000	1304986	0.194	253167.2	253.1672	0.56
Total	36500	1488499		286199.7	286.1997	0.65

References

1. Absorber Tray Ventilation. Union Carbide drawing number E-HV-20238. 1955.
2. Key Plans- Heating andVentilation Flow. Union Carbide drawing number E-M-318 and others in this series (listed in document). 1970.
3. Weekly Solvent Work Sheets, Industrial Hygiene Department. December 19, 1954.

Table 3
Building Exhaust System Summary for 9201-2

System	Exhaust cfm	Velocity fpm	Direction	Elevation
Roof exhaust- tray 1	1500	2200	up	967
Roof exhaust- tray 2	2000	2200	up	967
Roof exhaust- tray 3	2000	2200	up	967
Roof ventilator- fan 1 (S & W)	32000	2200	up	1004
Roof ventilator- fan 2 (S only)	32000	2200	up	1004

August 1, 1996

Ventilation Systems of Building 81-10
as Existed in 1955
by
E. E. Choat

Building Description

Building 81-10, the Solvent (Mercury) Salvage Facility, consisted of a gas fired furnace, drum unloading devices, conveyor, crusher, and cutter. These were mounted on a platform which may have been covered with a roof. An equipment plan of this facility is shown on drawings F4A-18002, F4A-18003 and F4A-18004.

The furnace was approximately 5 feet in diameter and 16 feet tall. It was mounted vertically beneath a platform and was heated via gas fired burners. Various materials contaminated with mercury, such as waste insulation, process sludge, and dirt from mercury spills, were introduced into the top of the furnace and heated to a high temperature to vaporize the mercury and separate it from the solid materials. Solid wastes were removed from the bottom. The furnace was equipped with a cooling coil to cool hot flue gases and condense and separate the mercury from the gas.

The manufacturer's drawings of this furnace, along with information on the burners exist in the Y-12 plant engineering files. However, these materials are copyrighted and are therefore available for review but not for reproduction.

A letter (Morehead, 1957) presents estimates of mercury losses from the mercury recovery furnace. An attached handwritten calculation cites a 1300 cfm volume flow rate and a 14 inch stack diameter for the furnace.

References

1. Manufacturer's drawings of furnace.
2. Archaeological and Historical Review Review for Building 81-10 Demolition, Y-12 Plant. Y/TS-1471.
3. Stripping Plan for 81-10. F.V. Tilson. September 22, 1983. Y/TS-1610.
4. Letter from Morehead to Whitson regarding sludge burner stack loss of solvent. June 18, 1957. Y/HG-0169.

August 6, 1996

Y-12 Steam Plants
Buildings 9401-1, 9401-2, and 9401-3
by
E. E. Choat

Building Description

Buildings 9401-1 and 9401-2 were relatively small, coal fired boiler plants, constructed in the 1940's to provide steam for processes and heating at Y-12 buildings. As recalled (Choat, 1996), they consisted of two boilers each which were equipped with traveling grate stokers. They were replaced by the construction of Building 9401-3 in 1956 and were subsequently shut down. Both buildings were later converted to other uses. Each of these buildings had one (9401-2) or two (9401-1) smoke stacks, which were torn down following shutdown of the plants. Drawings showing sizes and heights of the stacks could not be located, and photographs of old steam plants don't show the entire stack. From personal recollection (Choat, 1996), the height of these stacks is estimated to be about 100 feet.

Building 9401-3 consists of 4 boilers having a full-load capacity of 250,000 pounds of steam per hour each, or a total of 1,000,000 pounds per hour. Initially, it was a pulverized coal fired plant, but was converted to use natural gas shortly after start up. The operating choice of fuel was made on the relative prices and the availability of natural gas. The steam plant burned gas during summer months and coal in winter. Most likely, this practice varied slightly from year to year. The new Y-12 steam plant has two stacks that transport products of combustion to a an emission point that is 190 feet above grade. The west stack is 12.5 feet in diameter. The east stack is 15 feet in diameter. The top elevation of both is 1161 feet above sea level.

Effluents

Mercury emissions from these plants would vary widely depending upon fuel being used, the quantity of fuel, and mercury content of the fuel. I believe that plant operating records probably exist which would contain dated fuel usage and steam output. However, I do not recall having ever seen either any analysis for mercury content of the coal.

References

1. Photographs of the Y-12 Steam Plant. January 17, 1957.
2. Historical Building Assessment of the Oak Ridge Steam Plant. Thomason and Associates. May 1996. pp. A-256, A-405, and A-494.

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APPENDIX H

AIRBORNE RELEASES OF MERCURY– DATA AND CALCULATIONS

This appendix contains data collected, calculated, and cross-checked by the project team in the course of the mercury source term assessment. These tables were created primarily for recording and analyzing the data that form the basis for the Task 2 release estimates. The data analyses performed are described in Section 4.4. The tables were for the most part preserved in their original formats so that they would be indicative of the processes used to estimate historical mercury releases from the ORR.

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APPENDIX H

AIRBORNE RELEASES OF MERCURY– DATA AND CALCULATIONS

This appendix presents the tables and spreadsheets used by the Task 2 team to document the source term calculations for mercury released to air. The tables and spreadsheets are as follows:

- Table H-1 summarizes the air concentration and flow rate data used to estimate releases of mercury to ambient air for each year from 1953-62, and the uncertainty associated with these concentrations and flow rates.

- Table H-2 summarizes mercury releases to the air from Y-12 lithium separation buildings and steam plants between 1953 and 1962.

- Tables H-3 through H-7 present the calculations of mercury releases to air from Buildings 9201-5, 9201-4, 9204-4, 9201-2, and 81-10 based on building air concentrations and exhaust flow rates, incorporating the revised estimate of exhaust flow rate for Building 9201-4.

- Table H-8 compare monthly and quarterly building air mercury concentrations from four sources of data for Buildings 9201-5, 9201-4, and 9201-2.

- Table H-9 shows calculations used by the project team to check the 1983 Mercury Task Force Report calculation of pounds of mercury released to air.

These tables were created primarily for recording and analyzing the data that form the basis for the Task 2 release estimates. The tables were for the most part preserved in their original formats. In addition, the data and methodology used to calculate air emissions of mercury from the Building 81-10 Mercury Recovery Furnace are discussed below..

Air Emissions of Mercury from Building 81-10

A mercury recovery furnace that heated mercury-contaminated material to volatilize elemental mercury and then condense the mercury from the furnace off gases was operated for several years at Building 81-10. This furnace is known to have caused high mercury air concentrations in the immediate vicinity of the building (UCCND 1983a). The 1983 Mercury Task Force did not estimate releases from Building 81-10. Information obtained by the project team enable preparation of the Building 81-10 release estimate presented in the following section.

Estimates of Mercury Recovered at Building 81-10

A summary of mercury recovered at Building 81-10 between March 1957 and July 1962 is presented below. The Task 2 team independently checked the quantities of mercury recovered from 81-10, as presented on page 93 of UCCND (1983a), using the original log sheets identified in the Y-12 Mercury Files. Revised estimates were calculated using the spreadsheet included in this appendix as Table H-5. Annual estimates were revised as described below.

- The 1957 log sheets summed to 659,199 pounds, not 719,499 pounds. The quantity of mercury recovered during November 1957 (117,977 lbs) was taken from a cumulative summary sheet included with the monthly log sheets, since there was no log sheet for this month. Even with the inclusion of the 117,977 pounds of mercury recovered in November 1957, the Mercury Task Force estimate is 60,300 pounds higher.

- The quantities of mercury recovered in 1958, 1959, and 1960 on the log sheets are the same as the Mercury Task Force estimates. There were several problems with the 1961 estimate. There was apparently a mathematical error on the January 1961 log sheet of 4,975 pounds included in the log sheet cumulative total, but not substantiated by the log sheet. This quantity was therefore subtracted from the revised 1961 estimate. Also, the log sheets for August 1961 through December 1961 were missing. The cumulative total on the January 1962 log sheet included 77,337 pounds of mercury presumably recovered during this 5-month period. The cumulative total was assumed to be correct, since operations were ongoing during this period and no additional documentation was identified. These two corrections resulted in the revised 1961 estimate being 106,066 pounds higher than the 1983 Mercury Task Force estimate. Of the total volume of mercury recovered during the entire period of 81-10 operations, an average of 47.5% was condensed and 52.5% was decanted. However, the 77,337 pounds recovered from presumably both processes during the last 5 months of 1961 was conservatively assumed to be recovered by condensation, since more air releases resulted from this operation than from decanting. This quantity was included in the revised 1961 estimate of mercury recovered.

- The 1962 log sheets summed to 275,923 pounds instead of 324,645 pounds. There is a footnote to the 1983 Mercury Task Force estimate of the total quantity of mercury recovered during 1962 that states "includes mercury bottled after 81-10 was shutdown". However, no further explanation of this footnote is provided.

Annual estimates of total mercury recovered at Building 81-10 as estimated by UCCND (1983a) and the Task 2 team, are summarized below. All of the revisions to the annual estimates result in the 1995 estimate by the project team being 2,956 pounds lower than the 1983 Mercury Task Force estimate.

Date	Estimated Total Mercury Recovered (Pounds) (UCCND 1983, p. 93)	Estimated Total Mercury Recovered (Pounds) (Dose Reconstruction Project Team)
1957	719,499	659,199
1958	1,189,734	1,189,734
1959	770,774	770,774
1960	442,397	442,397
1961	150,159	256,225
1962	324,645	275,923
Total	**3,597,208**	**3,594,252**

Estimate of Mercury Released to Air from Distillation Operations at 81-10

Mercury recovered by condensation at Building 81-10 was as follows:

Year	Mercury recovered by condensation (lbs)
1957	395,000
1958	700,000
1959	220,000
1960	125,000
1961	151,000
1962	115,000

Air emissions from the roasting furnace can be estimated based on a test run from May 4, 1959 to May 12, 1959 (Reece 1959). The total recovery of mercury was 341 pounds, and the total recovery plus known losses was 371 pounds, indicating a furnace efficiency of 341/371 = 92%. Therefore, recovery should be about 0.92 times furnace input, yielding the following estimates of annual inputs to the roasting furnace:

Year	Input to roasting furnace (lbs)
1957	429,000
1958	761,000
1959	239,000
1960	136,000
1961	164,000
1962	125,000

The loss to stack gases during the test run was 0.18 pounds. This was 0.0005 (0.05%) of the total recovery plus known losses (0.18/371.1 = 0.0005). On this basis, the annual air emissions from the mercury roasting furnace were 0.05% of the estimated input to the furnace, or:

Year	Air emissions from roasting furnace (lbs)
1957	215
1958	381
1959	120
1960	68
1961	82
1962	63
Total	**929**

Table H-1
Measurements of Mercury Building Air Concentrations, Air Flow Rates and Pounds Released: Measurement Uncertainty

Building	Year	Conc mg/m3	Unc +/-	Air flow cfm ***(a)***	Unc +/-				Pounds Released
9201-5	1955	0.215	40%	Choat	10%				9212
9201-5	1956	0.088	40%	Choat	10%				5848
9201-5	1957	0.032	40%	Choat	10%				2077
9201-5	1958	0.020	40%	Choat	10%				1381
9201-5	1959	0.040	40%	Choat	10%				912
9201-5	1960	0.040	40%	Choat	10%				492
9201-4	1955	0.210	40%	Choat	10%				9280
9201-4	1956	0.065	40%	Choat	10%				6012
9201-4	1957	0.030	40%	Choat	10%				3487
9201-4	1958	0.028	40%	Choat	10%				3466
9201-4	1959	0.028	40%	Choat	10%				3286
9201-4	1960	0.025	40%	Choat	10%				3085
9201-4	1961	0.020	40%	Choat	10%				2324
9201-4	1962	0.020	40%	Choat	10%				2324
9204-4	1953	0.065	40%	Choat	10%				1142
9204-4	1954	0.068	40%	Choat	10%				3046
9204-4	1955	0.068	40%	Choat	10%				3807
9204-4	1956	0.060	40%	Choat	10%				1700
9204-4	1957	N/A	40%	Choat	10%				0
9204-4	1958	0.063	40%	Choat	10%				1459
9204-4	1959	0.038	40%	Choat	10%				916
9720-26	1958	N/A	50%	N/A	N/A				2500
9720-26	1959	N/A	50%	N/A	N/A				2500
81-10	1957	N/A	50%	N/A	N/A				215
81-10	1958	N/A	50%	N/A	N/A				381
81-10	1959	N/A	50%	N/A	N/A				120
81-10	1960	N/A	50%	N/A	N/A				68
81-10	1961	N/A	50%	N/A	N/A				82
81-10	1962	N/A	50%	N/A	N/A				63
9201-2	1953	0.098	40%	Choat	10%				162
9201-2	1954	0.13	40%	Choat	10%				200
9201-2	1955	0.083	40%	Choat	10%				115
9201-2	1956	0.048	40%	Choat	10%				79
9201-2	1957	0.043	40%	Choat	10%				42
			Steam Plants:	9401-1	9401-2	9401-3	Y-12 TOTAL	K-25	**TOTAL**
			Unc. +/-	lbs	lbs	lbs	lbs	lbs	
	1953		50%	96	96		192	319	511
	1954		50%	96	96		192	319	511
	1955		50%	96	96		192	319	511
	1956		50%	96	96		192	319	511
	1957		50%			82	82	319	401
	1958		50%			56	56	319	375
	1959		50%			69	69	319	388
	1960		50%			69	69	319	388
	1961		50%			69	69	319	388
	1962		50%			69	69	160	229

Total lbs 75996

(a) Choat = See Tables H-3, H-4, H-5, and H-6, and Appendix G

Table H-2
Task 2 Estimates of Air Emissions of Mercury

Year	Total Hg Emissions (lbs)	Bldg 9201-4	Bldg 9201-5	Bldg 9204-4	W of 9720-26	Bldg 9201-2	Bldg 81-10	Steam Plant 1	Steam Plant 2	Steam Plant 3	K-25 powerhouse (near S-50)	81-10 % of 9201-4,-5
Total Hg Emissions (lbs)	**75995**	**33263**	**19922**	**12069**	**5000**	**599**	**929**	**384**	**384**	**414**	**3031**	
1953	1815			1142		162		96	96		319	
1954	3757			3046		200		96	96		319	
1955	22925	9280	9212	3807		115		96	96		319	
1956	14150	6012	5848	1700		79		96	96		319	
1957	6221	3486	2077	0		42	215			82	319	
1958	9562	3466	1381	1459	2500	0	381			56	319	
1959	8122	3286	912	916	2500	0	120			69	319	
1960	4033	3085	492				68			69	319	
1961	2794	2324					82			69	319	
1962	2616	2324					63			69	160	
Total %	**100%**	**44%**	**26%**	**16%**	**7%**	**0.8%**	**1.2%**	**0.5%**	**0.5%**	**0.5%**	**4%**	**1.7%**
1953	100%			63%		9%		5%	5%		18%	
1954	100%			81%		5%		3%	3%		8%	
1955	100%	40%	40%	17%		0.5%		0%	0%		1%	
1956	100%	42%	41%	12%		0.6%		0.7%	0.7%		2%	
1957	100%	56%	33%	0%		0.7%	3%			1%	5%	3.9%
1958	100%	36%	14%	15%	26%		4%			0.6%	3%	7.9%
1959	100%	40%	11%	11%	31%		1%			0.8%	4%	2.9%
1960	100%	76%	12%				2%			2%	8%	1.9%
1961	100%	83%					3%			2%	11%	3.5%
1962	100%	89%					2%			3%	6%	2.7%

Sources:

1. 1983 Mercury Task Force Report(Y/EX-21/del rev) checked with Y-12 Quarterly reports 1957-62; IH report(LaFrance 1957) for 1955-57;
   Alloy Div Solvent Air monthly reports (LaFrance 1955-60).
2. Choat (1996). Ventilation systems of Y-12 buildings. August 19, 1996.

Table H-3
Calculation of Pounds of Mercury Exhausted to Atmosphere per Quarter from Building 9201-5

Year	Qtr.	Exhaust Cfm	m^3/day	Bldg Air Conc. mg/m^3	Effluent mg/day	Effluent grams/day	Effluent lbs/day	Effluent lbs/qtr	Wilcox Report 1bs/qtr
1955	1	1308545	53363512	0.20	10672702	10672.7	23.53	2117.6	1716
	2	1308545	53363512	0.15	8004527	8004.5	17.65	1588.2	1287
	3	1308545	53363512	0.31	16542689	16542.7	36.47	3282.3	2573
	4	1308545	53363512	0.21	11206338	11206.3	24.71	2223.5	3603
			avg	0.22		Annual	Totals	**9212**	9179
1956	1	1526610	62256377	0.12	7470765	7470.8	16.47	1482.3	1888
	2	2357755	96151135	0.10	9615114	9615.1	21.20	1907.8	1716
	3	2357755	96151135	0.09	8653602	8653.6	19.08	1717.0	1544
	4	1526610	62256377	0.06	3735383	3735.4	8.23	741.1	1029
			avg	0.09		Annual	Totals	**5848**	6177
1957	1	1526610	62256377	0.04	2490255	2490.3	5.49	494.1	686
	2	2357755	96151135	0.04	3846045	3846.0	8.48	763.1	686
	3	2357755	96151135	0.03	2884534	2884.5	6.36	572.3	515
	4	1526610	62256377	0.02	1245128	1245.1	2.74	247.0	343
			avg	0.03		Annual	Totals	**2077**	2230
1958	1	1526610	62256377	0.02	1245128	1245.1	2.74	247.0	343
	2	2357755	96151135	0.02	1923023	1923.0	4.24	381.6	343
	3	2357755	96151135	0.02	1923023	1923.0	4.24	381.6	343
	4	1526610	62256377	0.03	1867691	1867.7	4.12	370.6	343
			avg	0.02		Annual	Totals	**1381**	1372
1959	1	1526610	62256377	0.04	2490255	2490.3	5.49	494.1	515
	2	471551	19230227	0.05	961511.4	961.5	2.12	190.8	
	3	471551	19230227	0.04	769209.1	769.2	1.70	152.6	
	4	305322	12451275	0.03	373538.3	373.5	0.82	74.1	
			avg	0.04		Annual	Totals	**912**	--
1960	1	305322	12451275	0.03	373538.3	373.5	0.82	74.1	
	2	471551	19230227	0.04	769209.1	769.2	1.70	152.6	
	3	471551	19230227	0.05	961511.4	961.5	2.12	190.8	
	4	305322	12451275	0.03	373538.3	373.5	0.82	74.1	
			avg	0.04		Annual	Totals	**492**	--
						Total for all years		**19223**	19473

Notes:
1. Assumes "Winter" ventilation rates for 1st & 4th quarter.
2. Assumes "Summer" ventilation rates for 2nd & 3rd quarter.
3. Hg concentrations taken from "Wilcox" report (Y/EX-21), pg 110, with minor corrections by Susan Flack.
4. When process was shut down, ventilation was reduced to minimum as dictated by concentration level. It is estimated that the standby ventilation was 20% of the design rate (2Q59 through 4Q60).

Table H-4
Calculations of Pounds of Mercury per Quarter Exhausted to Atmosphere from 9201-4

Year	Qtr.	Exhaust Cfm	m^3/day	Bldg Air Conc. mg/m^3	Effluent mg/day	Effluent grams/day	Effluent lbs/day	Effluent lbs/qtr	Wilcox Report 1bs/qtr
1955	2	2050740	83630818	0.13	10872006	10872.0	23.97	2157	858
	3	2050740	83630818	0.26	21744013	21744.0	47.94	4314	2144
	4	1446429	58986532	0.24	14156768	14156.8	31.21	2809	2144
			avg	0.21		Annual	Totals	**9280**	5146
1956	1	1446429	58986532	0.12	7078384	7078.4	15.60	1404	2059
	2	4703040	191793734	0.05	9589687	9589.7	21.14	1903	858
	3	4703040	191793734	0.05	9589687	9589.7	21.14	1903	858
	4	2477380	101029538	0.04	4041182	4041.2	8.91	802	686
			avg	0.07		Annual	Totals	**6012**	4461
1957	1	2477380	101029538	0.04	4041182	4041.2	8.91	802	686
	2	4703040	191793734	0.03	5753812	5753.8	12.68	1142	515
	3	4703040	191793734	0.03	5753812	5753.8	12.68	1142	515
	4	2477380	101029538	0.02	2020591	2020.6	4.45	401	343
			avg	0.03		Annual	Totals	**3486**	2059
1958	1	2477380	101029538	0.02	2020591	2020.6	4.45	401	343
	2	4703040	191793734	0.03	5753812	5753.8	12.68	1142	515
	3	4703040	191793734	0.04	7671749	7671.7	16.91	1522	686
	4	2477380	101029538	0.02	2020591	2020.6	4.45	401	343
			avg	0.03		Annual	Totals	**3466**	1887
1959	1	2477380	101029538	0.03	3030886	3030.9	6.68	601	258
	2	4703040	191793734	0.03	5753812	5753.8	12.68	1142	515
	3	4703040	191793734	0.03	5753812	5753.8	12.68	1142	515
	4	2477380	101029538	0.02	2020591	2020.6	4.45	401	172
			avg	0.03		Annual	Totals	**3286**	1460
1960	1	2477380	101029538	0.02	2020591	2020.6	4.45	401	172
	2	4703040	191793734	0.03	5753812	5753.8	12.68	1142	515
	3	4703040	191793734	0.03	5753812	5753.8	12.68	1142	515
	4	2477380	101029538	0.02	2020591	2020.6	4.45	401	172
			avg	0.03		Annual	Totals	**3085**	1374
1961	1	2477380	101029538	0.02	2020591	2020.6	4.45	401	172
	2	4703040	191793734	0.02	3835875	3835.9	8.46	761	343
	3	4703040	191793734	0.02	3835875	3835.9	8.46	761	172
	4	2477380	101029538	0.02	2020591	2020.6	4.45	401	343
			avg	0.02		Annual	Totals	**2324**	1030
1962	1	2477380	101029538	0.02	2020591	2020.6	4.45	401	172
	2	4703040	191793734	0.02	3835875	3835.9	8.46	761	343
	3	4703040	191793734	0.02	3835875	3835.9	8.46	761	343
	4	2477380	101029538	0.02	2020591	2020.6	4.45	401	172
			avg	0.02		Annual	Totals	**2324**	1030
							Totals	**33262**	18447

Notes:
1. Assumes "Winter" ventilation rates for 1st & 4th quarter.
2. Assumes "Summer" ventilation rates for 2nd & 4th quarter.
3. Hg concentrations taken from "Wilcox" report (Y/EX-21), page 111.

Table H-5
Calculation of Pounds of Mercury Exhausted to Atmosphere per Quarter from Building 9204-4

Year	Qtr.	Exhaust cfm	m3/day	Bldg Air Conc mg/m3	Effluent mg/day	Effluent grams/day	Effluent lbs/day	Effluent lbs/qtr	lbs stack *	lbs air	lbs H2 gas	lbs used for modeling
1953	3	554,400	22609345.8	0.07	1582654.21	1582.65	3.49	314.0	380.7	314.0	66.7	380.7
	4	554,400	22609345.8	0.06	1356560.75	1356.56	2.99	269.2	761.4	269.2	492.2	761.4
			avg	0.065			Annual Totals	**583**				**1142**
1954	1	554,400	22609345.8	0.04	904373.83	904.37	1.99	179.4	761.4	179.4	582.0	761.4
	2	554,400	22609345.8	0.1	2260934.58	2260.93	4.98	448.6	761.4	448.6	312.8	761.4
	3	554,400	22609345.8	0.07	1582654.21	1582.65	3.49	314.0	761.4	314.0	447.4	761.4
	4	554,400	22609345.8	0.06	1356560.75	1356.56	2.99	269.2	761.4	269.2	492.2	761.4
			avg	0.068			Annual Totals	**1211**				**3046**
1955	1	554,400	22609345.8	0.08	1808747.66	1808.75	3.99	358.9	761.4	358.9	402.5	761.4
	2	1,054,000	42983857.3	0.06	2579031.44	2579.03	5.69	511.7	1142.1	511.7	630.4	1142.1
	3	1,054,000	42983857.3	0.07	3008870.01	3008.87	6.63	597.0	1142.1	597.0	545.1	1142.1
	4	554,400	22609345.8	0.06	1356560.75	1356.56	2.99	269.2	761.4	269.2	492.2	761.4
			avg	0.068			Annual Totals	**1737**				**3807**
1956	1	554,400	22609345.8	0.07	1582654.21	1582.65	3.49	314.0	761.4	314.0	447.4	761.4
	2	1,054,000	42983857.3	0.05	2149192.86	2149.19	4.74	426.4	NA	426.4	NA	426.4
	3	1,054,000	42983857.3	0.06	2579031.44	2579.03	5.69	511.7	NA	511.7	NA	511.7
	4	554,400	22609345.8	NR				0.0	NA	NR	NA	0.0
			avg	0.060			Annual Totals	**1252**				**1700**
1957	1	554,400	22609345.8	NR					NA	NR	NA	
	2	1,054,000	42983857.3	NR								
	3	1,054,000	42983857.3	NR								
	4	554,400	22609345.8	NR								
			avg	NR			Annual Totals	**0**				**0**
1958	1	554,400	22609345.8	NR						NR		0.0
	2	1,054,000	42983857.3	0.09	3868547.15	3868.55	8.53	767.6		767.6		767.6
	3	1,054,000	42983857.3	0.06	2579031.44	2579.03	5.69	511.7		511.7		511.7
	4	554,400	22609345.8	0.04	904373.83	904.37	1.99	179.4		179.4		179.4
			avg	0.063			Annual Totals	**1459**				**1459**
1959	1	554,400	22609345.8	0.03	678280.37	678.28	1.50	134.6		134.4		134.6
	2	1,054,000	42983857.3	0.04	1719354.29	1719.35	3.79	341.1		341.1		341.2
	3	1,054,000	42983857.3	0.02	859677.15	859.68	1.90	170.6		170.6		170.6
	4	554,400	22609345.8	0.06	1356560.75	1356.56	2.99	269.2		269.2		269.2
			avg	0.038			Annual Totals	**915**				**916**
1960	1			NR								
	2											
	3											
	4											
							TOTAL:	**7158**			446.4	**12069**

Notes: * based on 8.46 lb/d in exhaust air measured in October 1953.
NA = not applicable (H2 gas emissions during process operations only).
NR = not reported
Process area air Hg concs do NOT include Hg contaminated H2 gas measured in stack exhaust air. This is unique to Elex in 9204-4 bldg. Bldg ventilation was increased 50% in summer starting in 1955.

Table H-6
Calculation of Pounds of Mercury Exhausted to Atmosphere per Quarter from Building 9201-2

Year	Qtr	Exhaust cfm	m3/day	Bldg Air Conc mg/m3	Effluent mg/day	g/day	lbs/day	lbs/qtr	lbs used for Modeling
1953	1	36,500	1488530	0.07	104197.11	104.20	0.230	20.7	
	2	68,500	2793543	0.09	251418.86	251.42	0.554	49.9	
	3	68,500	2793543	0.09	251418.86	251.42	0.554	49.9	
	4	36,500	1488530	0.14	208394.22	208.39	0.460	41.4	
			avg	0.098			Annual Total	**162**	**162**
1954	1	36,500	1488530	0.14	208394.22	208.39	0.460	41.4	
	2	68,500	2793543	0.07	195548.00	195.55	0.431	38.8	
	3	68,500	2793543	0.11	307289.72	307.29	0.678	61.0	
	4	36,500	1488530	0.2	297706.03	297.71	0.656	59.1	
			avg	0.13			Annual Total	**200**	**200**
1955	1	36,500	1488530	NR				0	
	2	68,500	2793543	0.09	251418.86	251.42	0.554	49.9	
	3	68,500	2793543	0.07	195548.00	195.55	0.431	38.8	
	4	36,500	1488530	0.09	133967.71	133.97	0.295	26.6	
			avg	0.083			Annual Total	**115**	**115**
1956	1	36,500	1488530	0.08	119082.41	119.08	0.263	23.6	
	2	68,500	2793543	0.06	167612.57	167.61	0.370	33.3	
	3	68,500	2793543	0.03	83806.29	83.81	0.185	16.6	
	4	36,500	1488530	0.02	29770.60	29.77	0.066	5.9	
			avg	0.048			Annual Total	**79**	**79**
1957	1	36,500	1488530	0.03	44655.90	44.66	0.098	8.9	
	2	68,500	2793543	0.04	111741.72	111.74	0.246	22.2	
	3	68,500	2793543	0.02	55870.86	55.87	0.123	11.1	
	4	36,500	1488530	0.08	119082.41	119.08	0.263	23.6	basement exhaust off
			avg	0.043			Annual Total	**66**	**42**
1958	1	36,500	1488530	0.05	74426.51	74.43	0.164	14.8	basement exhaust off
	2	68,500	2793543	0.11	307289.72	307.29	0.678	61.0	basement exhaust off
	3	68,500	2793543	0.16	446966.86	446.97	0.986	88.7	basement exhaust off
	4	36,500	1488530	NR				0	basement exhaust off
			avg	0.11			Annual Total	**164**	**0**
1959	1	36,500	1488530	NR					basement exhaust off
	2	68,500	2793543	NR					basement exhaust off
	3	68,500	2793543	0.06	167612.57	167.61	0.370	33.3	basement exhaust off
	4	36,500	1488530	0.05	74426.51	74.43	0.164	14.8	basement exhaust off
			avg	0.055			Annual Total	**48**	**0**
1960	1			NR					
	2								
	3								
	4								
							TOTALS	**835**	**599**

NR = not reported

Table H-7
Tabulation of Pounds of Mercury Processed at the 81-10 Mercury Recovery Operations (4/57 - 9/62)

Month/Year	Recovered by Condensing (lbs)	Cumulative Total	Recovered by Decanting (lbs)	Cumulative Total	Comments	Days in Operation	Total lbs. Recovered
Apr-57	4,204	4,204	31,151	31,151		13	35,355
May-57	19,982	24,186	67,905	99,056		18	123,242
Jun-57	56,343	80,529	36,415	135,471		26	216,000
Jul-57	60,452	140,981	15,094	150,565		29	291,546
Aug-57	30,141	171,122	10,770	161,335		30	332,457
Sep-57	48,527	219,649	19,406	180,741		27	400,390
Oct-57	73,595	293,244	14,963	195,704		30	488,948
Nov-57	65,483	358,727	52,494	248,198	no logsheet	29	606,925
Dec-57	36,008	394,735	16,266	264,464		21	659,199
Jan-58	54,801	449,536	4,763	269,227		26	718,763
Feb-58	45,523	495,059	2,502	271,729		24	766,788
Mar-58	59,717	554,776	13,348	285,077		31	839,853
Apr-58	58,770	613,546	19,797	304,874		30	918,420
May-58	52,747	666,293	17,816	322,690		22	988,983
Jun-58	0	666,293	1,053	323,743		0	990,036
Jul-58	65,959	732,252	14,921	338,664		21	1,070,916
Aug-58	71,727	803,979	17,743	356,407		31	1,160,386
Sep-58	82,257	886,236	37,991	394,398		28	1,280,634
Oct-58	67,396	953,632	176,533	570,931		29	1,524,563
Nov-58	92,869	1,046,501	115,306	686,237		30	1,732,738
Dec-58	48,583	1,095,084	67,612	753,849		30	1,848,933
Jan-59	29,481	1,124,565	22,852	776,701		16	1,901,266
Feb-59	0	1,124,565	27,630	804,331		0	1,928,896
Mar-59	24,912	1,149,477	37,752	842,083		13	1,991,560
Apr-59	30,391	1,179,868	156,115	998,198		30	2,178,066
May-59	20,327	1,200,195	138,062	1,136,260		30	2,336,455
Jun-59	25,140	1,225,335	35,353	1,171,613		30	2,396,948
Jul-59	23,384	1,248,719	15,013	1,186,626		31	2,435,345
Aug-59	28,268	1,276,987	11,622	1,198,248		31	2,475,235
Sep-59	24,037	1,301,024	22,109	1,220,357		30	2,521,381
Oct-59	8,166	1,309,190	21,498	1,241,855		20	2,551,045
Nov-59	0	1,309,190	19,820	1,261,675		0	2,570,865
Dec-59	5,901	1,315,091	42,941	1,304,616		4	2,619,707
Jan-60	24,202	1,339,293	50,262	1,354,878		20	2,694,171
Feb-60	14,100	1,353,393	19,542	1,374,420		20	2,727,813
Mar-60	20,594	1,373,987	40,626	1,415,046		27	2,789,033
Apr-60	19,873	1,393,860	49,340	1,464,386		30	2,858,246
May-60	6,687	1,400,547	36,685	1,501,071		21	2,901,618
Jun-60	3,986	1,404,533	14,424	1,515,495		22	2,920,028
Jul-60	7,359	1,411,892	11,796	1,527,291		20	2,939,183
Aug-60	2,515	1,414,407	15,751	1,543,042		23	2,957,449
Sep-60	4,130	1,418,537	20,243	1,563,285		19	2,981,822
Oct-60	6,403	1,424,940	21,687	1,584,972		18	3,009,912
Nov-60	4,876	1,429,816	18,902	1,603,874		21	3,033,690
Dec-60	9,965	1,439,781	18,449	1,622,323		23	3,062,104
Jan-61	11,378	1,451,159	17,351	1,639,674		29.7	3,090,833
Feb-61	7,358	1,458,517	21,377	1,661,051		28	3,119,568
Mar-61	21,912	1,480,429	32,493	1,693,544		31	3,173,973
Apr-61	33,089	1,513,518	33,930	1,727,474		30	3,240,992
May-61	0	1,513,518	0	1,727,474		0	3,240,992
Jun-61	0	1,513,518	0	1,727,474		0	3,240,992
Jul-61	0	1,513,518	0	1,727,474		0	3,240,992
Aug-61	15,467	1,528,985	0	1,727,474	no logsheet	NR	3,256,459
Sep-61	15,468	1,544,453	0	1,727,474	no logsheet	NR	3,271,927
Oct-61	15,467	1,559,920	0	1,727,474	no logsheet	NR	3,287,394
Nov-61	15,468	1,575,388	0	1,727,474	no logsheet	NR	3,302,862
Dec-61	15,467	1,590,855	0	1,727,474	no logsheet	NR	3,318,329
Jan-62	22,744	1,613,599	6,314	1,733,788		20	3,347,387
Feb-62	32,619	1,646,218	43,312	1,777,100		28	3,423,318
Mar-62	39,505	1,685,723	43,003	1,820,103		30	3,505,826

Table H-7
Tabulation of Pounds of Mercury Processed at the 81-10 Mercury Recovery Operations (4/57 - 9/62)

Month/Year	Recovered by Condensing (lbs)	Cumulative Total	Recovered by Decanting (lbs)	Cumulative Total	Comments	Days in Operation	Total lbs. Recovered
Apr-62	12,762	1,698,485	24,977	1,845,080		30	3,543,565
May-62	7,615	1,706,100	8,580	1,853,660		12	3,559,760
Jun-62	0	1,706,100	0	1,853,660		0	3,559,760
Jul-62	0	1,706,100	0	1,853,660		0	3,559,760
Aug-62	0	1,706,100	29,453	1,883,113		NR	3,589,213
Sep-62	0	1,706,100	5,039	1,888,152		NR	3,594,252
Oct-62	0	**1,706,100**	0	**1,888,152**		NR	**3,594,252**
	Condensed %	**47.47%**	**Decanted %**	**52.53%**			

NR = Not Reported

Source: Y/HG-0005 and Y/HG-0023 logsheets

Table H-8
Tabulation of Building Air Mercury Concentrations and Calculation of Quarterly Averages

Qtr	9201-5 ***(1)*** Hg (mg/m3) monthly	9201-5 ***(2)*** Hg (mg/m3) monthly	9201-5 ***(3)*** Hg (mg/m3) monthly	9201-5 calc'd avg Hg (mg/m3) **quarterly**	9201-5 ***(4)*** Hg (mg/m3) quarterly	9201-5 Y/EX-21/del rev Comments unless referenced as (#)	9201-4 ***(1)*** Hg (mg/m3) monthly	9201-4 ***(2)*** Hg (mg/m3) monthly
				used (2) <3-57				
Jan-55	--	0.23	--	used (1) >3-57		Operation begins		--
Feb-55	.12/.16	0.17	--					--
Mar-55	--	0.21	--	0.20	0.20			--
Apr-55	--	0.12	0.12				--	--
May-55	--	0.13	0.12				--	--
Jun-55	--	0.21	0.20	0.15	0.15		--	0.13
Jul-55	0.30	0.33	0.30				0.32	0.32
Aug-55	0.30	0.33	0.30				0.20	0.22
Sep-55	0.26	0.27	0.26	0.31	0.30		0.19	0.24
Oct-55	0.21	0.23	0.21			10/24/55 New ventilation system complete (new vent. rate = ?)	0.19	0.24
Nov-55	0.19	0.21	0.20				0.18	0.21
Dec-55	0.18	0.20	0.18	0.21	0.21		0.22	0.28
Jan-56	0.15	0.15	0.15			Ventilation survey by Little conducted	0.16	0.20
Feb-56	0.10	0.11	0.10				0.10	0.11
Mar-56	0.08	0.09	0.08	0.12	0.11		0.06	0.06
Apr-56	0.07	0.10	0.07				0.04	0.05
May-56	0.08	0.10	0.08				0.04	0.05
Jun-56	0.08	0.10	0.08	0.10	0.10	Noisy fans replaced in tray rooms	0.04	0.05
Jul-56	0.08	0.10	0.08				0.05	0.06
Aug-56	0.07	0.10	0.07				0.04	0.05
Sep-56	0.06	0.07	0.06	0.09	0.09		0.03	0.04
Oct-56	0.07	0.07	0.07				0.04	0.04
Nov-56	0.05	0.07	0.05				0.04	0.04
Dec-56	0.05	0.05	0.05	0.06	0.06		0.04	0.04
Jan-57	0.04	0.04	0.04				0.04	0.04
Feb-57	0.04	0.04	0.04				0.04	0.04
Mar-57	0.04	0.04	0.04	0.04	0.04	LaFrance study (2) ends.	0.03	0.03
Apr-57	0.04		0.04				0.03	
May-57	0.04		0.04				0.03	
Jun-57	0.03		0.03	0.04	0.04		0.04	
Jul-57	0.04		0.04				0.03	
Aug-57	0.03		0.03				0.02	
Sep-57	0.03		0.03	0.03	0.03		0.03	
Oct-57	0.02		0.02				0.02	
Nov-57	0.03		0.03				0.02	
Dec-57	0.02		0.02	0.02	0.02		0.02	
Jan-58	0.02		0.02				0.02	
Feb-58	0.02		0.02				0.02	
Mar-58	0.02		0.02	0.02	0.02		0.02	

Table H-8
Tabulation of Building Air Mercury Concentrations and Calculation of Quarterly Averages

Qtr	9201-4 ***(3)*** Hg (mg/m3) monthly	9201-4 calc'd avg ***(1)*** Hg (mg/m3) **quarterly**	9201-4 ***(4)*** Hg (mg/m3) quarterly	9201-4 Y/EX-21/del rev Comments unless referenced as (#)	9204-4 ***(3)*** Hg (mg/m3) monthly	9204-4 calc'd avg ***(3)*** Hg (mg/m3) quarterly	9201-2 ***(3)*** Hg (mg/m3) monthly	9201-2 calc'd avg ***(3)*** Hg (mg/m3) **quarterly**
		used (2) <3-57						
Jan-55	--	used (1) >3-57						
Feb-55	--	used (4) >9-61						
Mar-55	--							
Apr-55	--			Operations begins	0.07		0.10	
May-55	0.06				0.05		0.08	
Jun-55	0.26	0.13	0.10		0.05	**0.06**	0.09	**0.09**
Jul-55	0.32				0.06		0.07	
Aug-55	0.20				0.08		0.06	
Sep-55	0.19	0.26	0.25		0.06	**0.07**	0.09	**0.07**
Oct-55	0.19				0.07		0.11	
Nov-55	0.18				0.05		0.09	
Dec-55	0.22	0.24	0.25		0.06	**0.06**	0.07	**0.09**
Jan-56	0.16			New ventilation system complete	0.08		0.07	
Feb-56	0.10				0.06		0.10	
Mar-56	0.06	0.12	0.12		0.07	**0.07**	0.07	**0.08**
Apr-56	0.04				0.05		0.06	
May-56	0.04				0.06		0.05	
Jun-56	0.04	0.05	0.05		0.04	**0.05**	0.06	**0.06**
Jul-56	0.05				0.05		0.04	
Aug-56	0.04				0.07		0.03	
Sep-56	0.03	0.05	0.05		NR	**0.06**	0.02	**0.03**
Oct-56	0.04				NR		0.03	
Nov-56	0.04				NR		0.02	
Dec-56	0.04	0.04	0.04		NR	NR	0.02	**0.02**
Jan-57	0.04				NR		0.04	
Feb-57	0.04				NR		0.03	
Mar-57	0.03	0.04	0.04		NR	NR	0.03	**0.03**
Apr-57	0.03				NR		0.03	
May-57	0.03				NR		0.04	
Jun-57	0.04	0.03	0.03		NR	NR	0.04	**0.04**
Jul-57	0.03				NR		0.03	
Aug-57	0.02				NR		0.02	
Sep-57	0.03	0.03	0.03		NR	NR	0.01	**0.02**
Oct-57	0.02				NR		0.06	
Nov-57	0.02				NR		0.09	bment exh off
Dec-57	0.02	0.02	0.02		NR	NR	NR	0.08
Jan-58	0.02				NR		0.00	
Feb-58	0.02				NR		0.05	
Mar-58	0.02	0.02	0.02		NR	NR	0.09	0.05

Table H-8
Tabulation of Building Air Mercury Concentrations and Calculation of Quarterly Averages

Qtr	9201-5 ***(1)*** Hg (mg/m3) monthly	9201-5 ***(2)*** Hg (mg/m3) monthly	9201-5 ***(3)*** Hg (mg/m3) monthly	9201-5 calc'd avg Hg (mg/m3) **quarterly**	9201-5 ***(4)*** Hg (mg/m3) quarterly	9201-5 Y/EX-21/del rev Comments unless referenced as (#)	9201-4 ***(1)*** Hg (mg/m3) monthly	9201-4 ***(2)*** Hg (mg/m3) monthly
Apr-58	0.03		0.03				0.02	
May-58	0.02		0.02				0.03	
Jun-58	0.02		0.02	0.02	0.02		0.04	
Jul-58	0.02		0.02				0.05	
Aug-58	0.02		0.02				0.03	
Sep-58	0.02		0.02	0.02	0.02		0.03	
Oct-58	0.02		0.02				0.02	
Nov-58	0.03		0.03				0.03	
Dec-58	0.03		0.03	0.03	0.02		0.02	
Jan-59	0.04		0.04			Operations ends	0.03	
Feb-59	0.03		0.03				0.03	
Mar-59	0.04		0.04	0.04	0.03	3/13/59 Began shutdown operations	0.02	
Apr-59	0.05		0.05				0.03	
May-59	0.07		0.07				0.03	
Jun-59	0.04		0.04	0.05	--		0.03	
Jul-59	0.04		0.04				0.03	
Aug-59	0.05		0.05				0.04	
Sep-59	0.04		0.04	0.04	--		0.03	
Oct-59	0.03		0.03				0.02	
Nov-59	0.04		0.04				0.02	
Dec-59	0.03		0.03	0.03	--		0.02	
Jan-60	0.04		0.04				0.02	
Feb-60	0.02		0.02			IH Reports (3) stop.	0.02	
Mar-60	0.02			0.03	--		0.02	
Apr-60	0.04						0.02	
May-60	0.03						0.03	
Jun-60	0.05			0.04	--		0.02	
Jul-60	0.05						0.04	
Aug-60	0.05						0.03	
Sep-60	0.04			0.05	--		0.03	
Oct-60	0.03						0.02	
Nov-60	0.03						0.02	
Dec-60	0.03			0.03	--	Quarterly reports stop reporting A-5 avg air concs.	0.03	
Jan-61	--						0.03	
Feb-61	--						0.02	
Mar-61	--						0.02	
Apr-61	--						0.02	
May-61	--						0.01	
Jun-61	--						0.02	

Table H-8
Tabulation of Building Air Mercury Concentrations and Calculation of Quarterly Averages

Qtr	9201-4 ***(3)*** Hg (mg/m3) monthly	9201-4 calc'd avg ***(1)*** Hg (mg/m3) **quarterly**	9201-4 ***(4)*** Hg (mg/m3) quarterly	9201-4 Y/EX-21/del rev Comments unless referenced as (#)	9204-4 ***(3)*** Hg (mg/m3) monthly	9204-4 calc'd avg ***(3)*** Hg (mg/m3) quarterly	9201-2 ***(3)*** Hg (mg/m3) monthly	9201-2 calc'd avg ***(3)*** Hg (mg/m3) **quarterly**
Apr-58	0.02				NR		0.08	
May-58	0.03				NR		0.12	
Jun-58	0.04	0.03	0.03		0.09	**0.09**	0.12	0.11
Jul-58	0.05				0.08		0.12	
Aug-58	0.03				0.05		NR	
Sep-58	0.03	0.04	0.04		0.06	**0.06**	0.20	0.16
Oct-58	0.02				0.05		NR	
Nov-58	0.03				0.05		NR	
Dec-58	0.02	0.02	0.02		0.02	**0.04**	NR	NR
Jan-59	0.03			Exhaust rates cut in half	0.02		NR	
Feb-59	0.03				0.01		NR	
Mar-59	0.02	0.03	0.03		0.05	**0.03**	NR	NR
Apr-59	0.03				0.05		NR	
May-59	0.03				0.04		NR	
Jun-59	0.03	0.03	0.03		0.03	**0.04**	NR	NR
Jul-59	0.03				0.03		0.06	
Aug-59	0.04				0.02		0.04	
Sep-59	0.03	0.03	0.03		0.02	**0.02**	0.08	0.06
Oct-59	0.02			Exhaust rates cut in half	0.06		0.05	
Nov-59	0.02				NR		0.05	
Dec-59	0.02	0.02	0.02		NR	**0.06**	NR	0.05
Jan-60	0.02				NR		NR	
Feb-60	0.02				NR		NR	
Mar-60		0.02	0.02					
Apr-60								
May-60								
Jun-60		0.02	0.03					
Jul-60								
Aug-60								
Sep-60		0.03	0.03					
Oct-60								
Nov-60								
Dec-60		0.02	0.02					
Jan-61								
Feb-61								
Mar-61		0.02	0.02					
Apr-61								
May-61								
Jun-61		0.02	0.02					

Table H-8
Tabulation of Building Air Mercury Concentrations and Calculation of Quarterly Averages

Qtr	9201-5 ***(1)*** Hg (mg/m3) monthly	9201-5 ***(2)*** Hg (mg/m3) monthly	9201-5 ***(3)*** Hg (mg/m3) monthly	9201-5 calc'd avg Hg (mg/m3) **quarterly**	9201-5 ***(4)*** Hg (mg/m3) quarterly	9201-5 Y/EX-21/del rev Comments unless referenced as (#)	9201-4 ***(1)*** Hg (mg/m3) monthly	9201-4 ***(2)*** Hg (mg/m3) monthly
Jul-61	--						0.02	
Aug-61	--						0.02	
Sep-61	--						0.02	
Oct-61	--						--	
Nov-61	--						--	
Dec-61	--						--	
Jan-62	--						--	
Feb-62	--						--	
Mar-62	--						--	
Apr-62	--						--	
May-62	--						--	
Jun-62	--						--	
Jul-62	--						--	
Aug-62	--						--	
Sep-62	--						--	
Oct-62	--						--	
Nov-62	--						--	
Dec-62	--					Building not stripped until 1965.	--	

Table H-8
Tabulation of Building Air Mercury Concentrations and Calculation of Quarterly Averages

Qtr	9201-4 ***(3)*** Hg (mg/m3) monthly	9201-4 calc'd avg ***(1)*** Hg (mg/m3) **quarterly**	9201-4 ***(4)*** Hg (mg/m3) quarterly	9201-4 Y/EX-21/del rev Comments unless referenced as (#)	9204-4 ***(3)*** Hg (mg/m3) monthly	9204-4 calc'd avg ***(3)*** Hg (mg/m3) quarterly	9201-2 ***(3)*** Hg (mg/m3) monthly	9201-2 calc'd avg ***(3)*** Hg (mg/m3) **quarterly**
Jul-61								
Aug-61								
Sep-61		0.02	0.02	Quarterly reports stop reporting A-4 avg air concs.				
Oct-61								
Nov-61								
Dec-61		--	0.02					
Jan-62								
Feb-62								
Mar-62		--	0.02					
Apr-62								
May-62								
Jun-62		--	0.02					
Jul-62								
Aug-62								
Sep-62		--	0.02					
Oct-62								
Nov-62								
Dec-62		--	0.02	Operation ends (To date, A-4 has not been stripped)				

Sources:
(1) Y-12 Quarterly Reports and ChR2-0201
(2) LaFrance 1957 (Y/HG-106)
(3) IH Monthly reports for Alloy Division 1955-60 (ChR2-0242)
(4) 1983 Mercury Task Force report (Y/EX-21/del rev)
Bolded values are used to calculate pounds of mercury released for modeling.

Table H-9
Comparison of 1983 Mercury Task Force Air Release Estimates with Task 2 Estimates

		Building 9201-5							Building 9201-4			
Year	Qtr	Task 2 Avg Air Conc (mg/m3)	Task Force Avg. Air Conc (mg/m3) (3)		Task Force lbs/d (3)	Days in Quarter	Task 2 lbs/qtr (4)	Task 2 Yr Total	Task 2 Avg Air Conc (mg/m3)		Task 2 lbs/qtr (4)	Task 2 Yr Total
1955	1	0.20	0.12		11.25	91.5	1716	9264			0	7463
	2	0.15	0.12		11.25	91.5	1287		0.13	(1)	1115	
	3	0.31	0.12	(1)	11.25	91.5	2659		0.26	(1)	2230	
	4	0.21	0.12		22.5	91.5	3603		0.24	(1)	4118	
1956	1	0.12	0.12	(1)	22.5	91.5	2059	6348	0.12		2059	4461
	2	0.10	0.12		22.5	91.5	1716		0.05		858	
	3	0.09	0.12		22.5	91.5	1544		0.05		858	
	4	0.06	0.12		22.5	91.5	1029		0.04		686	
1957	1	0.04	0.12		22.5	91.5	686	2230	0.04		686	2059
	2	0.04	0.12		22.5	91.5	686		0.03		515	
	3	0.03	0.12		22.5	91.5	515		0.03		515	
	4	0.02	0.12		22.5	91.5	343		0.02		343	
1958	1	0.02	0.12		22.5	91.5	343	1544	0.02		343	1887
	2	0.02	0.12		22.5	91.5	343		0.03		515	
	3	0.02	0.12		22.5	91.5	343		0.04		686	
	4	0.03	0.12	(2)	22.5	91.5	515		0.02		343	
1959	1	0.04	0.12	(1)	22.5	91.5	686	2745	0.03		515	1887
	2	0.05	0.12	(2)	22.5	91.5	858		0.03		515	
	3	0.04	0.12	(2)	22.5	91.5	686		0.03		515	
	4	0.03	0.12	(2)	22.5	91.5	515		0.02		343	
1960	1	0.03	0.12	(1)	22.5	91.5	429	2488	0.02		343	1716
	2	0.04	0.12	(2)	22.5	91.5	686		0.03		515	
	3	0.05	0.12	(2)	22.5	91.5	858		0.03		515	
	4	0.03	0.12	(2)	22.5	91.5	515		0.02		343	
1961	1		0.12		22.5	91.5	0		0.02		343	1373
	2		0.12		22.5	91.5	0		0.02		343	
	3		0.12		22.5	91.5	0		0.02		343	
	4		0.12		22.5	91.5	0		0.02		343	
1962	1		0.12		22.5	91.5	0		0.02		343	1373
	2		0.12		22.5	91.5	0		0.02		343	
	3		0.12		22.5	91.5	0		0.02		343	
	4		0.12		22.5	91.5	0		0.02		343	
						Task 2 Total	24619				22217	
						Y/EX-21	19473				18447	
						difference	-26%				-20%	

Notes

1 = Air concentrations corrected for discrepancy between quarterly averages calculated from monthly data in IH reports (LaFrance 1957) and quarterly averages reported in Y/EX-21/del rev (UCCND 1983a)
2 = Additional data located in IH reports (LaFrance 1955-60)
3 = Little (1956)
4 = Task 2 lbs/qtr = [Task 2 (mg/m3)] x [Hg Task Force lbs/d x d/qtr] / [Hg Task Force (mg/m3)]

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APPENDIX I

WATERBORNE RELEASES OF MERCURY– DATA AND CALCULATIONS

This appendix contains data collected, calculated, and cross-checked by the project team in the course of the mercury source term assessment. These tables were created primarily for recording and analyzing the data that form the basis for the Task 2 release estimates. The data analyses performed are described in Section 4.5. The tables were for the most part preserved in their original formats so that they would be indicative of the processes used to estimate historical mercury releases from the ORR.

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Table I-1: Measurements of EFPC Mercury Concentrations, Water Flow Rates, and Pounds Released: Measurement Uncertainty

Year	Conc mg/L	Unc +/- *(a)*	Ref	Flow MGD *(b)*	Unc +/- *(c)*	Ref		Pounds Released
1950	0.008	54%						260
1951	0.016	54%						520
1952	0.078	54%						2600
1953	0.35	50%	conc2	11.0	NA	AVG		11799
1954	0.22	50%	conc1/2	10.3	15%	TVA/AVG		7057
1955	1.06	50%	conc1	11.1	15%	flow1/2		35856
1956	0.85	50%	conc1/3	11.4	15%	flow1/2/3		29419
1957	2.22	15%	conc1/3	11.0	15%	flow1/3		72211
1958	2.33	15%	conc1	8.7	15%	flow1		64276
1959	0.68	15%	conc1	9.6	15%	flow1		19074
1960	0.24	30%	conc1/3	9.7	15%	flow1/3		6998
1961	0.20	30%	conc1/2	11.0	15%	flow1/3		6608
1962	0.12	40%	conc1/3	12.5	15%	flow1/3		4569
1963	0.086	40%	conc1	11.9	15%	Y/EX-21		3061
1964	0.044	40%	conc1/3	8.8	10%	Y/EX-21		1111
1965	0.095	40%	conc3	8.7	10%	Y/EX-21		2463
1966	0.043	40%	conc3	10.3	10%	Y/EX-21		1351
1967	0.031	40%	conc3	9.3	10%	Y/EX-21		834
1968	0.005	20%	conc3	10.1	10%	Y/EX-21		138
1969	0.006	20%	conc3	9.4	10%	Y/EX-21		177
1970	0.026	20%	conc3	8.9	10%	Y/EX-21		677
1971	0.006	20%	conc3	9.0	10%	Y/EX-21		168
1972	0.001	20%	conc3	7.7	10%	Y-12		19
1973	0.065	20%	conc3	8.7	10%	Y-12		1680
1974	0.015	20%	conc3	6.2	10%	Y-12		329
1975	0.001	20%	conc3	6.8	10%	Y-12		21
1976	0.001	20%	conc3	8.0	10%	Y-12		24
1977	0.002	20%	conc3	8.6	10%	Y-12		48
1978	0.001	20%	conc3	6.1	10%	Y-12		21
1979	0.002	20%	conc3	7.8	10%	Y-12		41
1980	0.002	20%	conc3	8.5	10%	Y-12		52
1981	0.002	20%	conc3	7.2	10%	Y-12		33
1982	0.003	20%	conc2/3	9.0	10%	Y-12		63
1983	0.002	10%	conc3	9.0	10%	Y-12		55
1984	0.0016	10%	conc3	9.2	10%	Y-12		45
1985	0.0018	10%	conc3	9.6	10%	Y-12		53
1986	0.0022	10%	conc3	9.4	10%	USGS		63
1987	0.0028	10%	conc3	8.2	10%	USGS		70
1988	0.0019	10%	conc3	6.8	10%	USGS		39
1989	0.0017	10%	conc3	7.4	10%	USGS		38
1990	0.0017	10%	conc3	6.8	10%	USGS		35
1991	0.0014	10%	conc3	5.5	10%	USGS		24
1992	0.0017	10%	conc3	4.3	10%	USGS		22
1993	0.0016	10%	conc3	5.0	10%	USGS		24
1994	NA	10%	NA	6.2	10%	USGS		0
1995	NA	10%	NA	4.2	10%	USGS		0
1996	NA	10%	NA	6.5	10%	USGS		0
							correction	8775
							factor	
							Total lbs	**282801**

Notes:

(a) Concentrations uncertainty

50% is the Y/EX-21 estimate for colorimetric method used prior to 1957.

15%, 30%, and *40%* are from the technical paper on the mercurometer method used between 1957 and 1967(coefficient of variation was higher at 1.0 than at 0.05 mg/L).

20% is theY/EX-21 estimate for the atomic absorption method used between 1967 and 1983.

10% is based on the use of EPA Method 245.1 after 1983.

(b) Millions of gallons per day

(c) Flow rate uncertainty

15% is based on use of the TVA installed weir by Building 9720-8 prior to the construction of New Hope Pond in 1963.

10% is based on use of the 6-ft Cipolletti weir at the outflow of New Hope Pond after 1963 (B. Bryan, USGS, 1996).

References indicate sources of concentrations and flow rates from Table I-2 (See bottom of Table I-2).

Table I-2: Quantities of Mercury Released to Water: Comparison of Three Data Sources and Calculation of Annual Totals (lbs/yr)

	Comparison of Conc. Sources			Selected	Comparison of Flow Rate Sources			Selected	Comparison of lbs - Different Data Sources					lbs USED	lbs USED
	Conc 1 *(a)*	Conc 2 *(b)*	Conc 3 *(c)*	CONC	Flow 1 *(a)*	Flow 2 *(b)*	Flow 3 *(c)*	FLOW	lbs 1 *(f)*	lbs 2 *(g)*	lbs 3 *(h)*	lbs3 *(i)*	lbs	for	vs.
	(calc'd)	(Qtrly)	(Y/EX-21)	(AVG.) *(d)*	(calc'd)	(Qtrly)	(Y/EX-21)	(AVG) *(d,e)*				(flow3)	reported	modeling	Y/EX-21 lbs
YEAR	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(MGD)	(MGD)	(MGD)	(MGD)	(calc'd)	(calc'd)	(calc'd)	(calc'd)	Y/EX-21	*(j)*	(+/-)
1950													100	**100**	0
1951													200	200	0
1952													1000	1000	0
1953		0.47		**0.47**				**11**					4000	**11799**	7799
1Q				NA										NA	
2Q		0.13		0.13				11						1088	
3Q		0.21		0.21				11						1757	
4Q		1.07		1.07				11						8954	
1954		0.23		**0.22**				**10.3**					6000	**7057**	1057
1Q		0.20		0.2				11						1674	
2Q	0.20	0.20		0.20				11						1674	
3Q	0.30	0.32		0.30				11						2510	
4Q	0.19	0.18		0.19		8.3		8.3	1200	1137				1200	
1955	1.06	1.06		**1.06**				**11.1**					5881	**35856**	
1Q	0.61	0.61		0.61		NA		11	NA	NA				5105	5105
2Q	1.80	1.81		1.8		11.0		11.0	15063	15147				15063	15063
3Q	1.12	1.13		1.12	11.6	11.6		11.6	9884	9972				9884	9884
4Q	0.70	0.70	0.709	0.7	10.9	10.8	10.8	10.9	5805	5805	5879	5825	5881	5805	-76
1956	0.87	0.96	0.903	**0.85**			11.4	**11.4**				30958	31153	**29419**	
1Q	0.36	0.37	0.359	0.36	NA	NA	11.7	11.7	3204	3293	3195	3195	3192	3204	12
2Q	0.64	0.66	0.642	0.64	11.2	11.3	11.3	11.2	5453	5623	5470	5519	5512	5453	-59
3Q	1.46	1.53	1.654	1.46	10.9	10.8	10.8	10.9	12107	12687	13715	13589	13711	12107	-1604
4Q	1.01	1.26	0.956	0.956	NA	11.9	11.9	11.9	9143	11407	8655	8655	8738	8655	-83
1957	2.23	2.21	2.213	**2.22**			11.0	**11.0**				72308	72414	**72211**	
1Q	1.61	1.54	1.609	1.61	NA	NA	13.2	13.2	16167	15465	16157	16157	15954	16167	213
2Q	2.49	2.40	2.422	2.422	10.5	NA	10.6	10.5	19890	19171	19347	19531	19497	19347	-150
3Q	3.02	3.10	3.015	3.02	9.5	NA	9.5	9.5	21826	22404	21790	21790	21993	21826	-167
4Q	1.81	1.80	1.805	1.81	10.8	NA	10.8	10.8	14871	14789	14830	14830	14970	14871	-99
1958	2.33	2.35	2.344	**2.33**	8.7		8.8	**8.7**				64829	64596	**64276**	
1Q	3.65	3.60	3.650	3.65	9.6	NA	9.6	9.6	26657	26292	26657	26657	26317	26657	340
2Q	3.06	3.10	3.062	3.06	9.4	NA	9.4	9.4	21882	22168	21897	21897	21854	21882	28
3Q	1.25	1.30	1.246	1.25	8.0	NA	8.3	8.0	7608	7912	7583	7868	7941	7608	-333
4Q	1.37	1.40	1.417	1.37	7.8	NA	7.8	7.8	8129	8307	8408	8408	8484	8129	-355
1959	0.68	0.63	0.666	**0.68**	9.6		9.5	**9.6**				18623	18604	**19074**	
1Q	1.02	1.00	0.990	1.02	8.5	NA	8.4	8.5	6596	6466	6402	6326	6246	6596	350
2Q	0.74	0.70	0.738	0.74	9.7	NA	9.7	9.7	5461	5166	5446	5446	5440	5461	21
3Q	0.75	0.60	0.738	0.75	9.5	NA	9.4	9.5	5420	4336	5334	5277	5329	5420	91
4Q	0.20	0.20	0.197	0.2	10.5	NA	10.5	10.5	1598	1598	1574	1574	1589	1598	9
1960	0.25	0.25	0.233	**0.24**	9.9		9.6	**9.7**				6687	6715	**6998**	
1Q	0.19	0.20	0.186	0.19	10.7	NA	10.7	10.7	1547	1628	1514	1514	1514	1547	33
2Q	0.20	0.20	0.198	0.20	10.2	NA	9.8	10.2	1552	1552	1536	1476	1471	1552	81
3Q	0.36	0.20	0.330	0.36	8.9	NA	8.9	8.9	2437	1354	2234	2234	2255	2437	182
4Q	NA	0.40	0.216	0.216	NA	NA	8.9	8.9	NA	2708	1462	1462	1475	1462	-13

Table I-2: Quantities of Mercury Released to Water: Comparison of Three Data Sources and Calculation of Annual Totals (lbs/yr)

YEAR	Comparison of Conc. Sources: Conc 1 *(a)* (calc'd) (mg/L)	Conc 2 *(b)* (Qtrly) (mg/L)	Conc 3 *(c)* (Y/EX-21) (mg/L)	Selected CONC (AVG.) *(d)* (mg/L)	Comparison of Flow Rate Sources: Flow 1 *(a)* (calc'd) (MGD)	Flow 2 *(b)* (Qtrly) (MGD)	Flow 3 *(c)* (Y/EX-21) (MGD)	Selected FLOW (AVG) *(d,e)* (MGD)	Comparison of lbs - Different Data Sources: lbs 1 *(f)* (calc'd)	lbs 2 *(g)* (calc'd)	lbs 3 *(h)* (calc'd)	lbs3 *(i)* (flow3) (calc'd)	lbs reported Y/EX-21	lbs USED for modeling *(j)*	lbs USED vs. Y/EX-21 lbs (+/-)
1961	0.23	0.15	0.146	**0.20**			10.7	**11.0**				4765	4778	**6608**	
1Q	0.30	0.10	0.133	0.30	10.5	NA	9.5	10.5	2396	799	1062	961	949	2396	1447
2Q	0.10	0.10	0.103	0.10	NA	NA	10.8	10.8	822	822	846	846	841	822	-19
3Q	0.28	0.28	0.230	0.28	NA	NA	10.9	10.9	2322	2322	1907	1907	1925	2322	397
4Q	NA	0.12	0.118	0.12	NA	NA	11.7	11.7	NA	1068	1050	1050	1063	1068	5
1962	0.13	0.13	0.130	**0.12**	NA		12.5	**12.5**				4886	4879	**4569**	
1Q	0.18	0.17	0.205	0.18	13.1	NA	13.2	13.1	1794	1694	2043	2059	2032	1794	-238
2Q	0.08	0.11	0.084	0.08	13.2	NA	13.4	13.2	803	1105	844	856	857	803	-54
3Q	NA	0.16	0.021	0.021	NA	12.4	12.4	12.4	NA	1509	198	198	200	198	-2
4Q	NA	0.07	0.210	0.210	NA	11.1	11.1	11.1	NA	591	1773	1773	1790	1773	-17
1963	0.086		0.028	**0.086**		11.9	11.9	**11.9**				1029	1021	**3061**	
1Q	0.07	"low"	0.016	0.07	NA	14.1	14.1	14.1	751	NA	172	172	169	172	3
2Q	0.23	1/4ly reporting	0.040	0.23	NA	14.7	14.7	14.7	2572	NA	447	447	441	2572	2131
3Q	0.02	stopped here	0.032	0.02	NA	10.2	10.2	10.2	155	NA	248	248	249	155	-94
4Q	0.023		0.025	0.023	NA	8.5	8.5	8.5	149	NA	162	162	162	162	0
1964	0.030		0.046	**0.044**		8.8	8.8	**8.8**				1243	1244	**1111**	
1Q	0.07		0.084	0.074	NA	9.6	9.6	9.6	511	NA	613	613	612	511	-101
2Q	0.02		0.024	0.024	NA	9.8	9.8	9.8	149	NA	179	179	181	149	-32
3Q	0		0.039	0.039	NA	7.8	7.8	7.8	0	NA	231	231	231	231	0
4Q	NA		0.037	0.037	NA	7.8	7.8	7.8	NA	NA	220	220	220	220	0
1965			0.095	**0.095**		8.7	8.7	**8.7**				2463	2460	**2463**	
1Q			0.050	0.050	NA	9.0	9.0	9.0			342	342	338	342	4
2Q			0.231	0.231	NA	8.3	8.3	8.3			1459	1459	1454	1459	5
3Q			0.050	0.050	NA	9.6	9.6	9.6			365	365	369	365	-4
4Q			0.050	0.050	NA	7.8	7.8	7.8			297	297	299	297	-2
1966			0.043	**0.043**		10.3	10.3	**10.3**				1351	1152	**1351**	
1Q			0.050	0.050	NA	9.5	9.5	9.5			361	361	357	361	4
2Q			0.054	0.054	NA	11.8	11.8	11.8			485	485	354	485	131
3Q			0.036	0.036	NA	10.7	10.7	10.7			293	293	227	293	66
4Q			0.030	0.030	NA	9.3	9.3	9.3			212	212	214	212	-2
1967			0.031	**0.031**		9.5	9.3	**9.3**				834	839	**834**	
1Q			0.042	0.042	NA	8.9	8.9	8.9			284	284	281	284	3
2Q			0.049	0.049	NA	9.5	8.5	8.5			317	317	319	317	-2
3Q			0.026	0.026	NA	9.9	9.9	9.9			196	196	201	196	-5
4Q			0.005	0.005	NA	9.8	9.8	9.8			37	37	38	37	-1
1968			0.005	**0.005**		10.1	10.1	**10.1**				138	136	**138**	
1Q			0.005	0.005	NA	9.7	9.7	9.7			37	37	34	37	3
2Q			0.005	0.005	NA	10.6	10.6	10.6			40	40	41	40	-1
3Q			0.004	0.004	NA	10.3	10.3	10.3			31	31	32	31	-1
4Q			0.004	0.004	NA	9.7	9.7	9.7			30	30	29	30	1
1969			0.006	**0.006**		9.4	9.4	**9.4**				177	178	**177**	
1Q			0.005	0.005	NA	11.0	11.0	11.0			42	42	42	42	0
2Q			0.006	0.006	NA	9.4	9.4	9.4			43	43	43	43	0
3Q			0.006	0.006	NA	8.4	8.4	8.4			38	38	39	38	-1
4Q			0.008	0.008	NA	8.8	8.8	8.8			54	54	54	54	0

Table I-2: Quantities of Mercury Released to Water: Comparison of Three Data Sources and Calculation of Annual Totals (lbs/yr)

	Comparison of Conc. Sources			Selected	Comparison of Flow Rate Sources			Selected	Comparison of lbs - Different Data Sources					lbs USED	lbs USED
YEAR	Conc 1 *(a)* (calc'd) (mg/L)	Conc 2 *(b)* (Qtrly) (mg/L)	Conc 3 *(c)* (Y/EX-21) (mg/L)	CONC (AVG.) *(d)* (mg/L)	Flow 1 *(a)* (calc'd) (MGD)	Flow 2 *(b)* (Qtrly) (MGD)	Flow 3 *(c)* (Y/EX-21) (MGD)	FLOW (AVG) *(d,e)* (MGD)	lbs 1 *(f)* (calc'd)	lbs 2 *(g)* (calc'd)	lbs 3 *(h)* (calc'd)	lbs3 *(i)* (flow3) (calc'd)	lbs reported Y/EX-21	for modeling *(j)*	vs. Y/EX-21 lbs (+/-)
1970			0.026	**0.026**		8.9	8.9	**8.9**				677	686	**677**	
1Q			0.006	0.006	NA	9.2	9.2	9.2			42	42	41	42	1
2Q			0.033	0.033	NA	7.2	7.2	7.2			181	181	182	181	-1
3Q			0.043	0.043	NA	8.9	8.9	8.9			291	291	296	291	-5
4Q			0.021	0.021	NA	10.2	10.2	10.2			163	163	167	163	-4
1971			0.006	**0.006**			9.0	**9.0**				168	217	**168**	
1Q			0.013	0.013	NA	NA	10.6	10.6			105	105	139	105	-34
2Q			0.003	0.003	NA	NA	10.0	10.0			23	23	24	23	-1
3Q			0.004	0.004	NA	NA	7.7	7.7			23	23	35	23	-12
4Q			0.003	0.003	NA	NA	7.6	7.6			17	17	19	17	-2
1972			0.001	**0.001**	7.7		8.4	**8.4**				20	22	**19**	
1Q			0.001	0.001	11.9	NA	10.3	10.3			9	8	8	9	1
2Q			0.001	0.001	7.3	NA	7.5	7.5			3	3	4	3	-1
3Q			0.001	0.001	5.1	NA	6.9	6.9			3	4	4	3	-1
4Q			0.001	0.001	6.6	NA	9.0	9.0			4	5	6	4	-2
1973			0.065	**0.065**	9.0		8.7	**8.7**				1674	1332	**1680**	
1Q			0.035	0.035	8.6	NA	8.6	8.6			228	229	126	228	102
2Q			0.026	0.026	10.2	NA	9.8	10.2			202	194	154	202	48
3Q			0.200	0.200	8.2	NA	8.2	8.2			1248	1248	1049	1248	199
4Q			0.0005	0.0005	NA	NA	8.0	8.0			3	3	3	3	0
1974			0.015	**0.015**	6.2		6.1	**6.2**				319	250	**329**	
1Q			0.035	0.035	8.4	NA	8.1	8.4			222	216	189	222	33
2Q			0.025	0.025	5.4	NA	5.2	5.4			103	99	56	103	47
3Q			0.0005	0.0005	4.5	NA	4.3	4.5			2	2	2	2	0
4Q			0.0005	0.0005	6.4	NA	6.9	6.4			2	3	3	2	-1
1975			0.001	**0.001**	6.8		7.3	**6.8**				22	23	**21**	
1Q			0.001	0.001	7.0	NA	8.7	7.0			5	7	8	5	-3
2Q			0.001	0.001	7.2	NA	7.2	7.2			5	5	5	5	0
3Q			0.001	0.001	5.8	NA	5.9	5.8			4	4	4	4	0
4Q			0.001	0.001	7.2	NA	7.4	7.2			5	6	6	5	-1
1976			0.001	**0.001**	8.0		8.3	**8.0**				25	26	**24**	
1Q			0.001	0.001	9.4	NA	8.6	9.4			7	7	7	7	0
2Q			0.001	0.001	6.4	NA	7.6	6.4			5	6	6	5	-1
3Q			0.001	0.001	7.6	NA	8.4	7.6			6	6	6	6	0
4Q			0.001	0.001	8.7	NA	8.7	8.7			7	7	7	7	0
1977			0.002	**0.002**	8.6		8.8	**8.6**				47	50	**48**	
1Q			0.001	0.001	5.7	NA	8.0	5.7			4	6	5	4	-1
2Q			0.001	0.001	9.2	NA	9.5	9.2			7	7	9	7	-2
3Q			0.002	0.002	10.2	NA	8.5	10.2			15	13	13	15	2
4Q			0.003	0.003	9.2	NA	9.1	9.2			21	21	23	21	-2
1978			0.001	**0.001**	6.1		7.8	**6.1**				31	37	**21**	
1Q			0.002	0.002	3.3	NA	9.8	3.3			5	15	17	5	-12
2Q			0.001	0.001	7.5	NA	7.5	7.5			6	6	7	6	-1
3Q			0.001	0.001	6.9	NA	6.9	6.9			5	5	7	5	-2
4Q			0.001	0.001	6.8	NA	6.9	6.8			5	5	6	5	-1

Table I-2: Quantities of Mercury Released to Water: Comparison of Three Data Sources and Calculation of Annual Totals (lbs/yr)

YEAR	Comparison of Conc. Sources Conc 1 *(a)* (calc'd) (mg/L)	Conc 2 *(b)* (Qtrly) (mg/L)	Conc 3 *(c)* (Y/EX-21) (mg/L)	Selected CONC (AVG.) *(d)* (mg/L)	Comparison of Flow Rate Sources Flow 1 *(a)* (calc'd) (MGD)	Flow 2 *(b)* (Qtrly) (MGD)	Flow 3 *(c)* (Y/EX-21) (MGD)	Selected FLOW (AVG) *(d,e)* (MGD)	Comparison of lbs - Different Data Sources lbs 1 *(f)* (calc'd)	lbs 2 *(g)* (calc'd)	lbs 3 *(h)* (calc'd)	lbs3 *(i)* (flow3) (calc'd)	lbs reported Y/EX-21	lbs USED for modeling *(j)*	lbs USED vs. Y/EX-21 lbs (+/-)
1979			0.002	**0.002**	7.8		7.7	**7.8**				41	41	**41**	
1Q			0.002	0.002	8.2	NA	8.1	8.2			12	12	12	12	0
2Q			0.001	0.001	7.5	NA	7.5	7.5			6	6	8	6	-2
3Q			0.002	0.002	8.0	NA	7.9	8.0			12	12	10	12	2
4Q			0.002	0.002	7.3	NA	7.3	7.3			11	11	11	11	0
		Conc 2B (b)													
		(Annual)													
1980		<0.002	0.002	**0.002**	8.5		8.5	**8.5**				52	51	**52**	
1Q			0.002	0.002	9.8	NA	9.7	9.8			15	15	17	15	-2
2Q			0.002	0.002	8.4	NA	8.4	8.4			13	13	13	13	0
3Q			0.002	0.002	7.5	NA	7.5	7.5			11	11	9	11	2
4Q			0.002	0.002	8.4	NA	8.4	8.4			13	13	12	13	1
1981		report not found	0.002	**0.002**			7.2	**7.2**				33	34	**33**	
1Q			0.002	0.002	NA	NA	7.5	7.5			11	11	13	11	-2
2Q			0.002	0.002	NA	NA	7.6	7.6			12	12	9	12	3
3Q			0.001	0.001	NA	NA	6.9	6.9			5	5	7	5	-2
4Q			0.001	0.001	NA	NA	6.6	6.6			5	5	5	5	0
1982		0.002	0.003	**0.002**	9.0		8.8	**9.0**				55	53	**63**	
1Q		N=12 at E-1	0.005	0.005	9.3	NA	9.2	9.3			35	35	33	35	2
2Q			0.001	0.001	8.0	NA	8.0	8.0			6	6	7	6	-1
3Q			0.002	0.002	9.1	NA	9.1	9.1			14	14	13	14	1
4Q		0.001		0.001	9.7	NA	NA	9.7		7	NA	NA	NA	7	7
1983		0.002		**0.002**	9.0			**9.0**		55		NA	NA	**55**	55
1Q		N=12 at E-1			9.1	NA	NA	9.1			NA	NA	NA		
2Q					9.3	NA	NA	9.3			NA	NA	NA		
3Q					8.2	NA	NA	8.2			NA	NA	NA		
4Q					9.4	NA	NA	9.4			NA	NA	NA		
1984		0.0016		**0.0016**	9.2			**9.2**		45				**45**	45
1Q		N=12 at E-1			9.9	NA	NA	9.9							
2Q					9.7	NA	NA	9.7							
3Q					8.9	NA	NA	8.9							
4Q					8.4	NA	NA	8.4							
1985		0.0035		**0.0035**	9.6			**9.6**		0				**0**	0
1Q		NPDES limit			8.4	NA	NA	8.4							
2Q		exceeded 9%			9.9	NA	NA	9.9							
3Q		of time at W-35			11.2	NA	NA	11.2							
4Q		NHP outfall 303			9.0	NA	NA	9.0							
1986					9.4			**9.4**		0				**0**	0
1Q		not reported			9.6	NA	NA	9.6							
2Q		NPDES NHP			8.9	NA	NA	8.9							
3Q		outfall 303			9.1	NA	NA	9.1							
4Q		at W-45			10.0	NA	NA	10.0							

Table I-2: Quantities of Mercury Released to Water: Comparison of Three Data Sources and Calculation of Annual Totals (lbs/yr)

	Comparison of Conc. Sources			Selected	Comparison of Flow Rate Sources			Selected	Comparison of lbs - Different Data Sources					lbs USED	lbs USED
YEAR	Conc 1 *(a)* (calc'd) (mg/L)	Conc 2 *(b)* (Qtrly) (mg/L)	Conc 3 *(c)* (Y/EX-21) (mg/L)	CONC (AVG.) *(d)* (mg/L)	Flow 1 *(a)* (calc'd) (MGD)	Flow 2 *(b)* (Qtrly) (MGD)	Flow 3 *(c)* (Y/EX-21) (MGD)	FLOW (AVG) *(d,e)* (MGD)	lbs 1 *(f)* (calc'd)	lbs 2 *(g)* (calc'd)	lbs 3 *(h)* (calc'd)	lbs3 *(i)* (flow3) (calc'd)	lbs reported Y/EX-21	for modeling *(j)*	vs. Y/EX-21 lbs (+/-)
1987		0.0082		**0.0082**	8.2			**8.2**		0				**0**	0
1Q		NHP influent-			10.5	NA	NA	10.5							
2Q		should not use			8.8	NA	NA	8.8							
3Q					7.8	NA	NA	7.8							
4Q					5.6	NA	NA	5.6							
1988		0.0019		**0.0019**	6.8			**6.8**		39				**39**	39
1Q		N=? for 2 months			8.2	NA	NA	8.2							
2Q		at Station #17			7.6	NA	NA	7.6							
3Q					7.3	NA	NA	7.3							
4Q					3.9	NA	NA	3.9							
1989		0.0017		**0.0017**	7.4			**7.4**		38				**38**	38
1Q		N=441 at #17			13.9	NA	NA	13.9							
2Q					6.3	NA	NA	6.3							
3Q					4.5	NA	NA	4.5							
4Q					4.8	NA	NA	4.8							
1990		0.0017		**0.0017**	6.8			**6.8**		35				**35**	35
1Q		N=508 at #17			5.8	NA	NA	5.8							
2Q					7.6	NA	NA	7.6							
3Q					5.5	NA	NA	5.5							
4Q					8.1	NA	NA	8.1							
1991		0.0014		**0.0014**	5.5			**5.5**		24				**24**	24
1Q		N=729 at #17			7.0	NA	NA	7.0							
2Q					5.0	NA	NA	5.0							
3Q					4.2	NA	NA	4.2							
4Q					5.9	NA	NA	5.9							
1992		0.0017		**0.0017**	4.3			**4.3**		22				**22**	22
1Q		N=248 at #17			4.5	NA	NA	4.5							
2Q		EFPC mile 23.4			NA	NA	NA	NA							
3Q					NA	NA	NA	NA							
4Q					4.1	NA	NA	4.1							
1993		0.0016		**0.0016**	5.0			**5.0**		24				**24**	24
1Q		N=203 at #17			5.8	NA	NA	5.8							
2Q					4.5	NA	NA	4.5							
3Q					4.3	NA	NA	4.3							
4Q					5.3	NA	NA	5.3							
1994					6.2			**6.2**		0				**0**	0
1Q					9.4	NA	NA	9.4							
2Q					7.3	NA	NA	7.3							
3Q					4.4	NA	NA	4.4							
4Q					3.8	NA	NA	3.8							
1995					4.2			**4.2**		0				**0**	0
1Q					5.3	NA	NA	5.3							
2Q					4.0	NA	NA	4.0							
3Q					3.1	NA	NA	3.1							
4Q					4.2	NA	NA	4.2							

Table I-2: Quantities of Mercury Released to Water: Comparison of Three Data Sources and Calculation of Annual Totals (lbs/yr)

YEAR	Comparison of Conc. Sources			Selected	Comparison of Flow Rate Sources			Selected	Comparison of lbs - Different Data Sources					lbs USED	lbs USED
	Conc 1 *(a)* (calc'd) (mg/L)	Conc 2 *(b)* (Qtrly) (mg/L)	Conc 3 *(c)* (Y/EX-21) (mg/L)	CONC (AVG.) *(d)* (mg/L)	Flow 1 *(a)* (calc'd) (MGD)	Flow 2 *(b)* (Qtrly) (MGD)	Flow 3 *(c)* (Y/EX-21) (MGD)	FLOW (AVG) *(d,e)* (MGD)	lbs 1 *(f)* (calc'd)	lbs 2 *(g)* (calc'd)	lbs 3 *(h)* (calc'd)	lbs3 *(i)* (flow3) (calc'd)	lbs reported Y/EX-21	for modeling *(j)*	vs. Y/EX-21 lbs (+/-)
1996					6.5			**6.5**		0					
1Q					5.7	NA	NA	5.7							
2Q					5.5	NA	NA	5.5							
3Q					8.3	NA	NA	8.3							
4Q					NA	NA	NA	NA							

		my math &	
	230169	revised nos=	2681
Y/EX-21	+8775	new data=	38908
Total lbs	**238944**	addtnl lbs=	41589
		TOTAL lbs=	**280533**

Notes:

MGD = Millions of gallons per day
NA = Average not reported, or not calculated because data were missing

(a) *Source:* Conc 1/Flow 1= Values are calculated based on average weekly concentrations reported in Y-12 Monthly Surface Water Sampling Reports (1954-64), Technical Div Monthly Progress Reports (1955-58), original flow charts and tables (1972-85), or USGS data (1986-96). Weekly numbers are averaged into monthly and quarterly totals.

(b) *Source:* Conc 2/Flow 2= Values are quarterly averages reported in Y-12 Quarterly Reports (1953-62 for conc., 1955-70 for flow). Quarterly averages reported in these documents are compared with calculated from the monthly reports. Beginning in 1980, these values are annual averages from the Site-wide environmental monitoring reports. These values were checked against the original source.

(c) *Souce:* Conc 3/Flow 3= Values are quarterly averages reported in Y/EX-21/del rev 1983. The source of the data referenced in this document is unavailable. These values are compared with those calculated from monthly reports and those reported in quarterly reports.

(d) Calculated quarterly values (Conc 1) are used to calculate annual avgs if data for all weeks/month are available. For quarters with missing data, Y/EX-21/del rev values are used to calculate annual lbs of mercury released.

(e) In the absence of other data, 11 MGD is used as an estimate of the quarterly average flow rate during the 1950's

(f) "lbs 1" = Conc. 1 x "Selected flow"

(g) "lbs 2" = Conc. 2 x "Selected flow"

(h) "lbs 3" = Conc. 3 x "Selected flow"

(i) "lbs 3" based on "flow 3" = Conc. 3 x Flow 3 (Y/EX-21 numbers)

(j) lbs used for modeling = "Selected" conc. x "Selected" flow value

Table I-3: Tabulation of Concentration, Flow Rate, and pH Data and Calculation of Quarterly Averages

	Mercury Water Concentration (mg/L)						Flow Rate (M gal)						pH			
	Calculated (Source #1,4)				Source #2,3	Source #5	Calculated (Source #4)				Source #2,3	Source #5	Calculated (Source #4)			Source #2,3
	rpt'd	calc'd avg	rpt'd	calc'd avg	rpt'd	rpt'd	rpt'd	calc'd avg	rpt'd	calc'd avg	rpt'd	rpt'd	calc'd avg	calc'd avg	calc'd avg	rpt'd
Month	weekly (#4)	mthly	mthly (#1,4)	qrtly	qrtly	quarterly	weekly	mthly	mthly	qrtly	qrtly	qrtly	weekly (a)	mthly	qrtly	qrtly
Apr-53																
May-53																
Jun-53																
					0.13	--										
Jul-53																
Aug-53																
Sep-53																8.2
					0.21	--										
Oct-53																
Nov-53																
Dec-53																
					1.07	--										
Jan-54																

Table I-3: Tabulation of Concentration, Flow Rate, and pH Data and Calculation of Quarterly Averages

	Mercury Water Concentration (mg/L)						Flow Rate (M gal)						pH			
	Calculated (Source #1,4)				Source #2,3	Source #5	Calculated (Source #4)				Source #2,3	Source #5	Calculated (Source #4)			Source #2,3
	rpt'd	calc'd avg	rpt'd	calc'd avg	rpt'd	rpt'd	rpt'd	calc'd avg	rpt'd	calc'd avg	rpt'd	rpt'd	calc'd avg	calc'd avg	calc'd avg	rpt'd
Month	weekly (#4)	mthly	mthly (#1,4)	qrtly	qrtly	quarterly	weekly	mthly	mthly	qrtly	qrtly	qrtly	weekly (a)	mthly	qrtly	qrtly
Feb-54																
Mar-54																
					0.2	--										
Apr-54																
			0.28													
May-54	0.14															
	0.10															
	0.06															
	0.09	0.10	0.10													
Jun-54	0.44															
	0.24															
	0.07															
	0.17	0.23	0.23	0.20	0.2	--										
Jul-54	0.23															
		0.23	0.23													
Aug-54																
	0.17															
	0.11															
		0.14	0.13													
Sep-54	0.15															
	1.57															
	0.28															
	0.15	0.54	0.54	0.30	0.32	--										
Oct-54	0.40															
	0.25															
	0.14															
	0.22										8.3					
		0.25	0.25													
Nov-54																
			0.191													

Table I-3: Tabulation of Concentration, Flow Rate, and pH Data and Calculation of Quarterly Averages

	Mercury Water Concentration (mg/L)						Flow Rate (M gal)						pH			
	Calculated (Source #1,4)				Source #2,3	Source #5	Calculated (Source #4)				Source #2,3	Source #5	Calculated (Source #4)			Source #2,3
	rpt'd	calc'd avg	rpt'd	calc'd avg	rpt'd	rpt'd	rpt'd	calc'd avg	rpt'd	calc'd avg	rpt'd	rpt'd	calc'd avg	calc'd avg	calc'd avg	rpt'd
Month	weekly (#4)	mthly	mthly (#1,4)	qrtly	qrtly	quarterly	weekly	mthly	mthly	qrtly	qrtly	qrtly	weekly (a)	mthly	qrtly	qrtly
Dec-54																
			0.14	0.19	0.18	--					8.3	--				
Jan-55																
			0.15													
Feb-55																
			0.59													
Mar-55																
	0.42															
	1.95	1.19	1.09	0.61	0.61	--										
Apr-55	0.85															
	1.37	1.11														
			1.48													
May-55																
			1.98						10.45							
Jun-55																
							11.11						9.6			
							12.31						10.6			
							10.85						11.1			
			1.93	1.80	1.81	--	11.4	11.4	11.46	11.4	11.0	--	10.3	10.4	--	10.6
Jul-55							11.697						9.9			
							11.485						9.8			
							11.454						8.6			
							11.262						10.7			
		1.06	1.06				10.807	11.3	11.3				10.5	9.9		
Aug-55							11.474						9.9			
							10.919						9.8			
							11.649						10.6			
							12.273						10.0			
		1.05	1.05				11.454	11.6	11.62				10.5	10.2		

Table I-3: Tabulation of Concentration, Flow Rate, and pH Data and Calculation of Quarterly Averages

	Mercury Water Concentration (mg/L)						Flow Rate (M gal)						pH			
	Calculated (Source #1,4)				Source #2,3	Source #5	Calculated (Source #4)				Source #2,3	Source #5	Calculated (Source #4)			Source #2,3
	rpt'd	calc'd avg	rpt'd	calc'd avg	rpt'd	rpt'd	rpt'd	calc'd avg	rpt'd	calc'd avg	rpt'd	rpt'd	calc'd avg	calc'd avg	calc'd avg	rpt'd
Month	weekly (#4)	mthly	mthly (#1,4)	qrtly	qrtly	quarterly	weekly	mthly	mthly	qrtly	qrtly	qrtly	weekly (a)	mthly	qrtly	qrtly
Sep-55	1.16						11.284						10.1			
	1.89						11.519						10.7			
	1.07						12.056						10.7			
	0.84	1.24	1.28	1.12	1.13	--	12.446	11.8	11.7	11.6	11.6	--	10.9	10.6	10.2	10.0
Oct-55	0.44						12.074						9.0			
	0.33						10.914						8.7			
	0.73												9.5			
	1.08	0.65	0.64				11.393	11.5	11.4				9.9	9.3		
Nov-55	0.74						11.505						9.5			
	0.71						11.861						9.0			
	0.79						9.690						9.5			
	0.96						10.775						9.2			
	0.63	0.77	0.77				10.898	10.9					10.4	9.5		
Dec-55	0.23						9.968						9.4			
	0.40						10.669						8.7			
	0.57						9.992						9.6			
	1.48	0.67	0.67	0.70	0.7	0.709	10.622	10.9		10.9	10.8	10.8	9.4	9.3	9.4	9.4
Jan-56	0.38						10.122						9.4			
	0.43						10.526						9.2			
	0.32						10.698						9.2			
	0.36	0.37	0.37				11.951	10.3					9.2	9.3		
Feb-56	0.10						14.309						9.3			
	0.27						12.057						9.4			
	0.18						12.361						9.0			
	0.34	0.22	0.22				11.968	12.7					7.7	8.9		
Mar-56	0.40						11.822				11.7	11.7	9.3			
	0.46						11.266						7.3			
	0.10												9.2			
	0.78												9.5			
	0.55	0.46	0.46	0.36	0.37	0.359		11.5		11.7			10.2	9.1	9.1	8.7
Apr-56	0.44						13.603						8.5			
	0.32						12.819						7.6			
	0.55						11.445						7.4			
	0.55	0.47	0.47				10.644	12.1					7.1	7.7		
May-56	0.74						10.985						10.4			
	0.70						10.715						9.9			
	0.42						10.170						9.4			
	0.58	0.61	0.61				10.265	10.5					9.0	9.7		

Table I-3: Tabulation of Concentration, Flow Rate, and pH Data and Calculation of Quarterly Averages

	Mercury Water Concentration (mg/L)						Flow Rate (M gal)						pH			
	Calculated (Source #1,4)				Source #2,3	Source #5	Calculated (Source #4)				Source #2,3	Source #5	Calculated (Source #4)			Source #2,3
	rpt'd	calc'd avg	rpt'd	calc'd avg	rpt'd	rpt'd	rpt'd	calc'd avg	rpt'd	calc'd avg	rpt'd	rpt'd	calc'd avg	calc'd avg	calc'd avg	rpt'd
Month	weekly (#4)	mthly	mthly (#1,4)	qrtly	qrtly	quarterly	weekly	mthly	mthly	qrtly	qrtly	qrtly	weekly (a)	mthly	qrtly	qrtly
Jun-56	1.03						11.095				11.3	11.3	9.2			
	1.31						10.261						9.0			
	0.37						11.497						9.2			
	0.89						11.128						9.4			
	0.45	0.81	0.81	0.64	0.66	0.642	11.087	11.0		11.2			9.1	9.2	8.8	8.8
Jul-56	1.17						10.681						9.1			
	0.56						10.489						8.6			
	0.96						10.748						8.4			
	1.32	1.00	1.00				10.318	10.6					8.4	8.6		
Aug-56	1.17						10.3						8.9			
	0.67						10.9						8.5			
	1.19						11.2						9.2			
	2.31						11.2						8.9			
	3.06	1.68	1.70				11.1	11.1					8.9	8.9		
Sep-56	3.60						10.2				10.8	10.8	8.6			
	0.80						11.2						8.7			
	0.80						11.4						8.3			
	1.40	1.65	1.65	1.46	1.53	1.654	11.4	11.1		10.9			8.4	8.5	8.7	8.8
Oct-56	0.50						11.2						8.2			
	1.30						11.8						8.7			
	1.10						11.4						8.4			
	0.48						11.3						9.0			
	0.94	0.86	0.86				11.6	11.5					9.1	8.7		
Nov-56	0.94						11.6						8.5			
	0.78						11.7						8.8			
	2.00						11.7						8.8			
	1.50						11.7						8.5			
	1.10	1.26	1.26				11.4	11.6					8.6	8.6		
Dec-56	0.74												8.9			
	0.87												8.8			
	0.71												8.3			
	1.20	0.88	0.7	1.01	1.26	0.956				11.5	11.9	11.9	8.2	8.6	8.6	8.7
Jan-57	1.70												8.5			
	0.51												8.9			
	1.70												9.1			
	1.17												8.5			
	1.20	1.26	1.2				16.4	16.4					8.3	8.7		
Feb-57	2.60						13.7						8.2			
	1.90						11.2						8.4			
	1.70						11.0						8.6			
	1.40	1.90	2.0				11.8	11.9					8.4	8.4		

Table I-3: Tabulation of Concentration, Flow Rate, and pH Data and Calculation of Quarterly Averages

	Mercury Water Concentration (mg/L)						Flow Rate (M gal)						pH			
	Calculated (Source #1,4)				Source #2,3	Source #5	Calculated (Source #4)				Source #2,3	Source #5	Calculated (Source #4)			Source #2,3
	rpt'd	calc'd avg	rpt'd	calc'd avg	rpt'd	rpt'd	rpt'd	calc'd avg	rpt'd	calc'd avg	rpt'd	rpt'd	calc'd avg	calc'd avg	calc'd avg	rpt'd
Month	weekly (#4)	mthly	mthly (#1,4)	qrtly	qrtly	quarterly	weekly	mthly	mthly	qrtly	qrtly	qrtly	weekly (a)	mthly	qrtly	qrtly
Mar-57	2.30						11.6						9.2			
	1.70						10.6						9.4			
	1.30						10.5						9.2			
	1.74	1.76	1.7	1.61	1.54	1.609	10.3	10.8		13.0		13.2	8.8	9.2	8.7	8.6
Apr-57	2.54						12.0						9.2			
	2.20						11.9						9.7			
	4.03						10.1						8.9			
	2.00						10.2						8.5			
	3.20	2.79	2.5				10.4	10.9					6.9	8.6		
May-57	0.92						9.7						8.6			
	3.20						10.6						8.9			
	3.80						11.4						8.1			
	1.20						9.5	10.3					8.1			
		2.28	2.25										8.6	8.5		
Jun-57	1.60						10.7						8.2			
	4.12						10.2						9.0			
	1.50						10.3						8.8			
	2.10	2.33	2.5	2.49	2.4	2.422	10.1	10.3		10.5		10.6	8.5	8.6	8.6	8.8
Jul-57	3.40						9.8						9.2			
	1.70						10.1						8.7			
	7.20						9.9						8.7			
	3.80	4.03	?				10.1	10.0					8.9	8.9		
Aug-57	4.40						9.9						8.3			
	5.00						9.5						9.5			
	5.20						9.0						10.5			
	1.50						9.5						9.4			
	0.70	3.36	4.0				9.2	9.4					9.0	9.3		
Sep-57	1.60						9.0						9.0			
	2.00						8.8						8.8			
	1.40						10.4						8.8			
	1.40	1.60	2.0	3.02	3.1	3.015	8.7	9.2		9.5		9.5	7.8	8.6	8.9	9.0
Oct-57	0.53						10.5						8.1			
	1.00						8.1						8.4			
	2.30						8.2						8.7			
	1.30	1.28	1.4				8.5	8.8					8.8	8.5		
Nov-57	1.60						8.5						8.6			
	2.80						8.9						8.2			
	3.40						17.3						8.3			
	1.24						14.0						7.9			
	1.10	2.03	2.2				10.9	11.9					8.2	8.2		

Table I-3: Tabulation of Concentration, Flow Rate, and pH Data and Calculation of Quarterly Averages

	Mercury Water Concentration (mg/L)						Flow Rate (M gal)						pH			
	Calculated (Source #1,4)				Source #2,3	Source #5	Calculated (Source #4)				Source #2,3	Source #5	Calculated (Source #4)			Source #2,3
	rpt'd	calc'd avg	rpt'd	calc'd avg	rpt'd	rpt'd	rpt'd	calc'd avg	rpt'd	calc'd avg	rpt'd	rpt'd	calc'd avg	calc'd avg	calc'd avg	rpt'd
Month	weekly (#4)	mthly	mthly (#1,4)	qrtly	qrtly	quarterly	weekly	mthly	mthly	qrtly	qrtly	qrtly	weekly (a)	mthly	qrtly	qrtly
Dec-57	1.40						13.5						8.6			
	2.80						11.0						8.3			
	1.70						11.2						8.1			
	2.30	2.05	2.1	1.81	1.8	1.805	9.9	11.4		10.7		10.8	8.2	8.3	8.3	8.3
Jan-58	1.20						9.2						8.9			
	3.10						9.3						9.6			
	2.90						9.6						9.0			
	3.40						10.1						8.6			
	10.70	4.26	4.2				9.5	9.5					8.2	8.9		
Feb-58	3.40						10.1						8.8			
	3.70						9.2						8.4			
							8.9						8.1			
	3.20	3.43	3.6				9.9	9.5					8.4	8.4		
Mar-58	2.10						9.6						8.7			
	3.00						9.8						8.1			
	5.80						9.8						8.5			
	1.30	3.05	2.6	3.65	3.6	3.65	9.7	9.7		9.6		9.6	8.0	8.3	8.5	8.6
Apr-58	4.10						9.5						8.6			
	1.50						9.8						8.7			
	3.90						9.4						8.4			
	1.20	2.68	2.6				12.0	10.2					8.6	8.6		
May-58	2.60						11.2						9.0			
	14.50						10.2						8.7			
	2.10						8.8						8.4			
	2.00						8.9						8.6			
	2.00	4.64	4.5				8.3	9.5					8.7	8.7		
Jun-58	0.90						8.4						9.2			
	1.40						8.4						8.8			
	1.30						9.0						8.8			
	2.30	1.48	1.5	3.06	3.1	3.062	8.0	8.5		9.4		9.4	8.7	8.9	8.7	8.7
Jul-58	2.40						7.5						8.7			
	1.30						8.2						9.1			
	2.00						9.1						9.5			
	1.20	1.73	1.7				8.4	8.3					8.8	9.0		
Aug-58	0.90						8.7						8.8			
	1.00						7.7						8.3			
	0.80						8.0						8.5			
	1.70						7.9						8.4			
	1.40	1.16	1.25				7.6	8.0					8.3	8.5		

Table I-3: Tabulation of Concentration, Flow Rate, and pH Data and Calculation of Quarterly Averages

	Mercury Water Concentration (mg/L)						Flow Rate (M gal)						pH			
	Calculated (Source #1,4)				Source #2,3	Source #5	Calculated (Source #4)				Source #2,3	Source #5	Calculated (Source #4)			Source #2,3
	rpt'd	calc'd avg	rpt'd	calc'd avg	rpt'd	rpt'd	rpt'd	calc'd avg	rpt'd	calc'd avg	rpt'd	rpt'd	calc'd avg	calc'd avg	calc'd avg	rpt'd
Month	weekly (#4)	mthly	mthly (#1,4)	qrtly	qrtly	quarterly	weekly	mthly	mthly	qrtly	qrtly	qrtly	weekly (a)	mthly	qrtly	qrtly
Sep-58	1.30						7.5						8.5			
	1.00						7.5						8.5			
	0.60						8.0						8.1			
	0.60	0.88	0.95	1.25	1.3	1.246	7.4	7.6		8.0		8.3	8.0	8.3	8.6	8.6
Oct-58	6.00						7.9						8.2			
	0.49						7.8						9.2			
	0.90						8.0						8.6			
	1.67						7.4						9.2			
	0.91	1.99	1.3				7.6	7.7					8.7	8.8		
Nov-58	0.75						7.6						8.3			
	0.60						7.9						8.3			
	0.60						7.5						8.0			
	1.30	0.81	0.75				9.4	8.1					8.6	8.3		
Dec-58	1.20						7.6						8.4			
	1.00						7.4						8.0			
	2.40						7.5						8.3			
	0.60						8.4						7.9			
	0.70	1.18	1.3	1.37	1.4	1.417	7.7	7.7		7.9		7.8	8.6	8.2	8.4	8.5
Jan-59	1.30						7.6						7.6			
	0.70						7.7						8.6			
	0.80						10.6						9.8			
	1.30	1.03					7.3	8.3					8.7	8.7		
Feb-59	1.60						7.8						9.1			
	1.00						10.4						9.0			
	0.70						7.7						8.6			
		1.10					7.7	8.4					8.3	8.8		
Mar-59	0.68						7.6						8.3			
	0.90						8.2						8.1			
	1.50						8.9						8.5			
	0.70	0.95		1.02	1.0	0.99	10.4	8.8		8.5		8.4	8.5	8.4	8.6	8.6
Apr-59	0.90						8.1						8.3			
	0.70						9.3						8.3			
	1.20						13.3						8.3			
	1.10	0.98					10.2	10.2					7.9	8.2		
May-59	1.50						9.1						8.0			
	1.10						9.1						9.0			
	0.50						9.5						9.1			
	0.30						8.9						9.4			
	0.70	0.82					10.7	9.5					8.2	8.7		
Jun-59	0.40						10.1						8.4			
	0.30						9.6						8.6			
	0.50						8.8						8.5			
	0.40	0.40		0.74	0.7	0.738	10.1	9.6		9.8		9.7	8.4	8.5	8.5	8.5

Table I-3: Tabulation of Concentration, Flow Rate, and pH Data and Calculation of Quarterly Averages

	Mercury Water Concentration (mg/L)						Flow Rate (M gal)						pH			
	Calculated (Source #1,4)				Source #2,3	Source #5	Calculated (Source #4)				Source #2,3	Source #5	Calculated (Source #4)			Source #2,3
	rpt'd	calc'd avg	rpt'd	calc'd avg	rpt'd	rpt'd	rpt'd	calc'd avg	rpt'd	calc'd avg	rpt'd	rpt'd	calc'd avg	calc'd avg	calc'd avg	rpt'd
Month	weekly (#4)	mthly	mthly (#1,4)	qrtly	qrtly	quarterly	weekly	mthly	mthly	qrtly	qrtly	qrtly	weekly (a)	mthly	qrtly	qrtly
Jul-59	1.50						9.8						8.5			
	1.40						8.9						8.6			
	0.90						9.2						8.4			
	0.60						9.2						8.7			
	0.40	0.96					9.2	9.3					8.7	8.6		
Aug-59	0.60						13.0						8.3			
	1.70						9.3						8.2			
	0.30						9.2						8.1			
	0.20	0.70					9.6	10.3					8.5	8.3		
Sep-59	0.20						9.4						9.5			
	0.10						8.8						9.0			
	1.70						8.7						8.9			
	0.20	0.55		0.75	0.6	0.738	9.1	9.0		9.5		9.4	8.7	9.0	8.6	8.6
Oct-59	0.24						8.7						9.1			
	0.22						9.1						9.1			
	0.21						9.6						8.2			
	0.19						9.5						8.0			
	0.24	0.22					9.9	9.3					8.2	8.5		
Nov-59	0.30						9.7						8.3			
	0.09						9.6						8.2			
	0.10						10.0						8.0			
	0.30	0.20					13.8	10.8					6.1	7.7		
Dec-59	0.33						10.9						8.1			
	0.13						11.1						8.3			
	0.14						14.4						8.0			
	0.19						10.2						8.0			
	0.08	0.17		0.20	0.2	0.197	11.1	11.5		10.6		10.5	8.1	8.1	8.1	8.1
Jan-60	0.18						12.1									
	0.04						9.7									
	0.16						9.7									
	0.24	0.16					9.6	10.3								
Feb-60	0.09						9.8									
	0.17						10.8									
	0.18						12.2									
	0.14	0.15					9.9	10.7								
Mar-60	0.05						11.5									8.1
							10.8									
	0.51						11.1									
	0.29						9.2									
	0.23	0.27		0.19	0.2	0.186	12.3	11.0		10.6		10.7				
Apr-60	0.24						9.5									
	0.34						9.0									
	0.13						9.6									
	0.23	0.24					9.6	9.4								

Table I-3: Tabulation of Concentration, Flow Rate, and pH Data and Calculation of Quarterly Averages

	Mercury Water Concentration (mg/L)						Flow Rate (M gal)						pH			
	Calculated (Source #1,4)				Source #2,3	Source #5	Calculated (Source #4)				Source #2,3	Source #5	Calculated (Source #4)			Source #2,3
	rpt'd	calc'd avg	rpt'd	calc'd avg	rpt'd	rpt'd	rpt'd	calc'd avg	rpt'd	calc'd avg	rpt'd	rpt'd	calc'd avg	calc'd avg	calc'd avg	rpt'd
Month	weekly (#4)	mthly	mthly (#1,4)	qrtly	qrtly	quarterly	weekly	mthly	mthly	qrtly	qrtly	qrtly	weekly (a)	mthly	qrtly	qrtly
May-60	0.16						9.5									
	0.12						9.9									
	0.18						9.7									
	0.12	0.15					9.9	9.8								
Jun-60	0.21						8.8									8.8
	0.19						12.3									
	0.25						10.9									
	0.27						13.0									
	0.12	0.21		0.20	0.2	0.198	10.3	11.0		10.1		9.8				
Jul-60	0.15						9.8									
	0.16						10.3									
	1.99						9.0									
	0.14	0.61					9.2	9.6								
Aug-60	0.23						10.0									
	0.18						10.7									
	0.16						7.7									
	0.09						7.3									
	0.14	0.16					7.6	8.7								
Sep-60	0.12						9.5									8.8
	0.14						8.4									
	0.33						7.7									
	0.85	0.36		0.36	0.2	0.33	8.1	8.4		8.9		8.9				
Oct-60	0.22						9.1									
	0.27						8.3									
	0.15						9.1									
	0.40	0.26					8.0	8.6								
Nov-60	0.19						8.4									
	0.27						9.6									
	0.61						8.1									
							7.5									
	0.03	0.28					9.3	8.6								
Dec-60																8.4
				0.27	0.4	0.216				8.6		8.9				
Jan-61							9.4									
	0.05						9.0									
	0.20						9.1									
		0.13						9.2								

Table I-3: Tabulation of Concentration, Flow Rate, and pH Data and Calculation of Quarterly Averages

	Mercury Water Concentration (mg/L)						Flow Rate (M gal)						pH			
	Calculated (Source #1,4)				Source #2,3	Source #5	Calculated (Source #4)				Source #2,3	Source #5	Calculated (Source #4)			Source #2,3
	rpt'd	calc'd avg	rpt'd	calc'd avg	rpt'd	rpt'd	rpt'd	calc'd avg	rpt'd	calc'd avg	rpt'd	rpt'd	calc'd avg	calc'd avg	calc'd avg	rpt'd
Month	weekly (#4)	mthly	mthly (#1,4)	qrtly	qrtly	quarterly	weekly	mthly	mthly	qrtly	qrtly	qrtly	weekly (a)	mthly	qrtly	qrtly
Feb-61	0.07						8.9									
	0.16						10.1									
	0.28						9.1									
	0.04	0.14					17.6	11.4								
Mar-61	0.16						11.1									8.3
	0.10						12.9									
	0.09						9.7									
	1.80	0.54		0.30	0.1	0.133	8.8	10.7		10.4		9.5				
Apr-61																
	0.20															
	0.15															
	0.10	0.15														
May-61	0.12															
	0.10															
	0.09															
	0.07	0.10														
Jun-61	0.06															8.4
	0.09															
	0.07															
	0.08	0.08		0.10	0.1	0.103						10.8				
Jul-61	0.26															
	0.68															
	0.05															
	0.16	0.29														
Aug-61	0.36															
	0.08															
	0.17															
	0.33															
	0.51	0.29														
Sep-61	0.42						9.7									9.0
	0.10						11.9									
	0.18						10.3									
	0.29	0.25		0.28	0.28	0.23	9.3	10.3		10.3		10.9				
Oct-61																
Nov-61	0.10						10.9									
	0.15						10.7									
	0.13						12.2									
	0.10						10.9									
	0.09	0.11					11.0	11.1								
Dec-61																9.3
				0.11	0.12	0.118				11.1		11.7				

Table I-3: Tabulation of Concentration, Flow Rate, and pH Data and Calculation of Quarterly Averages

	Mercury Water Concentration (mg/L)						Flow Rate (M gal)						pH			
	Calculated (Source #1,4)				Source #2,3	Source #5	Calculated (Source #4)				Source #2,3	Source #5	Calculated (Source #4)			Source #2,3
	rpt'd	calc'd avg	rpt'd	calc'd avg	rpt'd	rpt'd	rpt'd	calc'd avg	rpt'd	calc'd avg	rpt'd	rpt'd	calc'd avg	calc'd avg	calc'd avg	rpt'd
Month	weekly (#4)	mthly	mthly (#1,4)	qrtly	qrtly	quarterly	weekly	mthly	mthly	qrtly	qrtly	qrtly	weekly (a)	mthly	qrtly	qrtly
Jan-62	0.07						12.0									
	0.06						12.2									
	0.15						11.4									
	0.20						14.8									
	0.20	0.14					11.3	12.3								
Feb-62	0.28						11.0									
	0.34						10.2									
	0.16						16.3									
	0.06	0.21					15.7	13.3								
Mar-62	0.26						13.9									9.0
	0.21						12.3									
	0.13						16.5									
	0.20	0.20		0.18	0.17	0.205	13.4	14.0		13.2		13.2				
Apr-62	0.16						12.4									
	0.12						15.7									
							10.8									
	0.16	0.15					12.1	12.8								
May-62	0.10						12.5									
	0.27						11.9									
	0.04						12.7									
	0.01						13.7									
	0.01	0.09					13.5	12.9								
Jun-62	0.06						14.2									9.6
	0.01						16.0									
	0.05						12.4									
	0.02	0.04		0.08	0.11	0.084	12.8	13.9		13.2		13.4				
Jul-62																
Aug-62	0.02						13.1									
	0.01						12.1									
	0.01						11.3									
	0.01						11.1									
	0.01	0.01					10.9									
Sep-62																9.3
				0.01	0.16	0.021						12.4				
Oct-62	0.06						11.8									
	0.03						10.6									
	0.04						10.1									
	0.03						10.0									
	0.06	0.04					10.1	10.5								
Nov-62																

Table I-3: Tabulation of Concentration, Flow Rate, and pH Data and Calculation of Quarterly Averages

	Mercury Water Concentration (mg/L)						Flow Rate (M gal)						pH			
	Calculated (Source #1,4)				Source #2,3	Source #5	Calculated (Source #4)				Source #2,3	Source #5	Calculated (Source #4)			Source #2,3
	rpt'd	calc'd avg	rpt'd	calc'd avg	rpt'd	rpt'd	rpt'd	calc'd avg	rpt'd	calc'd avg	rpt'd	rpt'd	calc'd avg	calc'd avg	calc'd avg	rpt'd
Month	weekly (#4)	mthly	mthly (#1,4)	qrtly	qrtly	quarterly	weekly	mthly	mthly	qrtly	qrtly	qrtly	weekly (a)	mthly	qrtly	qrtly
Dec-62																8.6
				0.04	0.07	0.21				10.5		11.1				
Jan-63							NA									
	0.09						NA									
	0.03						NA									
							NA									
		0.06					NA	NA								
Feb-63	0.03						13.0									
	0.015						13.9									
	0.045						13.2									
	0.06	0.04					15.5	13.9								
Mar-63	0.09						NA									8.4
	0.05						15.5									
	0.14						15.6									
	0.16	0.11		0.07	"low"	0.016	14.1	15.1		14.5		14.1				
Apr-63	0.03						13.9									
	0.08						3.6									
							NA									
	0.03	0.05					13.3	10.3								
May-63	0.126						16.3									
	0.358						12.3									
	0.943						13.0									
	0.016						12.9									
	0.007	0.29					NA	13.6								
Jun-63	0.30						13.1									
	0.79						13.6									
	0.012						13.2									
	0.015	0.28		0.23			NA	13.3								
Jul-63	0.008						15.5									
	0.004						11.3									
	0.010						13.2									
	0.007	0.007					11.0	12.7								
Aug-63	0.003						10.5									
	0.008						10.8									
	0.008						7.8									
	0.008	0.007					9.8	9.7								
Sep-63	0.043						8.3									
	0.043						7.1									
	0.030						8.3									
	0.022	0.035		0.016			8.9	8.1								
Oct-63	0.015						7.8									
	0.014						7.5									
	0.007						7.0									
		0.012					NA	7.4								

Table I-3: Tabulation of Concentration, Flow Rate, and pH Data and Calculation of Quarterly Averages

	Mercury Water Concentration (mg/L)						Flow Rate (M gal)						pH			
	Calculated (Source #1,4)				Source #2,3	Source #5	Calculated (Source #4)				Source #2,3	Source #5	Calculated (Source #4)			Source #2,3
	rpt'd	calc'd avg	rpt'd	calc'd avg	rpt'd	rpt'd	rpt'd	calc'd avg	rpt'd	calc'd avg	rpt'd	rpt'd	calc'd avg	calc'd avg	calc'd avg	rpt'd
Month	weekly (#4)	mthly	mthly (#1,4)	qrtly	qrtly	quarterly	weekly	mthly	mthly	qrtly	qrtly	qrtly	weekly (a)	mthly	qrtly	qrtly
Nov-63	0.054						7.3									
	0.014						7.4									
	0.014						8.0									
	0.023	0.026					9.2	8.0								
Dec-63							8.2									
	0.060						7.0									
							6.7									
	0.008	0.034		0.023			11.3	8.3								
Jan-64	0.330						10.9									
	0.010						9.6									
							7.8									
	0.026						9.5									
	0.034	0.100					8.4	9.2								
Feb-64	0.310						9.2									
	0.027						11.7									
	0.032						9.3									
	0.100	0.117					10.4	10.1								
Mar-64	0.000						7.8									
	0.000						11.8									
	0.010						11.0									
	0.010	0.005		0.074			8.6	9.8								
Apr-64	0.000						11.9									
	0.050						9.9									
	0.050						8.0									
	0.013	0.028					15.8	11.4								
May-64	0.021						9.3									
	0.000						7.8									
	0.013						7.9									
	0.008						9.5									
	0.050	0.018					9.4	8.8								
Jun-64																
	0.027		0.027	0.023					8.7							
Jul-64																
			0						8.5							

Notes

MGD = Millions of gallons per day

a Weekly values hand-calculated from daily values (not shown)

Source 1: Technical Division Monthly Progress Reports (1954-1964) and Y-12 Monthly Surface Water Sampling Reports

Source 2: Y-12 Quarterly Reports

Source 3: Y/HG-437 (3Q54 to 4Q56 only)

Source 4: Y/HG-0055/1,-0077, -0079, ChR2-0185 and M-840 (EFPC conc and flow rate letter reports; see listings in Appendix D and E)

Source 5: Y/EX-21 del rev

Table I-4: Comparison of Fee and Sanders (1982) Data with Data from Monthly Surface Water Sampling Reports (1953-64) [(a)]

YEAR	Quarter	Monthly SW Sampling Report Conc. (mg/L)	Y/EX-21 Conc. (source given as Fee and Sanders, 1982) (mg/L)	Conc. from Fee and Sanders (1982) (math corrected)
1953	2Q	**0.13**	NR	
1953	3Q	**0.21**	NR	
1953	4Q	**1.07**	NR	
1954	1Q	**0.20**	NR	
1954	2Q	**0.20**	NR	
1954	3Q	**0.30**	NR	
1954	4Q	**0.19**	NR	
1955	1Q	**0.61**	NR	
1955	2Q	**1.80**	NR	
1955	3Q	**1.12**	NR	
1955	4Q	**0.70**	0.709	
1956	1Q	0.36	**0.359**	
1956	2Q	0.64	**0.642**	
1956	3Q	**1.46**	1.654	
1956	4Q	1.01	**0.956**	
1957	1Q	1.61	**1.609**	
1957	2Q	2.49	**2.422**	
1957	3Q	3.02	**3.015**	
1957	4Q	1.81	**1.805**	
1958	1Q	3.65	**3.650**	
1958	2Q	3.06	**3.062**	
1958	3Q	1.25	**1.246**	
1958	4Q	**1.37**	1.417	
1959	1Q	**1.02**	0.990	
1959	2Q	0.74	**0.738**	
1959	3Q	**0.75**	0.738	
1959	4Q	0.20	**0.197**	
1960	1Q	**0.19**	0.186	
1960	2Q	**0.20**	0.198	
1960	3Q	**0.36**	0.330	
1960	4Q	0.40	**0.216**	
1961	1Q	**0.30**	0.133	
1961	2Q	0.10	**0.103**	
1961	3Q	**0.28**	0.230	
1961	4Q	0.12	**0.118**	
1962	1Q	**0.18**	0.205	
1962	2Q	0.08	**0.084**	
1962	3Q	0.16	**0.021**	
1962	4Q	0.07	**0.210**	
1963	1Q	**0.07**	0.016	
1963	2Q	**0.23**	0.040	
1963	3Q	**0.02**	0.032	
1963	4Q	**0.023**	0.025	
1964	1Q	**0.07**	0.084	
1964	2Q	**0.02**	0.024	
1964	3Q	NA	**0.039**	
1964	4Q	NA	**0.037**	

Table I-4: Comparison of Fee and Sanders (1982) Data with Data from Monthly Surface Water Sampling Reports (1953-64) [(a)]

YEAR	Quarter	Monthly SW Sampling Report Conc. (mg/L)	Y/EX-21 Conc. (source given as Fee and Sanders, 1982) (mg/L)	Conc. from Fee and Sanders (1982) (math corrected)
1965	1Q	NA	**0.050**	
1965	2Q	NA	**0.231**	
1965	3Q	NA	**0.050**	
1965	4Q	NA	**0.050**	
1966	1Q	NA	**0.050**	
1966	2Q	NA	0.040	**0.054**
1966	3Q	NA	0.028	**0.036**
1966	4Q	NA	**0.030**	
1967	1Q	NA	**0.042**	
1967	2Q	NA	**0.049**	
1967	3Q	NA	**0.026**	
1967	4Q	NA	**0.005**	
1968	1Q	NA	**0.005**	
1968	2Q	NA	**0.005**	
1968	3Q	NA	**0.004**	
1968	4Q	NA	**0.004**	
1969	1Q	NA	**0.005**	
1969	2Q	NA	**0.006**	
1969	3Q	NA	**0.006**	
1969	4Q	NA	**0.008**	
1970	1Q	NA	**0.006**	
1970	2Q	NA	**0.033**	
1970	3Q	NA	**0.043**	
1970	4Q	NA	**0.021**	
1971	1Q	NA	0.017	**0.013**
1971	2Q	NA	**0.003**	
1971	3Q	NA	0.006	**0.004**
1971	4Q	NA	**0.003**	
1972	1Q	NA	**0.001**	
1972	2Q	NA	**0.0006**	
1972	3Q	NA	**0.0007**	
1972	4Q	NA	**0.0008**	
1973	1Q	NA	0.020	**0.035**
1973	2Q	NA	0.019	**0.026**
1973	3Q	NA	0.161	**0.200**
1973	4Q	NA	**0.0005**	
1974	1Q	NA	**0.035**	
1974	2Q	NA	0.017	**0.025**
1974	3Q	NA	**0.0005**	
1974	4Q	NA	**0.0005**	
1975	1Q	NA	**0.001**	
1975	2Q	NA	**0.001**	
1975	3Q	NA	**0.001**	
1975	4Q	NA	**0.001**	
1976	1Q	NA	**0.001**	
1976	2Q	NA	**0.001**	
1976	3Q	NA	**0.001**	
1976	4Q	NA	**0.001**	

Table I-4: Comparison of Fee and Sanders (1982) Data with Data from Monthly Surface Water Sampling Reports (1953-64) [a]

YEAR	Quarter	Monthly SW Sampling Report Conc. (mg/L)	Y/EX-21 Conc. (source given as Fee and Sanders, 1982) (mg/L)	Conc. from Fee and Sanders (1982) (math corrected)
1977	1Q	NA	**0.001**	
1977	2Q	NA	**0.001**	
1977	3Q	NA	**0.002**	
1977	4Q	NA	**0.003**	
1978	1Q	NA	**0.002**	
1978	2Q	NA	**0.001**	
1978	3Q	NA	**0.001**	
1978	4Q	NA	**0.001**	
1979	1Q	NA	**0.002**	
1979	2Q	NA	**0.001**	
1979	3Q	NA	**0.002**	
1979	4Q	NA	**0.002**	
1980	1Q	NA	**0.002**	
1980	2Q	NA	**0.002**	
1980	3Q	NA	0.001	**0.002**
1980	4Q	NA	**0.002**	
1981	1Q	NA	**0.002**	
1981	2Q	NA	**0.002**	
1981	3Q	NA	**0.001**	
1981	4Q	NA	**0.001**	
1982	1Q	NA	**0.005**	
1982	2Q	NA	**0.001**	
1982	3Q	NA	**0.002**	
1982	4Q	NA	NA	

Notes:

a Details of calculation of "math corrected" (i.e., source checked) values are given in Table I-5; bold font indicates value used to calculate pounds released to EFPC

NR = Not included in Fee and Sanders (1982).

NA = Not applicable (no surface water reports available for these years).

Table I-5: Detailed Comparison of Fee and Sanders' (1982) Data with Data from Monthly Surface Water Sampling Rpts (1953-64)

YEAR	Quarter	Monthly SW Sampling Rpts Quarterly Avg "Conc 1" (mg/L)	Y/EX-21 (source given as Fee and Sanders, 1982) Quarterly Avg "Conc 3" (mg/L)	Original Data used to Source Check Y/EX-21 (from Fee and Sanders, 1982) Weekly Avg. (mg/L)	Quarterly Avg. (mg/L)	Comments
1954	**2Q**	**0.20**	NR	0.28	0.203	
				0.10		
				0.23		
1954	**3Q**	**0.30**	NR	0.23	0.300	
				0.13		
				0.54		
1954	**4Q**	**0.19**	NR	0.25	0.194	
				0.191		
				0.14		
1955	**1Q**	**0.61**	NR	0.15	0.610	
				0.59		
				1.09		
1955	**2Q**	**1.80**	NR	1.48	1.797	
				1.98		
				1.93		
1955	**3Q**	**1.12**	NR	1.06	1.130	avg has one addtnl value
				1.05		
				1.28		
1955	**4Q**	**0.70**	0.709	0.44	0.709	conc 3 has one addtnl value
				0.33		
				0.73		
				1.08		
				0.84		
				0.74		
				0.71		
				0.79		
				0.96		
				0.23		
				0.40		
				0.57		
				1.48		
				0.63		
1956	**1Q**	0.36	**0.359**	0.38	0.359	
				0.43		
				0.32		
				0.36		
				0.1		
				0.27		
				0.18		
				0.34		
				0.40		
				0.46		
				0.10		
				0.78		
				0.55		
1956	**2Q**	0.64	**0.642**	0.44	0.642	
				0.32		
				0.55		
				0.55		
				0.74		
				0.70		
				0.42		
				0.58		
				1.03		
				1.31		
				0.37		
				0.89		
				0.45		
1956	**3Q**	**1.46**	1.654	1.17	1.654	conc 3 has one typo and one addtnl value
				0.56		
				0.96		
				1.32		
				1.17		
				0.67		
				1.19		
				2.31		
				3.60		
				3.6		
				0.8		
				0.8		
				1.4		
				3.6		

Table I-5: Detailed Comparison of Fee and Sanders' (1982) Data with Data from Monthly Surface Water Sampling Rpts (1953-64)

YEAR	Quarter	Monthly SW Sampling Rpts Quarterly Avg "Conc 1" (mg/L)	Y/EX-21 (source given as Fee and Sanders, 1982) Quarterly Avg "Conc 3" (mg/L)	Original Data used to Source Check Y/EX-21 (from Fee and Sanders, 1982) Weekly Avg. (mg/L)	Quarterly Avg. (mg/L)	Comments
1956	**4Q**	1.01	**0.956**	0.5	0.956	conc 3 has 4 addtnl values for Nov and one
				1.3		missing value
				1.1		
				0.48		
				0.94		
				0.74		
				0.71		
				0.79		
				0.96		
				0.94		
				0.78		
				2.0		
				1.5		
				0.74		
				0.87		
				0.71		
				1.2		
1957	**1Q**	1.61	**1.609**	1.7	1.609	
				0.51		
				1.7		
				1.17		
				2.6		
				1.9		
				1.7		
				1.2		
				2.3		
				1.7		
				1.3		
				1.74		
				1.4		
1957	**2Q**	2.49	**2.422**	2.54	2.422	conc 3 has one addtnl value for June
				2.2		
				4.03		
				2.0		
				0.920		
				3.2		
				3.8		
				1.2		
				3.2		
				1.6		
				4.12		
				1.5		
				2.1		
				1.5		
1957	**3Q**	3.02	**3.015**	3.4	3.015	
				1.7		
				7.2		
				3.8		
				4.3		
				5.0		
				5.2		
				1.5		
				0.7		
				1.6		
				2.0		
				1.4		
				1.4		
1957	**4Q**	1.81	**1.805**	0.53	1.805	
				1.0		
				2.30		
				1.30		
				1.60		
				2.80		
				3.40		
				1.24		
				1.10		
				1.40		
				2.80		
				1.70		
				2.30		

Table I-5: Detailed Comparison of Fee and Sanders' (1982) Data with Data from Monthly Surface Water Sampling Rpts (1953-64)

YEAR	Quarter	Monthly SW Sampling Rpts Quarterly Avg "Conc 1" (mg/L)	Y/EX-21 (source given as Fee and Sanders, 1982) Quarterly Avg "Conc 3" (mg/L)	Original Data used to Source Check Y/EX-21 (from Fee and Sanders, 1982) Weekly Avg. (mg/L)	Quarterly Avg. (mg/L)	Comments
1958	**1Q**	3.65	**3.650**	1.2	3.650	
				3.1		
				2.9		
				3.4		
				10.7		
				3.4		
				3.7		
				3.2		
				2.1		
				3.0		
				5.8		
				1.3		
1958	**2Q**	3.06	**3.062**	4.1	3.062	
				1.5		
				3.9		
				1.2		
				2.6		
				14.5		
				2.10		
				2.0		
				2.0		
				0.9		
				1.4		
				1.3		
				2.3		
1958	**3Q**	1.25	**1.246**	2.4	1.246	
				1.3		
				2.0		
				1.2		
				0.9		
				1.0		
				0.8		
				1.7		
				1.4		
				1.3		
				1.0		
				0.6		
				0.6		
1958	**4Q**	**1.37**	1.417	6.0	1.417	conc 3 has one less value
				0.49		
				0.898		
				1.67		
				0.91		
				0.75		
				0.6		
				0.6		
				1.3		
				1.2		
				1.0		
				2.4		
				0.6		
1959	**1Q**	**1.02**	0.990	0.7	0.990	conc 3 has one addtnl value
				1.3		
				0.7		
				0.8		
				1.3		
				1.6		
				1.0		
				0.7		
				0.68		
				0.9		
				1.5		
				0.7		

Table I-5: Detailed Comparison of Fee and Sanders' (1982) Data with Data from Monthly Surface Water Sampling Rpts (1953-64)

		Monthly SW Sampling Rpts	Y/EX-21 (source given as Fee and Sanders, 1982)	Original Data used to Source Check Y/EX-21 (from Fee and Sanders, 1982)		
YEAR	Quarter	Quarterly Avg "Conc 1" (mg/L)	Quarterly Avg "Conc 3" (mg/L)	Weekly Avg. (mg/L)	Quarterly Avg. (mg/L)	Comments
1959	**2Q**	0.74	**0.738**	0.9	0.738	
				0.7		
				1.2		
				1.1		
				1.5		
				1.1		
				0.5		
				0.3		
				0.7		
				0.4		
				0.3		
				0.5		
				0.4		
1959	**3Q**	**0.75**	0.738	1.3	0.738	conc 3 has one typo
				1.4		
				0.9		
				0.6		
				0.4		
				0.6		
				1.7		
				0.3		
				0.2		
				0.2		
				0.1		
				1.7		
				0.2		
1959	**4Q**	0.20	**0.197**	0.24	0.197	rounding
				0.22		
				0.21		
				0.19		
				0.24		
				0.30		
				0.09		
				0.10		
				0.30		
				0.33		
				0.13		
				0.14		
				0.19		
				0.08		
1960	**1Q**	**0.19**	0.186	0.18	0.186	conc 3 has one less value
				0.04		
				0.16		
				0.24		
				0.09		
				0.17		
				0.18		
				0.14		
				0.05		
				0.51		
				0.29		
1960	**2Q**	**0.20**	0.198	0.23	0.198	conc 3 has one addtnl value and 2 typos
				0.24		
				0.34		
				0.13		
				0.23		
				0.16		
				0.12		
				0.18		
				0.12		
				0.21		
				0.19		
				0.15		
				0.27		

Table I-5: Detailed Comparison of Fee and Sanders' (1982) Data with Data from Monthly Surface Water Sampling Rpts (1953-64)

YEAR	Quarter	Monthly SW Sampling Rpts Quarterly Avg "Conc 1" (mg/L)	Y/EX-21 (source given as Fee and Sanders, 1982) Quarterly Avg "Conc 3" (mg/L)	Original Data used to Source Check Y/EX-21 (from Fee and Sanders, 1982) Weekly Avg. (mg/L)	 Quarterly Avg. (mg/L)	Comments
1960	**3Q**	**0.36**	0.330	0.15	0.330	conc 3 has 2 addtnl data points
				0.16		
				1.99		
				0.14		
				0.13		
				0.23		
				0.18		
				0.16		
				0.09		
				0.14		
				0.12		
				0.14		
				0.33		
				0.85		
				0.14		
1960	**4Q**	0.40	**0.216**	0.22	0.216	1/4 ly report says 0.40
				0.27		I only have 2 of 3 sw sampling reports
				0.15		
				0.40		
				0.19		
				0.27		
				0.61		
				0.10		
				0.13		
				0.15		
				0.07		
				0.03		
1961	**1Q**	**0.30**	0.133	0.05	0.133	One value in conc 3 is a typo.
				0.20		
				0.07		
				0.16		
				0.28		
				0.04		
				0.16		
				0.10		
				0.09		
				0.18		
1961	**2Q**	0.10	**0.103**	0.20	0.103	
				0.15		
				0.10		
				0.12		
				0.10		
				0.09		
				0.07		
				0.06		
				0.09		
				0.07		
				0.08		
1961	**3Q**	**0.28**	0.230	0.26	0.230	One value in conc 3 is a typo.
				0.08		
				0.05		
				0.16		
				0.36		
				0.08		
				0.17		
				0.33		
				0.42		
				0.10		
				0.18		
				0.29		
				0.51		
1961	**4Q**	0.12	**0.118**	0.32	0.118	I only have 1 of 3 sw sampling reports
				0.11		
				0.08		
				0.10		
				0.15		
				0.13		
				0.09		
				0.09		
				0.12		
				0.05		
				0.08		
				0.10		

Table I-5: Detailed Comparison of Fee and Sanders' (1982) Data with Data from Monthly Surface Water Sampling Rpts (1953-64)

YEAR	Quarter	Monthly SW Sampling Rpts Quarterly Avg "Conc 1" (mg/L)	Y/EX-21 (source given as Fee and Sanders, 1982) Quarterly Avg "Conc 3" (mg/L)	Original Data used to Source Check Y/EX-21 (from Fee and Sanders, 1982) Weekly Avg. (mg/L)	Quarterly Avg. (mg/L)	Comments
1962	**1Q**	**0.18**	0.205	0.28	0.205	conc 3 does not include Jan. values
				0.34		
				0.16		
				0.26		
				0.21		
				0.13		
				0.20		
				0.06		
1962	**2Q**	0.08	**0.084**	0.16	0.084	
				0.12		
				0.16		
				0.10		
				0.27		
				0.04		
				0.01		
				0.06		
				0.01		
				0.05		
				0.02		
				0.01		
1962	**3Q**	0.16	**0.021**	0.01	0.021	1/4 ly report says 0.16
		0.01		0.02		I only have 1 of 3 sw sampling reports
				0.03		
				0.003		
				0.02		
				0.01		
				0.01		
				0.01		
				0.01		
				0.01		
				0.04		
				0.04		
				0.06		
1962	**4Q**	0.07	**0.210**	0.06	0.210	1/4 ly report says 0.07
		0.04		0.03		I only have 1 of 3 sw sampling reports
				0.04		
				0.03		
				0.06		
				0.20		
				0.06		
				0.08		
				0.01		
				0.06		
				0.10		
				1.0		
				1.0		
1963	**1Q**	**0.07**	0.016	0.016		conc 3 based on one data point
1963	**2Q**	**0.23**	0.040	NA	NA	1964,65 avg for 2Q is 0.054 not 0.040
1963	**3Q**	**0.02**	0.032	0.015	0.032	I have all 3 sw sampling reports
				0.022		
				0.030		
				0.043		
				0.043		
				0.015		
				0.043		
				0.043		
1963	**4Q**	**0.023**	0.025	0.017	0.025	conc 3 included downstream values
				0.033		
				0.004		
				0.014		0.028
				0.004		
				0.004		
				0.014		
				0.004		
				0.054		
				0.014		
				0.021		
				0.014		
				0.017		
				0.033		
				0.09		
				0.06		

Table I-5: Detailed Comparison of Fee and Sanders' (1982) Data with Data from Monthly Surface Water Sampling Rpts (1953-64)

		Monthly SW Sampling Rpts	Y/EX-21 (source given as Fee and Sanders, 1982)	Original Data used to Source Check Y/EX-21 (from Fee and Sanders, 1982)		
YEAR	Quarter	Quarterly Avg "Conc 1" (mg/L)	Quarterly Avg "Conc 3" (mg/L)	Weekly Avg. (mg/L)	Quarterly Avg. (mg/L)	Comments
1964	1Q	**0.07**	0.084	0.034	0.084	conc 3 included downstream values
				0.33		
				0.010		
				0.026		
				0.006		
				0.11		
				0.011		
				0.12		
				0.31		
				0.10		
				0.032		
				0.015		
				0.05		0.04
				0.022		
1964	2Q	**0.02**	0.024	0.013	0.024	
				0.05		
				0.050		
				0.010		
				0.010		
				0.004		
				0.013		
				0.013		
				0.021		
				0.05		
				0.05		
				0.008		
1964	3Q	ND	**0.039**	0.027	0.039	
				0.05		
1964	4Q	NA	**0.037**	0.010	0.037	
				0.05		
				0.05		
1965	1Q	NA	**0.050**	0.05	0.050	
				0.05		
1965	2Q	NA	**0.231**	0.05	0.231	
				0.4115		
1965	3Q	NA	**0.050**	0.05	0.050	
				0.05		
1965	4Q	NA	**0.050**	0.05	0.050	
				0.05		
1966	1Q	NA	**0.050**	0.05		one data point
1966	2Q	NA	0.040	NA	NA	1964,65 avg for 2Q is **0.054**
1966	3Q	NA	0.028	NA	NA	1963,64,65 avg for 3Q is **0.036**
1966	4Q	NA	**0.030**	0.05	0.030	
				0.01		
1967	1Q	NA	**0.042**	0.05	0.042	
				0.05		
				0.05		
				0.05		
				0.01		
1967	2Q	NA	**0.049**	0.049	0.049	
				0.049		
				0.049		
				0.05		
				0.05		
1967	3Q	NA	**0.026**	0.049	0.0264	
				0.049		
				0.0002		
				0.01		
				0.0500		
				0.0002		
1967	4Q	NA	**0.005**	0.01	0.005	
				0.0002		
				0.0002		
				0.01		
				0.01		
				0.0002		

Table I-5: Detailed Comparison of Fee and Sanders' (1982) Data with Data from Monthly Surface Water Sampling Rpts (1953-64)

YEAR	Quarter	Monthly SW Sampling Rpts Quarterly Avg "Conc 1" (mg/L)	Y/EX-21 (source given as Fee and Sanders, 1982) Quarterly Avg "Conc 3" (mg/L)	Original Data used to Source Check Y/EX-21 (from Fee and Sanders, 1982) Weekly Avg. (mg/L)	Original Data used to Source Check Y/EX-21 (from Fee and Sanders, 1982) Quarterly Avg. (mg/L)	Comments
1968	**1Q**	NA	**0.005**	0.01	0.005	
				0.0002		
				0.0002		
				0.01		
				0.002		
				0.0002		
				0.01		
1968	**2Q**	NA	**0.005**	0.01	0.005	
				0.0002		
				0.01		
				0.0002		
				0.01		
				0.0002		
1968	**3Q**	NA	**0.004**	0.01	0.004	
				0.0002		
				0.0002		
				0.01		
				0.0002		
				0.01		
				0.0002		
				0.002		
1968	**4Q**	NA	**0.004**	0.01	0.004	
				0.0002		
				0.0002		
				0.01		
				0.0002		
				0.01		
				0.0002		
				0.0002		
1969	**1Q**	NA	**0.005**	0.01	0.005	
				0.01		
				0.0002		
				0.0004		
				0.0002		
				0.01		
1969	**2Q**	NA	**0.006**	0.01	0.006	
				0.0002		
				0.01		
				0.01		
				0.0002		
1969	**3Q**	NA	**0.006**	0.01	0.006	
				0.0002		
				0.01		
				0.0002		
				0.01		
1969	**4Q**	NA	**0.008**	0.01	0.008	
				0.01		
				0.01		
				0.01		
				0.0002		
1970	**1Q**	NA	**0.006**	0.01	0.006	
				0.001		
				0.01		
				0.01		
				0.0002		
				0.01		
				0.0001		
1970	**2Q**	NA	**0.033**	0.01	0.033	
				0.0002		
				0.0002		
				0.01		
				0.1		
				0.001		
				0.01		
				0.10		
				0.1		
				0.0010		

Table I-5: Detailed Comparison of Fee and Sanders' (1982) Data with Data from Monthly Surface Water Sampling Rpts (1953-64)

YEAR	Quarter	Monthly SW Sampling Rpts Quarterly Avg "Conc 1" (mg/L)	Y/EX-21 (source given as Fee and Sanders, 1982) Quarterly Avg "Conc 3" (mg/L)	Original Data used to Source Check Y/EX-21 (from Fee and Sanders, 1982) Weekly Avg. (mg/L)	Quarterly Avg. (mg/L)	Comments
1970	**3Q**	NA	**0.043**	0.01	0.043	
				0.1		
				0.001		
				0.01		
				0.10		
				0.001		
				0.01		
				0.1		
				0.1		
				0.001		
1970	**4Q**	NA	**0.021**	0.01	0.021	
				0.10		
				0.1		
				0.01		
				0.001		
				0.001		
				0.0001		
				0.001		
				0.01		
				0.001		
				0.0001		
1971	**1Q**	NA	0.017	0.001	**0.013**	conc 3 math error?
				0.001		
				0.012		
				0.039		
1971	**2Q**	NA	**0.003**	0.015	0.003	
				0.001		
				0.001		
				0.001		
				0.001		
				0.01		
				0.001		
				0.001		
				0.001		
				0.001		
				0.01		
				0.0005		
				0.001		
				0.0005		
				0.005		
				0.001		
1971	**3Q**	NA	0.006	0.01	**0.004**	conc 3 math error?
				0.0025		
				0.0001		
				0.0001		
				0.01		
				0.001		
				0.001		
				0.01		
1971	**4Q**	NA	**0.003**	0.01	0.003	
				0.001		
				0.001		
				0.001		
				0.001		
				0.001		
				0.001		
				0.01		
				0.0005		
				0.0075		
				0.001		
				0.01		
				0.0015		
				0.0022		
				0.0002		
				0.0005		

Table I-5: Detailed Comparison of Fee and Sanders' (1982) Data with Data from Monthly Surface Water Sampling Rpts (1953-64)

YEAR	Quarter	Monthly SW Sampling Rpts Quarterly Avg "Conc 1" (mg/L)	Y/EX-21 (source given as Fee and Sanders, 1982) Quarterly Avg "Conc 3" (mg/L)	Original Data used to Source Check Y/EX-21 (from Fee and Sanders, 1982) Weekly Avg. (mg/L)	 Quarterly Avg. (mg/L)	Comments
1972	**1Q**	NA	**0.001**	0.001	0.0011	
				0.0002		
				0.001		
				0.0030		
				0.0005		
				0.001		
				0.001		
				0.001		
				0.001		
1972	**2Q**	NA	**0.0006**	0.0007	0.00066	
				0.0002		
				0.0003		
				0.0006		
				0.001		
				0.0005		
				0.001		
				0.0005		
				0.001		
				0.0006		
				0.001		
				0.0005		
				0.001		
				0.0005		
				0.001		
				0.0005		
				0.0005		
				0.0005		
1972	**3Q**	NA	**0.0007**	0.001	0.00073	
				0.0005		
				0.001		
				0.001		
				0.0005		
				0.001		
				0.0005		
				0.001		
				0.0005		
				0.001		
				0.0005		
				0.0005		
				0.0005		
1972	**4Q**	NA	**0.0008**	0.0005	0.00075	
				0.001		
				0.0005		
				0.0005		
				0.001		
				0.0005		
				0.001		
				0.0005		
				0.001		
				0.0005		
				0.001		
				0.001		
1973	**1Q**	NA	0.020	0.0005	**0.035**	conc 3 math error?
				0.1		
				0.005		
1973	**2Q**	NA	0.019	0.005	**0.026**	conc 3 math error?
				0.0006		
				0.0003		
				0.1		
1973	**3Q**	NA	0.161	0.1	**0.200**	conc 3 math error?
				0.0004		
				0.001		
				1.0		
				0.0002		
				0.1		
1973	**4Q**	NA	**0.0005**	0.0005	0.00050	
				0.0005		
				0.0005		
				0.0005		

Table I-5: Detailed Comparison of Fee and Sanders' (1982) Data with Data from Monthly Surface Water Sampling Rpts (1953-64)

YEAR	Quarter	Monthly SW Sampling Rpts Quarterly Avg "Conc 1" (mg/L)	Y/EX-21 (source given as Fee and Sanders, 1982) Quarterly Avg "Conc 3" (mg/L)	Original Data used to Source Check Y/EX-21 (from Fee and Sanders, 1982) Weekly Avg. (mg/L)	Quarterly Avg. (mg/L)	Comments
1974	**1Q**	NA	**0.035**	0.005	0.035	
				0.0005		
				0.005		
				0.1		
				0.1		
				0.0005		
1974	**2Q**	NA	0.017	0.0005	**0.025**	conc 3 math error?
				0.1		
				0.0005		
				0.0005		
1974	**3Q**	NA	**0.0005**	0.0005	0.00050	
				0.0005		
				0.0005		
1974	**4Q**	NA	**0.0005**	0.0005	0.00050	
				0.0005		
1975	**1Q**	NA	**0.001**	0.0011	0.0013	
				0.0020		
				0.0015		
				0.001		
				0.001		
1975	**2Q**	NA	**0.001**	0.001	0.001	
				0.001		
				0.001		
1975	**3Q**	NA	**0.001**	0.001	0.001	
				0.001		
				0.001		
1975	**4Q**	NA	**0.001**	0.001	0.001	
				0.001		
				0.001		
1976	**1Q**	NA	**0.001**	0.001	0.001	
				0.001		
				0.001		
1976	**2Q**	NA	**0.001**	0.001	0.001	
				0.001		
				0.001		
1976	**3Q**	NA	**0.001**	0.001	0.001	
				0.001		
				0.001		
1976	**4Q**	NA	**0.001**	0.001	0.001	
				0.001		
				0.001		
1977	**1Q**	NA	**0.001**	0.0005	0.0009	
				0.0013		
				0.001		
1977	**2Q**	NA	**0.001**	0.001	0.001	
				0.001		
				0.002		
1977	**3Q**	NA	**0.002**	0.0015	0.0020	
				0.003		
				0.0015		
1977	**4Q**	NA	**0.003**	0.001	0.0030	
				0.0049		
				0.0028		
				0.0026		
				0.0028		
				0.0034		
				0.0037		

Table I-5: Detailed Comparison of Fee and Sanders' (1982) Data with Data from Monthly Surface Water Sampling Rpts (1953-64)

YEAR	Quarter	Monthly SW Sampling Rpts Quarterly Avg "Conc 1" (mg/L)	Y/EX-21 (source given as Fee and Sanders, 1982) Quarterly Avg "Conc 3" (mg/L)	Original Data used to Source Check Y/EX-21 (from Fee and Sanders, 1982) Weekly Avg. (mg/L)	Original Data used to Source Check Y/EX-21 (from Fee and Sanders, 1982) Quarterly Avg. (mg/L)	Comments
1978	**1Q**	NA	**0.002**	0.0033	0.0025	
				0.003		
				0.0031		
				0.0037		
				0.0027		
				0.0033		
				0.0015		
				0.0038		
				0.0018		
				0.0042		
				0.0025		
				0.0029		
				0.0025		
				0.0027		
				0.0019		
				0.0023		
				0.0007		
				0.0010		
				0.0007		
1978	**2Q**	NA	**0.001**	0.0023	0.0014	
				0.0022		
				0.0028		
				0.0018		
				0.0008		
				0.0006		
				0.0005		
				0.0019		
				0.0008		
				0.0010		
				0.0009		
				0.0011		
1978	**3Q**	NA	**0.001**	0.0008	0.0013	
				0.0008		
				0.0005		
				0.0005		
				0.0017		
				0.0015		
				0.0012		
				0.0015		
				0.0008		
				0.006		
				0.0006		
				0.0006		
				0.0008		
1978	**4Q**	NA	**0.001**	0.0011	0.0012	
				0.0017		
				0.0016		
				0.0005		
				0.0005		
				0.0007		
				0.0020		
				0.0014		
				0.0011		
				0.001		
1979	**1Q**	NA	**0.002**	0.001	0.0020	
				0.002		
				0.002		
				0.002		
				0.003		
				0.001		
				0.002		
				0.003		
				0.002		
				0.001		
				0.002		
				0.002		
				0.003		

Table I-5: Detailed Comparison of Fee and Sanders' (1982) Data with Data from Monthly Surface Water Sampling Rpts (1953-64)

YEAR	Quarter	Monthly SW Sampling Rpts Quarterly Avg "Conc 1" (mg/L)	Y/EX-21 (source given as Fee and Sanders, 1982) Quarterly Avg "Conc 3" (mg/L)	Original Data used to Source Check Y/EX-21 (from Fee and Sanders, 1982) Weekly Avg. (mg/L)	Quarterly Avg. (mg/L)	Comments
1979	**2Q**	NA	**0.001**	0.001	0.0014	
				0.001		
				0.003		
				0.001		
				0.002		
				0.002		
				0.001		
				0.001		
				0.001		
				0.002		
				0.001		
				0.001		
				0.001		
1979	**3Q**	NA	**0.002**	0.001	0.0016	
				0.002		
				0.001		
				0.002		
				0.002		
				0.002		
				0.002		
				0.002		
				0.001		
				0.001		
				0.001		
				0.002		
				0.00118		
1979	**4Q**	NA	**0.002**	0.001	0.0018	
				0.006		
				0.002		
				0.001		
				0.002		
				0.001		
				0.001		
				0.002		
				0.001		
				0.001		
				0.001		
				0.002		
				0.002		
				0.002		
1980	**1Q**	NA	**0.002**	0.002	0.0023	
				0.002		
				0.001		
				0.002		
				0.003		
				0.001		
				0.002		
				0.003		
				0.006		
				0.002		
				0.002		
				0.003		
				0.003		
				0.001		
				0.001		
				0.002		
1980	**2Q**	NA	**0.002**	0.002	0.0020	
				0.003		
				0.001		
				0.001		
				0.002		
				0.002		
				0.002		
				0.002		
				0.002		
				0.001		
				0.003		
				0.003		
				0.002		

Table I-5: Detailed Comparison of Fee and Sanders' (1982) Data with Data from Monthly Surface Water Sampling Rpts (1953-64)

YEAR	Quarter	Monthly SW Sampling Rpts Quarterly Avg "Conc 1" (mg/L)	Y/EX-21 (source given as Fee and Sanders, 1982) Quarterly Avg "Conc 3" (mg/L)	Original Data used to Source Check Y/EX-21 (from Fee and Sanders, 1982) Weekly Avg. (mg/L)	Quarterly Avg. (mg/L)	Comments
1980	**3Q**	NA	0.001	0.001	0.0015	conc 3 should be rounded to **0.002**
				0.001		
				0.002		
				0.004		
				0.001		
				0.001		
				0.001		
				0.002		
				0.001		
				0.002		
				0.001		
				0.001		
1980	**4Q**	NA	**0.002**	0.002	0.0019	
				0.002		
				0.002		
				0.001		
				0.002		
				0.002		
				0.002		
				0.002		
				0.002		
				0.001		
				0.002		
				0.002		
				0.003		
1981	**1Q**	NA	**0.002**	0.003	0.0022	
				0.001		
				0.003		
				0.004		
				0.003		
				0.003		
				0.002		
				0.002		
				0.001		
				0.002		
				0.002		
				0.002		
				0.001		
1981	**2Q**	NA	**0.002**	0.002	0.0015	
				0.002		
				0.001		
				0.002		
				0.004		
				0.001		
				0.001		
				0.001		
				0.001		
				0.001		
				0.001		
				0.001		
				0.001		
1981	**3Q**	NA	**0.001**	0.001	0.0014	
				0.001		
				0.001		
				0.001		
				0.002		
				0.001		
				0.002		
				0.001		
				0.001		
				0.002		
				0.002		
				0.002		
				0.001		

Table I-5: Detailed Comparison of Fee and Sanders' (1982) Data with Data from Monthly Surface Water Sampling Rpts (1953-64)

YEAR	Quarter	Monthly SW Sampling Rpts	Y/EX-21 (source given as Fee and Sanders, 1982)	Original Data used to Source Check Y/EX-21 (from Fee and Sanders, 1982)		Comments
		Quarterly Avg "Conc 1" (mg/L)	Quarterly Avg "Conc 3" (mg/L)	Weekly Avg. (mg/L)	Quarterly Avg. (mg/L)	
1981	**4Q**	NA	**0.001**	0.001	0.0010	
				0.001		
				0.001		
				0.001		
				0.001		
				0.001		
				0.001		
				0.001		
				0.001		
				0.001		
				0.001		
				0.001		
1982	**1Q**	NA	**0.005**	0.003	0.0047	
				0.003		
				0.002		
				0.002		
				0.002		
				0.002		
				0.002		
				0.002		
				0.002		
				0.04		
				0.002		
				0.001		
				0.001		
				0.002		
1982	**2Q**	NA	**0.001**	0.001	0.0011	
				0.001		
				0.002		
				0.001		
				0.001		
				0.001		
				0.001		
				0.001		
				0.001		
				0.001		
				0.001		
				0.001		
1982	**3Q**	NA	**0.002**	0.002	0.0018	
				0.003		
				0.002		
				0.001		
				0.002		
				0.001		
				0.002		
				0.001		
				0.003		
				0.002		
				0.001		
				0.002		
1982	**4Q**	NA	NA	NA	NA	

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APPENDIX J

DESCRIPTION OF HISTORICAL INVESTIGATIONS OF MERCURY CONTAMINATION NEAR THE ORR

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APPENDIX J

DESCRIPTION OF HISTORICAL INVESTIGATIONS OF MERCURY CONTAMINATION NEAR THE ORR

This appendix describes historical monitoring programs conducted near the ORR from the 1950s to the present that have measured mercury concentrations in different environmental media, including air, soil, sediment, surface water, and biota. Summaries of historical ambient air, sediment, fish, aquatic biota, and vegetation (other than vegetables and pasture) data are presented in Tables J-1 through J-5, respectively. Historical surface water data are presented in the main body of the report in Table 6-1. Historical soil data are presented in Appendix Q. Historical vegetable and pasture grass data are presented in Appendix T.

J.1 1983 Mercury Task Force Compilation of Environmental Sampling Data, pre-1983 (UCC, 1983)

The Mercury Task Force was established following publication of the declassified version of the 1977 Mercury Inventory Report (Case 1977) on May 17, 1983, to address concerns regarding the use of mercury at Y-12 (UCCND 1983a). In addition to compiling historical information on mercury accountability, the 1983 Mercury Task Force summarized studies conducted through 1983 to evaluate the impact of mercury releases from Y-12 on worker health and the environment. These data are described in the Mercury Task Force Report, *Mercury at Y-12: A Study of Mercury Use at the Y-12 Plant, Accountability, and Impacts on Y-12 Workers and the Environment– 1950 to 1983* (UCCND 1983a). Studies described include:

- Measurement of mercury in fish, water, and sediment from EFPC and New Hope Pond in 1970 by Sanders (1970),
- Measurement of mercury in sediment cores from EFPC and Poplar Creek in 1972 and 1973 by Reece (1974),
- Measurement of mercury in fish, benthic invertebrates, and sediments from Poplar Creek, the Clinch River, and Melton Hill Reservoir in 1976 by Elwood (1977),
- Union Carbide annual environmental monitoring from 1971 through 1982,
- Measurement of mercury in moss, liverwort, and sycamore roots along Bear Creek and EFPC in 1981 (UCCND 1983a),
- Measurement of mercury in sediment, fish, moss, and pasture grass along EFPC and Bear Creek in 1982 by Van Winkle et al. (1984),

- Measurement of mercury in Poplar Creek fish in 1982 by Stiff (1982),
- Measurement of mercury in hair samples from livestock from the EFPC floodplain in 1982 by the Comparative Animal Research Laboratory (CARL) (UCCND 1983a), and
- Measurement of mercury in sediment cores in Watts Bar Lake in 1983.

These studies and others are described in greater detail below.

J.2 Evaluation of Mercury in New Hope Pond, EFPC, and Bear Creek Water, Sediments, and Fish, 1970 (Sanders 1970)

In 1970, a survey was initiated by M. Sanders, the Y-12 Environmental Coordinator, to determine the mercury content in water, sediment, and fish samples from various parts of the Oak Ridge area. Results were reported to J.D. McLendon in an internal memorandum dated August 6, 1970. This memorandum was not located; however, the results are summarized in the 1983 Mercury Task Force Report (UCCND 1983a). A total of 12 water samples and 10 mud samples from New Hope Pond, EFPC, Bear Creek, and Melton Hill Reservoir were collected and analyzed for mercury. In addition, fish samples were collected in EFPC and Bear Creek. Exact sample locations were not given.

J.3 ORR Routine Environmental Monitoring, 1971 - present

Periodic environmental monitoring around the ORR has been conducted since the early 1950s, and summarized in reservation-wide annual environmental monitoring reports (UCC, 1972-1982; MMES, 1984-1991). Since 1971, this program included environmental monitoring for mercury. Beginning in 1971 and 1972, respectively, surface water samples for mercury were collected from the Clinch River below Poplar Creek and from EFPC at New Hope Pond. Beginning in 1975, sediment samples were collected from the Clinch River (above and below Poplar Creek), EFPC, and Poplar Creek. Beginning in 1978, fish samples were collected in the Clinch River and, beginning in 1985, in EFPC. Ambient air samples for mercury have been collected at the Y-12 Plant since 1986.

J.4 Evaluation of Mercury in Bear Creek, EFPC, and Poplar Creek Sediment, 1972 - 1974 (Reece 1974)

Preliminary surveys of water and sediment in EFPC, Poplar Creek, and Bear Creek were conducted during 1972, 1973, and 1974 (Reece 1974). The surveys were conducted to identify possible areas of concern and to determine the continuance or abatement of problems. Water samples were not analyzed for mercury; however, it is not known what other contaminants were evaluated. Sediment samples showed mercury levels ranging from less than 0.05 mg kg^{-1} to 72 mg kg^{-1}.

J.5 Evaluation of Mercury Contamination in Poplar Creek and the Clinch River, 1974 - 1976 (Elwood 1976, 1984)

An evaluation of mercury contamination in the EFPC- Poplar Creek- Clinch River drainage was conducted from 1974 through 1976 by the Environmental Sciences Division of ORNL (Elwood 1976, 1984). The study was conducted to verify mercury contamination in the drainage and the extent of contamination in fish. Fish were collected in May, June, and October 1976 from Poplar Creek and the Clinch River and analyzed for mercury. Collection locations included the Clinch River from CRM 4.5 to 13.5, Melton Hill Reservoir, and Poplar Creek from PCM 0.0 to the confluence with EFPC. During 1976, a total of 11 samples were collected in Melton Hill Reservoir, 86 in Poplar Creek, and 186 in the Clinch River upstream and downstream of the confluence with Poplar Creek. Raw data are tabulated in the report by Elwood (1976).

J.6 Ecological Studies of the Biotic Communities in the Vicinity of the ORGDP and ORNL, 1977 - 1980 (Loar et al., 1981a and 1981b)

From 1977 through 1980, sampling of phytoplankton, zooplankton, periphyton, benthic macroinvertebrates,and fish in the vicinity of the Oak Ridge Gaseous Diffusion Plant (ORGDP) and ORNL was conducted by the ORNL Environmental Sciences Division to evaluate effects of plant operations on aquatic biota (Loar et al., 1981a and 1981b). From April 1977 through September 1978, samples of aquatic biota were collected near ORGDP in Poplar Creek at miles 0.5, 5.5, and 11.0 and in the Clinch River at miles 10.5, 11.5, and 15.0. (Loar et al., 1981a). From March 1979 through June 1980, samples were collected in the WOC watershed and in the Clinch River to evaluate effects of ORNL operations on aquatic communities (Loar et al., 1981b). Analyses were conducted for heavy metals, including mercury, and PCBs. In addition, water quality and sediment sampling data were collected.

J.7 Evaluation of Mercury in Bear Creek and EFPC Sediments and Biota, 1981 - 1982 (UCCND 1983a)

Samples of moss, liverwort, and sycamore roots along Bear Creek and EFPC were collected in December 1981 an ORNL biologist and a scientist with USGS (UCCND 1983a). Data were gathered to justify a joint DOE-USGS research project on the presence of heavy metals, including mercury, reported to be in the local environment. Samples were originally analyzed by the USGS Geochemistry Laboratory in Denver, and were reanalyzed at the Y-12 Plant.

Because of differences in the analytical results reported by the two laboratories, additional samples were collected by the ORNL Environmental Sciences Division and analyzed at Y-12 in May 1982. The 1982 samples included multiple samples at each location (UCCND 1983a).

J.8 Evaluation of Mercury Contamination of Sediment, Fish, Moss, and Pasture Grass in EFPC Floodplain, 1982 (Van Winkle et al. 1982)

During May and July, 1982, an evaluation of mercury contamination in the EFPC floodplain was conducted by the ORNL Environmental Sciences Division at the request of Y-12 management to determine the concentration of mercury in sediment, fish, moss, and pasture grass in the EFPC and Bear Creek drainages and to ascertain whether mercury was still being released from Y-12 (Van Winkle et al. 1982). Surface sediment, fish, moss, and liverwort samples were collected along the length of EFPC, and samples of live and dead foliage were collected in the floodplain along two transects across EFPC. A sediment core was collected from New Hope Pond to determine historical mercury contamination in the pond.

J.9 Evaluation of Mercury in Tissues from a Cow and Horse Grazing on EFPC Floodplain, 1982 (UCCND 1983a)

Hair samples from a cow and a horse grazing on the EFPC floodplain and drinking out of the creek were collected in August 1982 and analyzed for mercury. These data are summarized in the 1983 Mercury Task Force Report (UCCND 1983a). Samples were also collected at the Comparative Animal Research Laboratory (CARL) from animals not exposed to mercury-contaminated grasses or waters. In November 1982, kidney, liver, brain, and muscle tissue samples from one of the cows grazing on the EFPC floodplain were analyzed for mercury. These data were not located.

J.10 Evaluation of Mercury Contamination in EFPC and Poplar Creek Fish, 1982 (Stiff 1982)

During 1982, 96 fish of 14 species were collected in Poplar Creek from three locations near the K-25 site (Stiff 1982). The locations were upstream and downstream of the confluence with EFPC, and near the mouth of Poplar Creek. Samples were analyzed for methylmercury. Results are tabulated in the report.

J.11 Environmental Monitoring and Surveillance of the Oak Ridge Community, 1983 - 1987

In 1983, following the discovery of mercury contamination in EFPC, the DOE requested that ORAU assist in monitoring of the Oak Ridge community. A program of environmental monitoring and surveillance was initiated in response to citizens' requests for an investigation of soils, sediments, vegetables, and well water for mercury contamination. Areas studied were the EFPC floodplain, the Oak Ridge sewerline beltway, and private properties where floodplain soils were used as fill. Data from the ORAU studies were reported monthly to DOE and distributed to federal, state, and local government agencies. Data are summarized in the annual environmental monitoring reports (MMES, 1984; 1985; 1986; 1987; 1988). Raw data are available (TDHE, 1983; Hibbitts, 1984; Hibbitts, 1986). This program was terminated in September 1987.

J.12 TVA Instream Contaminant Study, 1984 - 1985

The TVA Instream Contaminant Study investigated mercury and other contaminants in sediment and aquatic biota downstream of Oak Ridge, with emphasis on mercury-contaminated sediments (TVA, 1985a, 1985b, 1985c, 1985d, 1985e). Approximately 1,500 samples of water, sediment, and biota were collected between April 16, 1984 and April 7, 1985. Systems evaluated included EFPC, Bear Creek, Poplar Creek, WOC, the Clinch River including Melton Hill Reservoir, and the Tennessee River, including Watts Bar Reservoir.

J.13 The Oak Ridge Task Force, 1984 - 1988

From 1984 through 1988, the Oak Ridge Task Force (ORTF) conducted studies to investigate health hazards associated with contamination of EFPC, with a focus on mercury (Travis et al., 1989). The Task Force included the Tennessee Valley Authority (TVA), which performed an instream contaminant study to investigate contamination of surface water, sediment, fish, and floodplains; the United States Geological Survey (USGS), which investigated groundwater contamination; Oak Ridge Associated Universities (ORAU), which investigated contamination of EFPC floodplain and the terrestrial foodchain; and the United States Department of the Interior (USDI), which collected stream flow data. Numerous reports were produced by the ORTF (TVA, 1985a; TVA, 1985b; TVA, 1985c; TVA, 1985d; TVA, 1985e; TVA, 1986; Travis et al., 1986; USGS, 1985a; USGS, 1985b; USGS, 1986; USGS, 1988a; USGS, 1988b; USDI, 1984).

J.14 TDHE and CDC Biomonitoring Study for Mercury, 1984 (Rowley et al., 1985)

In June through July 1984, the TDHE and Centers for Disease Control (CDC) studied human body levels of mercury, to determine whether exposure to mercury-contaminated soils or consumption of fish contaminated with mercury were a health risk to residents of Oak Ridge (Rowley et al., 1985). The study evaluated exposure of 2,627 residents and city workers to mercury-contaminated soil and/or fish. Mercury concentrations in urine and hair were measured for subsamples of the population with high and low levels of exposure. The study concluded that urine and hair mercury concentrations were not at levels associated with known health risks.

J.15 Evaluation of Pollutant Sources in K-25- Area Streams, 1985 (Ashwood et al., 1986)

During January and February, 1985, a survey of sediments in streams surrounding K-25 identified points where pollutants, including mercury, entered surface waters (Ashwood et al., 1986). Approximately 180 surface-sediment grab samples were collected in the Clinch River, in Poplar Creek from the confluence with the Clinch River to upstream of the mouth of EFPC, in EFPC, and in tributaries draining K-25. Three sediment cores were collected (one in EFPC near the confluence with Poplar Creek, one in lower Poplar Creek near its mouth on the Clinch River, and one in a sediment accumulation zone where the Clinch River widens into Watts Bar Lake). To estimate historical deposition of contaminated sediment. Based on these analyses, the authors concluded that mercury originated from sources outside K-25.

J.16 Mercury in Poplar Creek Sediment Core, 1985 (Olsen and Cutshall 1985)

On June 25, 1985, one floodplain soil core and one creekbed sediment core were collected at the proposed construction site for the new Blair Road Bridge over Poplar Creek, to determine the vertical distribution of contaminants, including mercury, radionuclides, organics, and other metals. Samples were collected by the Environmental Sciences Division of ORNL. Raw data are available in this report.

J.17 Clinch River RCRA Facility Investigation, 1986 (Olsen et al., 1992)

In 1986, during the Clinch River RCRA Facility Investigation, sediment and water samples were collected in Watts Bar Reservoir and analyzed for cesium-137, a tracer for quantifying transport and accumulation patterns of other particle-reactive contaminants, including mercury (Olsen et al., 1992). Watts Bar Reservoir is the major zone of contaminant accumulation in the Clinch River (Olsen et al., 1992). The study estimated that 75 metric tons of mercury accumulated in Watts Bar Reservoir. Vertical distributions of cesium-137 and mercury in dated sediment cores were used to estimate contaminant levels in the water column during the past 40 years.

J.18 Clinch River Remedial Investigation, 1989 - 1990 (Cook et al. 1992)

Surface water, sediment (surface and core), and fish samples were collected as part of the Clinch River Remedial Investigation from December 1989 through July 1990 (Cook et al. 1992). The study was conducted to evaluate contaminant release histories as shown by the depositional history of particle-associated contaminants and determine the range and spatial distribution of contaminant concentrations in Clinch River/ Watts Bar Reservoir. Mercury was one of the analytes included in the investigation. Sample locations included Poplar Creek, the Clinch River, and Watts Bar Reservoir.

J.19 EFPC/Sewer Line Beltway Remedial Investigation/ Feasibility Study, 1991 -1992 (DOE/SAIC, 1994)

The East Fork Poplar Creek-Sewer Line Beltway Remedial Investigation/Feasibility Study (RI/FS) analyzed contamination in the EFPC drainage, with special emphasis on mercury (DOE/SAIC, 1994). Sampling of EFPC and the EFPC floodplain conducted during the RI took place in two phases (Ia and Ib) from 1990 to 1992. Phase Ia included base flow surface water and sediment sampling from EFPC, as well as storm flow sampling from EFPC during two flood events. Soil samples were collected from three areas of known contamination (NOAA, Bruner's Center sites, and Sturm sites). During Phase Ib, large scale sampling of floodplain soils was conducted in 159 transects across the floodplain at 100 m (330 ft) intervals. Stream sediment samples were also collected at odd-numbered intervals. Special studies included analysis of the speciation of mercury in floodplain soils and collection and analysis of grasses and browse from sites in the EFPC floodplain and a special vegetable plot on the floodplain. Soil data collected in this study are summarized in Appendix Q. Vegetation data are summarized in Appendix T.

Table J-1: Concentrations of Mercury in Ambient Air Near Y-12

Date	Location	Study	Number of Samples	Minimum (µg/m^3)	Maximum (µg/m^3)	Mean (µg/m^3)	Comments
1986	Ambient No. 2 (east end of Y-12)	ORR Annual Environ.Monit. (MMES, 1991)	34	0.003	0.058	0.011	
1987	Ambient No. 2 (east end of Y-12)	ORR Annual Environ.Monit. (MMES, 1991)	52	0.001	0.033	0.009	
1988	Ambient No. 2 (east end of Y-12)	ORR Annual Environ.Monit. (MMES, 1991)	52	0.003	0.036	0.010	
1989	Ambient No. 2 (east end of Y-12)	ORR Annual Environ.Monit. (MMES, 1991)	52	0.003	0.012	0.006	
1990	Ambient No. 2 (east end of Y-12)	ORR Annual Environ.Monit. (MMES, 1991)	52	<0.001	0.018	0.006	
1991	Ambient No. 2 (east end of Y-12)	ORR Annual Environ.Monit. (MMES, 1991)	51	<0.001	0.073	0.008	
1986	Ambient No. 8 (west end of Y-12)	ORR Annual Environ.Monit. (MMES, 1991)	27	<0.001	0.034	0.017	
1987	Ambient No. 8 (west end of Y-12)	ORR Annual Environ.Monit. (MMES, 1991)	52	0.007	0.067	0.032	
1988	Ambient No. 8 (west end of Y-12)	ORR Annual Environ.Monit. (MMES, 1991)	52	0.007	0.407	0.041	
1989	Ambient No. 8 (west end of Y-12)	ORR Annual Environ.Monit. (MMES, 1991)	52	0.006	1.187	0.14	
1990	Ambient No. 8 (west end of Y-12)	ORR Annual Environ.Monit. (MMES, 1991)	51	0.002	0.025	0.011	
1991	Ambient No. 8 (west end of Y-12)	ORR Annual Environ.Monit. (MMES, 1991)	51	0.005	0.067	0.016	
1986	Bldg. 9404-13 (SW of bldg 9201-4)	ORR Annual Environ.Monit. (MMES, 1991)	31	0.033	0.197	0.11	
1987	Bldg. 9404-13 (SW of bldg 9201-4)	ORR Annual Environ.Monit. (MMES, 1991)	52	0.044	0.465	0.17	
1988	Bldg. 9404-13 (SW of bldg 9201-4)	ORR Annual Environ.Monit. (MMES, 1991)	51	0.028	0.34	0.14	
1989	Bldg. 9404-13 (SW of bldg 9201-4)	ORR Annual Environ.Monit. (MMES, 1991)	52	0.024	0.25	0.10	
1990	Bldg. 9404-13 (SW of bldg 9201-4)	ORR Annual Environ.Monit. (MMES, 1991)	52	0.0	0.277	0.067	
1991	Bldg. 9404-13 (SW of bldg 9201-4)	ORR Annual Environ.Monit. (MMES, 1991)	51	0.018	0.181	0.070	
1986	Bldg. 9805-1 (SE of bldg 9201-4)	ORR Annual Environ.Monit. (MMES, 1991)	15	0.026	0.137	0.070	
1987	Bldg. 9805-1 (SE of bldg 9201-4)	ORR Annual Environ.Monit. (MMES, 1991)	52	0.036	0.226	0.11	
1988	Bldg. 9805-1 (SE of bldg 9201-4)	ORR Annual Environ.Monit. (MMES, 1991)	52	0.017	0.384	0.097	
1989	Bldg. 9805-1 (SE of bldg 9201-4)	ORR Annual Environ.Monit. (MMES, 1991)	51	0.017	0.206	0.072	
1990	Bldg. 9805-1 (SE of bldg 9201-4)	ORR Annual Environ.Monit. (MMES, 1991)	52	0.018	0.162	0.070	
1991	Bldg. 9805-1 (SE of bldg 9201-4)	ORR Annual Environ.Monit. (MMES, 1991)	48	0.003	0.275	0.058	
1987	New Hope Pond	ORR Annual Environ.Monit. (MMES, 1991)	20	0.006	0.039	0.016	
1988	New Hope Pond	ORR Annual Environ.Monit. (MMES, 1991)	52	0.004	0.412	0.046	
1989	New Hope Pond	ORR Annual Environ.Monit. (MMES, 1991)	37	0.002	0.009	0.0040	
1988	Chestnut Ridge (at Rain Gge #2)	ORR Annual Environ.Monit. (MMES, 1991)	47	0.002	0.016	0.0060	
1989	Chestnut Ridge (at Rain Gge #2)	ORR Annual Environ.Monit. (MMES, 1991)	47	<0.001	0.015	0.0050	

Table J-2: Concentrations of Mercury Measured in Sediment Downstream from Y-12

Date	Location	Study	Number of Samples	Minimum (mg/kg, dry)	Maximum (mg/kg, dry)	Mean (mg/kg, dry)	Comments
1970	EFPC (200 yds below New Hope Pond)	Sanders, 1970	1	---	0.90	0.90	
1970	EFPC (Oak Ridge Country Club)	Sanders, 1970	1	---	11.3	11.3	
1970	EFPC (Wiltshire Estate)	Sanders, 1970	1	---	1.6	1.6	
1970	New Hope Pond (EFPC)	Sanders, 1970	1	---	63	63	
Jul-74	Poplar Cr Mile 0-1	Elwood, 1984	1	---	20	20	
Jul-74	Clinch River Mile 12.3-13.5	Elwood, 1984	1	<0.1	<0.1	<0.1	
Jul-74	Poplar Cr Mile 1-2	Elwood, 1984	2	3	20	11.5	
Jul-74	Poplar Cr Mile 2-3	Elwood, 1984	2	5	10	7.5	
Jul-74	Poplar Cr Mile 4-5.2	Elwood, 1984	2	10	30	20	
Jul-75	Poplar Cr Mile 0-1	Elwood, 1984	23	<0.1	20	8.6	
Jul-75	Clinch River Mile 12.3-13.5	Elwood, 1984	5	<0.1	<0.1	<0.1	
Jul-75	Poplar Cr Mile 1-2	Elwood, 1984	15	<0.1	300	45	
Jul-75	Poplar Cr Mile 2-3	Elwood, 1984	23	<0.1	30	8.9	
Jul-75	Poplar Cr Mile 3-4	Elwood, 1984	14	<0.1	20	4.6	
Jul-75	Poplar Cr Mile 4-5.2	Elwood, 1984	20	<0.1	10	3.4	
Jul-75	Poplar Cr Mile 6-10	Elwood, 1984	4	<0.1	<0.1	<0.1	
Nov-75	Clinch River Mile 12.3-13.5	Elwood, 1984	1	<0.1	<0.1	<0.1	
Nov-75	Poplar Cr Mile 0-1	Elwood, 1984	3	2	10	5.7	
Nov-75	Poplar Cr Mile 1-2	Elwood, 1984	2	4	10	7	
Nov-75	Poplar Cr Mile 2-3	Elwood, 1984	4	<0.1	2	1.2	
Nov-75	Poplar Cr Mile 4-5.2	Elwood, 1984	8	<0.1	250	65.5	
Jul-76	Clinch River Mile 12.3-13.5	Elwood, 1984	1	<0.1	<0.1	<0.1	
Jul-76	Poplar Cr Mile 0-1	Elwood, 1984	3	---	---	2.0	
Jul-76	Poplar Cr Mile 1-2	Elwood, 1984	2	5	10	7.5	
Jul-76	Poplar Cr Mile 2-3	Elwood, 1984	4	1	10	7.8	
Jul-76	Poplar Cr Mile 4-5.2	Elwood, 1984	9	1	10	3.3	
Nov-76	Clinch River Mile 11	Elwood, 1984	1	20	20	20	
Nov-76	Clinch River Mile 12.3-13.5	Elwood, 1984	1	0.1	0.1	0.1	
Nov-76	Poplar Cr Mile 0-1	Elwood, 1984	3	2	20	8	
Nov-76	Poplar Cr Mile 1-2	Elwood, 1984	2	2	10	6	
Nov-76	Poplar Cr Mile 2-3	Elwood, 1984	3	0.5	125	45.2	
Nov-76	Poplar Cr Mile 4-5.2	Elwood, 1984	8	<0.1	100	21.2	
May-82	EFPC Mile 1.3	Van Winkle et al., 1984	1	---	19	19	<0.125-mm size fraction
May-82	EFPC Mile 13.8	Van Winkle et al., 1984	1	---	127	127	<0.125-mm size fraction
May-82	EFPC Mile 14.1	Van Winkle et al., 1984	1	---	62	62	<0.125-mm size fraction
May-82	EFPC Mile 14.2	Van Winkle et al., 1984	1	---	90	90	<0.125-mm size fraction
May-82	EFPC Mile 4.8	Van Winkle et al., 1984	1	---	32	32	<0.125-mm size fraction
May-82	EFPC Mile 6.8	Van Winkle et al., 1984	1	---	30	30	<0.125-mm size fraction
May-82	EFPC Mile 8.3	Van Winkle et al., 1984	1	---	55	55	<0.125-mm size fraction
6/20/84	EFPC Floodplain- Mile 1.2 (17 ft from center of creek)	TVA, 1985b	2	8.3	15	12	1-9 cm core; avg. of <62 µm and <500 µm fraction
6/20/84	EFPC Floodplain- Mile 1.2 (17 ft from center of creek)	TVA, 1985b	2	0.89	1.0	0.95	10-18 cm core; avg. of <62 µm and <500 µm fraction
6/20/84	EFPC Floodplain- Mile 1.2 (17 ft from center of creek)	TVA, 1985b	2	0.8	0.9	0.85	19-36 cm core; avg. of <62 µm and <500 µm fraction
6/20/84	EFPC Floodplain- Mile 1.2 (17 ft from center of creek)	TVA, 1985b	2	0.42	0.58	0.50	37-41 cm core; avg. of <62 µm and <500 µm fraction
6/20/84	EFPC Floodplain- Mile 1.2 (17 ft from center of creek)	TVA, 1985b	2	0.1	0.1	0.1	42-45 cm core; avg. of <62 µm and <500 µm fraction
6/20/84	EFPC Mile 1.2 (center of creek)	TVA, 1985b	1	---	22	22	Surface; <500 µm fraction
6/22/84	EFPC Mile 2.36 (center of creek)	TVA, 1985b	2	10	12	11	Surface; <500 µm fraction
6/28/84	EFPC Mile 0.23 (center of creek)	TVA, 1985b	2	42	69	56	1-6 cm core; avg. of <62 µm and <500 µm fraction
6/28/84	EFPC Mile 0.23 (center of creek)	TVA, 1985b	2	0.7	0.75	0.73	7-10 cm core; avg. of <62 µm and <500 µm fraction
9/21/84	EFPC Floodplain- Mile 0.23 (175 ft from center of creek)	TVA, 1985b	1	---	0.53	0.53	1-10 cm core; <500 µm fraction
9/21/84	EFPC Floodplain- Mile 0.23 (75 ft from center of creek)	TVA, 1985b	2	2.5	2.9	2.7	1-8 cm core; avg. of <62 µm and <500 µm fraction
9/21/84	EFPC Floodplain- Mile 0.23 (75 ft from center of creek)	TVA, 1985b	1	---	9.6	9.6	1-9 cm core; <500 µm fraction
9/21/84	EFPC Floodplain- Mile 0.23 (75 ft from center of creek)	TVA, 1985b	1	---	0.95	0.95	10-18 cm core; <500 µm fraction
9/21/84	EFPC Floodplain- Mile 1.35 (151 ft from center of creek)	TVA, 1985b	2	21.4	31	26	1-9 cm core; avg. of <62 µm and <500 µm fraction
9/21/84	EFPC Floodplain- Mile 1.35 (151 ft from center of creek)	TVA, 1985b	1	---	160	160	10-18 cm core; <500 µm fraction
9/21/84	EFPC Floodplain- Mile 1.35 (251 ft from center of creek)	TVA, 1985b	1	---	39	39	1-9 cm core; <500 µm fraction

Table J-2: Concentrations of Mercury Measured in Sediment Downstream from Y-12

Date	Location	Study	Number of Samples	Minimum (mg/kg, dry)	Maximum (mg/kg, dry)	Mean (mg/kg, dry)	Comments
9/21/84	EFPC Floodplain- Mile 1.35 (251 ft from center of creek)	TVA, 1985b	1	---	5.2	5.2	10-18 cm core; <500 µm fraction
9/21/84	EFPC Floodplain- Mile 1.35 (351 ft from center of creek)	TVA, 1985b	1	---	2.2	2.2	1-8 cm core; <500 µm fraction
9/21/84	EFPC Floodplain- Mile 1.35 (51 ft from center of creek)	TVA, 1985b	4	68.9	120	92	1-9 cm core; avg. of <62 µm and <500 µm fractions
9/21/84	EFPC Floodplain- Mile 1.35 (51 ft from center of creek)	TVA, 1985b	3	74	160	131	10-18 cm core; <500 µm fraction
9/21/84	EFPC Mile 0.23 (center of creek)	TVA, 1985b	2	26.4	30	28	Surface; avg. of <62 µm and <500 µm fraction
9/21/84	EFPC Mile 1.35 (center of creek)	TVA, 1985b	2	8.3	14	11	Surface; avg. of <62 µm and <500 µm fractions
9/21/84	EFPC Mile 2.36 (center of creek)	TVA, 1985b	2	17.9	34	26	Surface; avg. of <62 µm and <500 µm fractions
11/6/84	EFPC Floodplain- Mile 1.35 (151 ft from center of creek)	TVA, 1985b	1	---	22	22	1-9 cm core; <500 µm fraction
11/6/84	EFPC Floodplain- Mile 1.35 (151 ft from center of creek)	TVA, 1985b	1	---	140	140	10-18 cm core; <500 µm fraction
11/6/84	EFPC Floodplain- Mile 1.35 (151 ft from center of creek)	TVA, 1985b	1	---	1.5	1.5	19-27 cm core; <500 µm fraction
11/6/84	EFPC Floodplain- Mile 1.35 (151 ft from center of creek)	TVA, 1985b	1	---	0.47	0.47	28-36 cm core; <500 µm fraction
11/6/84	EFPC Floodplain- Mile 1.35 (51 ft from center of creek)	TVA, 1985b	1	---	40	40	1-9 cm core; <500 µm fraction
11/6/84	EFPC Floodplain- Mile 1.35 (51 ft from center of creek)	TVA, 1985b	1	---	8.3	8.3	19-27 cm core; <500 µm fraction
11/6/84	EFPC Floodplain- Mile 1.35 (51 ft from center of creek)	TVA, 1985b	1	---	0.55	0.55	28-36 cm core; <500 µm fraction
11/6/84	EFPC Floodplain- Mile 1.35 (51 ft from center of creek)	TVA, 1985b	1	---	0.25	0.25	37-45 cm core; <500 µm fraction
Jan-85	Clinch River below Poplar Creek	Ashwood et al., 1986	3	0.7	5.3	2.3	Surface sediment grab samples
Jan-85	Clinch River below Poplar Creek	Ashwood et al., 1986	1	---	4.2	4.2	0-4 cm core
Jan-85	EFPC near Poplar Creek	Ashwood et al., 1986	2	3.5	45	24	Surface sediment grab samples
Jan-85	EFPC near Poplar Creek	Ashwood et al., 1986	1	---	20.7	20.7	0-4 cm core
Jan-85	Poplar Creek	Ashwood et al., 1986	15	<0.1	25.6	6.9	Surface sediment grab samples
Jan-85	Poplar Creek	Ashwood et al., 1986	1	---	3.1	3.1	0-4 cm core
June, 1985	Poplar Creek near Blair Road Bridge	Olsen & Cutshall, 1985	1 core (14 depths)	2.2	460	---	Max. at depth of 80-84 cm in 1 m core
June, 1985	Soil near Blair Road Bridge on Poplar Creek	Olsen & Cutshall, 1985	1 core (11 depths)	<1.0	8.1	---	Max. at depth of 2-6 cm in 0.66 m core
1990	Clinch River (mouth to Poplar Cr confluence)	Cook et al., 1992	52	0.061	160.00	9.66 (SD = 23.12)	Sediment cores
1990	Poplar Cr (mouth to EFPC confluence)	Cook et al., 1992	28	0.3	4.59	0.38 (SD = 1.0)	Sediment cores
1990	Watts Bar Reservoir	Cook et al., 1992	51	0.09	10.93	1.86 (SD = 2.43)	Sediment cores
May/June, 1990	K-25 Water Intake (CRM 13)	TVA, 1991b	5 (composited)	0.45	---	0.45	Composited sediment cores (depth not given)
May/June, 1990	Riley Creek Recreation Area (TRM 570)	TVA, 1991b	5 (composited)	<0.10	---	<0.10	Composited sediment cores (depth not given)
May/June, 1990	City of Kingston Municipal Intake (TRM 568.4)	TVA, 1991b	5 (composited)	2.5	---	2.5	Composited sediment cores (depth not given)
May/June, 1990	Southwest Point Park (TRM 568)	TVA, 1991b	5 (composited)	0.15	---	0.15	Composited sediment cores (depth not given)
May/June, 1990	Roane County Park (TRM 562.5)	TVA, 1991b	5 (composited)	<0.10	---	<0.10	Composited sediment cores (depth not given)
May/June, 1990	Rockwood Water Treatment Plant Intake (TRM 552.5)	TVA, 1991b	5 (composited)	<0.10	---	<0.10	Composited sediment cores (depth not given)
May/June, 1990	Eagle Lodge (TRM 545)	TVA, 1991b	5 (composited)	<0.10	---	<0.10	Composited sediment cores (depth not given)
May/June, 1990	Campground on the Lakeshore (TRM 540.5)	TVA, 1991b	5 (composited)	<0.10	---	<0.10	Composited sediment cores (depth not given)
May/June, 1990	Hornsby Hollow Recreation Area (TRM 539.5)	TVA, 1991b	5 (composited)	<0.10	---	<0.10	Composited sediment cores (depth not given)
May/June, 1990	Fooshee Pass Recreation Area (TRM 538)	TVA, 1991b	5 (composited)	0.15	---	0.15	Composited sediment cores (depth not given)
May/June, 1990	Sand Island Recreation Area (TRM 538)	TVA, 1991b	5 (composited)	0.15	---	0.15	Composited sediment cores (depth not given)
May/June, 1990	Watts Bar Dam Recreation Area (TRM 530)	TVA, 1991b	5 (composited)	<0.10	---	<0.10	Composited sediment cores (depth not given)
May/June, 1990	Watts Bar Nuclear Plant Intake (TRM 528)	TVA, 1991b	5 (composited)	<0.10	---	<0.10	Composited sediment cores (depth not given)
1982	Watts Bar Reservoir (TRM 531.0)	TVA, 1986a	9 (composited)	---	0.62	0.62	Reservoir forebay sediments; top 3 inches of cores

Table J-3: Summary of Mercury Concentrations Measured in Fish Downstream from Y-12

Date	Location	Study	Yr-Loc-Fish	Minimum (mg/kg, fresh)	Maximum (mg/kg, fresh)	Mean (mg/kg, fresh)	Mean Wt (g)
May/June/Oct, 1976	Clinch R Mile 10.5 - 11.5	Elwood, 1984	1976, Clinch River, Bigmouth buffalo	---	0.61	0.61	ND
May/June/Oct, 1976	Clinch R Mile 12.0 (PC Mouth)	Elwood, 1984	1976, Clinch River, Bigmouth buffalo	1.68	2.08	1.88	ND
May/June/Oct, 1976	Clinch R Mile 12.4 - 13.5	Elwood, 1984	1976, Clinch River, Bigmouth buffalo	---	0.61	0.61	ND
May/June/Oct, 1976	Clinch R Mile 9.5 - 10.5	Elwood, 1984	1976, Clinch River, Bigmouth buffalo	0.04	0.2	0.12	ND
May/June/Oct, 1976	Clinch R Mile 4.5 - 5.5	Elwood, 1984	1976, Clinch River, Bluegill	---	---	0.05	118
May/June/Oct, 1976	Clinch R Mile 9.5 - 10.5	Elwood, 1984	1976, Clinch River, Bluegill	---	---	0.10	118
May/June/Oct, 1976	Clinch R Mile 10.5 - 11.5	Elwood, 1984	1976, Clinch River, Bluegill	---	---	0.13	118
May/June/Oct, 1976	Clinch R Mile 12.0 (PC Mouth)	Elwood, 1984	1976, Clinch River, Bluegill	---	---	0.23	118
May/June/Oct, 1976	Clinch R Mile 12.4 - 13.5	Elwood, 1984	1976, Clinch River, Bluegill	---	---	0.10	118
May/June/Oct, 1976	Clinch R Mile 10.5 - 11.5	Elwood, 1984	1976, Clinch River, Carp	---	0.07	0.07	ND
May/June/Oct, 1976	Clinch R Mile 12.0 (PC Mouth)	Elwood, 1984	1976, Clinch River, Carp	0.18	0.5	0.34	ND
May/June/Oct, 1976	Clinch R Mile 12.4 - 13.5	Elwood, 1984	1976, Clinch River, Carp	0.17	0.23	0.2	ND
May/June/Oct, 1976	Clinch R Mile 4.5 - 5.5	Elwood, 1984	1976, Clinch River, Carp	0.14	0.26	0.15	ND
May/June/Oct, 1976	Clinch R Mile 9.5 - 10.5	Elwood, 1984	1976, Clinch River, Carp	0.15	0.39	0.27	ND
May/June/Oct, 1976	Clinch R Mile 4.5 - 5.5	Elwood, 1984	1976, Clinch River, Largemouth bass	---	---	0.13	210
May/June/Oct, 1976	Clinch R Mile 9.5 - 10.5	Elwood, 1984	1976, Clinch River, Largemouth bass	---	---	0.09	210
May/June/Oct, 1976	Clinch R Mile 10.5 - 11.5	Elwood, 1984	1976, Clinch River, Largemouth bass	---	---	0.24	210
May/June/Oct, 1976	Clinch R Mile 12.0 (PC Mouth)	Elwood, 1984	1976, Clinch River, Largemouth bass	---	---	0.54	210
May/June/Oct, 1976	Clinch R Mile 12.4 - 13.5	Elwood, 1984	1976, Clinch River, Largemouth bass	---	---	0.19	210
May/June/Oct, 1976	Clinch R Mile 10.5 - 11.5	Elwood, 1984	1976, Clinch River, Sucker	0.14	0.42	0.28	ND
May/June/Oct, 1976	Clinch R Mile 4.5 - 5.5	Elwood, 1984	1976, Clinch River, Sucker	ND	0.44	0.21	ND
May/June/Oct, 1976	Clinch R Mile 4.5 - 5.5	Elwood, 1984	1976, Clinch River, White crappie	---	0.03	0.03	ND
May/June/Oct, 1976	Clinch R Mile 9.5 - 10.5	Elwood, 1984	1976, Clinch River, White crappie	0.02	0.08	0.05	ND
			Clinch River average (1976)		**2.1**	**0.29**	
April, 1977	Clinch R Mile 10.5	Loar et al., 1981a	1977, Clinch River, Bluegill	0.15	0.30	0.22	31.5
April, 1977	Clinch R Mile 10.5	Loar et al., 1981a	1977, Clinch River, Gizzard shad	0.02	0.05	0.04	249
April, 1977	Clinch R Mile 11.5	Loar et al., 1981a	1977, Clinch River, Gizzard shad	0.03	0.13	0.06	221
April/May, 1977	Clinch R Mile 15.0	Loar et al., 1981a	1977, Clinch River, Gizzard shad	0.04	0.10	0.07	235
April, 1977	Clinch R Mile 10.5	Loar et al., 1981a	1977, Clinch River, Largemouth bass	0.04	0.15	0.08	61.4
Oct/Nov, 1977	Clinch R Mile 10.5	Loar et al., 1981a	1977, Clinch River, Largemouth bass	0.16	0.65	0.32	284
November, 1977	Clinch R Mile 11.5	Loar et al., 1981a	1977, Clinch River, Largemouth bass	0.40	0.47	0.44	328
November, 1977	Clinch R Mile 15.0	Loar et al., 1981a	1977, Clinch River, Largemouth bass	0.07	0.37	0.24	102
April, 1977	Clinch R Mile 10.5	Loar et al., 1981a	1977, Clinch River, Lepomis	0.05	0.28	0.16	69.4
April, 1977	Clinch R Mile 11.5	Loar et al., 1981a	1977, Clinch River, Lepomis	0.15	0.51	0.49	84.5
Oct/Nov, 1977	Clinch R Mile 10.5	Loar et al., 1981a	1977, Clinch River, Lepomis	0.04	0.37	0.16	11.8
November, 1977	Clinch R Mile 11.5	Loar et al., 1981a	1977, Clinch River, Lepomis	0.08	0.65	0.36	56.2
November, 1977	Clinch R Mile 15.0	Loar et al., 1981a	1977, Clinch River, Lepomis	<0.02	1.51	0.53	34.2
Oct/Nov, 1977	Clinch R Mile 10.5	Loar et al., 1981a	1977, Clinch River, Redbreast sunfish	---	0.20	0.20	125.2
November, 1977	Clinch R Mile 11.5	Loar et al., 1981a	1977, Clinch River, Redbreast sunfish	0.19	0.32	0.26	101
April, 1977	Clinch R Mile 11.5	Loar et al., 1981a	1977, Clinch River, Rock bass	---	0.33	0.33	63.8
April/May, 1977	Clinch R Mile 15.0	Loar et al., 1981a	1977, Clinch River, Sauger	---	0.29	0.29	660.2
Oct/Nov, 1977	Clinch R Mile 10.5	Loar et al., 1981a	1977, Clinch River, Sauger	0.29	0.72	0.48	693
April, 1977	Clinch R Mile 10.5	Loar et al., 1981a	1977, Clinch River, Spotted sucker	---	0.08	0.08	747

Table J-3: Summary of Mercury Concentrations Measured in Fish Downstream from Y-12

Date	Location	Study	Yr-Loc-Fish	Minimum (mg/kg, fresh)	Maximum (mg/kg, fresh)	Mean (mg/kg, fresh)	Mean Wt (g)
Oct/Nov, 1977	Clinch R Mile 10.5	Loar et al., 1981a	1977, Clinch River, Striped bass	0.04	0.16	0.08	87.6
Oct/Nov, 1977	Clinch R Mile 10.5	Loar et al., 1981a	1977, Clinch River, White bass	0.04	0.08	0.06	65.1
November, 1977	Clinch R Mile 11.5	Loar et al., 1981a	1977, Clinch River, White bass	0.08	0.18	0.13	56.8
November, 1977	Clinch R Mile 15.0	Loar et al., 1981a	1977, Clinch River, White bass	0.03	0.05	0.04	64.1
November, 1977	Clinch R Mile 11.5	Loar et al., 1981a	1977, Clinch River, White crappie	---	0.33	0.33	64.3
			Clinch River average (1977)		**1.5**	**0.23**	
December, 1979	Clinch R Mile 19.0	Loar et al., 1981b	1979, Clinch River, Bluegill	0.030	0.115	0.064	85.6
December, 1979	Clinch R Mile 21.9	Loar et al., 1981b	1979, Clinch River, Bluegill	0.037	1.07	0.21	77.2
December, 1979	Clinch R Mile 52 (MH Res)	Loar et al., 1981b	1979, Clinch River, Bluegill	0.031	0.077	0.061	89.7
March, 1979	Clinch R Mile 19.0	Loar et al., 1981b	1979, Clinch River, Sauger	0.054	0.129	0.077	488
March, 1979	Clinch R Mile 21.9	Loar et al., 1981b	1979, Clinch River, Sauger	0.063	0.197	0.103	576
March, 1979	Clinch R Mile 19.0	Loar et al., 1981b	1979, Clinch River, Striped bass	0.085	0.22	0.134	1250
March, 1979	Clinch R Mile 19.0	Loar et al., 1981b	1979, Clinch River, Yellow bass	0.076	0.148	0.10	98
			Clinch River average (1979)		**1.1**	**0.11**	
May/June 1984	Clinch R Mile 6.0	TVA, 1985e	1984, Clinch River, Bluegill	0.12	0.33	0.19	66.2
May/June 1984	Clinch R Mile 11.0	TVA, 1985e	1984, Clinch River, Bluegill	<0.10	0.40	0.17	92.1
May/June 1984	Clinch R Mile 2.0	TVA, 1985e	1984, Clinch River, Bluegill	<0.10	0.13	0.065	83
May/June 1984	Clinch R Mile 6.0	TVA, 1985e	1984, Clinch River, Largemouth bass	0.20	0.56	0.31	1350
May/June 1984	Clinch R Mile 11.0	TVA, 1985e	1984, Clinch River, Largemouth bass	0.19	0.58	0.34	1058
May/June 1984	Clinch R Mile 2.0	TVA, 1985e	1984, Clinch River, Largemouth bass	<0.10	0.26	0.12	660
May/June 1984	Clinch R Mile 11.0	TVA, 1985e	1984, Clinch River, Smallmouth buffalo	<0.10	1.2	0.48	1988
			Clinch River average (1984)		**1.2**	**0.24**	
1990	Clinch R Mile 9.5	Cook et al., 1992	1990, Clinch River, Bluegill, Channel catfish, Largemouth bass	0.186	0.77	0.43	ND
1990	Clinch R Mile 0.5	Cook et al., 1992	1990, Clinch River, Bluegill, Channel catfish, Largemouth bass	0.044	0.22	0.11	ND
			Clinch River average (1990)		**0.77**	**0.27**	
1970	Pond/ EFPC	Sanders, 1970	1970, EFPC, Bluegill	0.41	1.3	0.76	ND
1970	EFPoplar Cr Mile 14.2	Sanders, 1970	1970, EFPC, Carp	---	0.32	0.32	ND
1970	Pond/ EFPC	Sanders, 1970	1970, EFPC, Carp	---	0.57	0.57	ND
			EFPC average (1970)		**1.3**	**0.55**	
May, 1982	EFPoplar Cr Mile 1.3	Van Winkle et al., 1984	1982, EFPC, Bluegill, Largemouth bass, White bass	0.32	0.72	0.56	32.5
May, 1982	EFPoplar Cr Mile 14.1	Van Winkle et al., 1984	1982, EFPC, Bluegill, Largemouth bass, White bass	0.66	2.5	1.56	61.1
May, 1982	EFPoplar Cr Mile 14.2	Van Winkle et al., 1984	1982, EFPC, Bluegill, Largemouth bass, White bass	1.7	3.6	2.13	62.7
May, 1982	EFPoplar Cr Mile 8.3	Van Winkle et al., 1984	1982, EFPC, Bluegill, Largemouth bass, White bass	0.73	2.2	1.39	54.6
			EFPC average (1982)		**3.6**	**1.4**	
1983	Golf Course Pond (nr EFPC)	Blaylock, 1983	1983, EFPC, Bluegill	0.17	0.60	0.29	81
1983	Scarboro Pond (nr EFPC)	Blaylock, 1983	1983, EFPC, Bluegill	0.20	0.24	0.22	91.9
1983	Lower Tuskegee Crk (nr EFPC)	Blaylock, 1983	1983, EFPC, Central stoneroller	---	0.16	0.16	15
1983	Lower Tuskegee Crk (nr EFPC)	Blaylock, 1983	1983, EFPC, Creek club	0.10	0.20	0.16	38.6
1983	Scarboro Pond (nr EFPC)	Blaylock, 1983	1983, EFPC, Largemouth bass	0.28	0.74	0.42	77.3
1983	Lower Tuskegee Crk (nr EFPC)	Blaylock, 1983	1983, EFPC, Red breast sunfish	0.31	0.56	0.44	63.4
			EFPC average (1983)		**0.74**	**0.28**	
May/June 1984	EFPC Mile 4.0	TVA, 1985e	1984, EFPC, Black redhorse	---	0.57	0.57	671
May/June 1984	EFPC Mile 8.8	TVA, 1985e	1984, EFPC, Bluegill	0.51	1.0	0.80	55.9

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Date	Location	Study	Yr-Loc-Fish	Minimum (mg/kg, fresh)	Maximum (mg/kg, fresh)	Mean (mg/kg, fresh)	Mean Wt (g)
May/June 1984	EFPC Mile 4.0	TVA, 1985e	1984, EFPC, Bluegill	<0.10	1.2	0.75	88.5
May/June 1984	EFPC Mile 13.8	TVA, 1985e	1984, EFPC, Bluegill	---	0.54	0.54	ND
May/June 1984	EFPC Mile 13.8	TVA, 1985e	1984, EFPC, Bluegill	0.5	1.1	0.8	ND
May/June 1984	EFPC Mile 1.7	TVA, 1985e	1984, EFPC, Bluegill	0.6	0.6	0.6	ND
May/June 1984	EFPC Mile 13.8	TVA, 1985e	1984, EFPC, Carp	0.21	1.3	0.77	2193
May/June 1984	EFPC Mile 13.8	TVA, 1985e	1984, EFPC, Carp	0.2	0.2	0.2	ND
May/June 1984	EFPC Mile 1.7	TVA, 1985e	1984, EFPC, Carp	0.8	0.9	0.85	ND
May/June 1984	EFPC Mile 4.0	TVA, 1985e	1984, EFPC, Gissard shad	---	0.12	0.12	27.2
May/June 1984	EFPC Mile 4.0	TVA, 1985e	1984, EFPC, Green sunfish	---	0.52	0.52	31.8
May/June 1984	EFPC Mile 13.8	TVA, 1985e	1984, EFPC, Largemouth bass	0.8	1.2	1.2	294
May/June 1984	EFPC Mile 8.8	TVA, 1985e	1984, EFPC, Redbreast	0.65	1.4	0.96	71.2
May/June 1984	EFPC Mile 4.0	TVA, 1985e	1984, EFPC, Redbreast	0.62	0.70	0.65	45.4
May/June 1984	EFPC Mile 4.0	TVA, 1985e	1984, EFPC, Rockbass	---	1.0	1.0	118
May/June 1984	EFPC Mile 4.0	TVA, 1985e	1984, EFPC, Warmouth	---	0.96	0.96	104
May/June 1984	EFPC Mile 4.0	TVA, 1985e	1984, EFPC, White sucker	0.54	1.4	0.97	376
May/June 1984	EFPC Mile 4.0	TVA, 1985e	1984, EFPC, Yellow perch	---	0.93	0.93	49.9
			EFPC average (1984)		**1.4**	**0.73**	
May/June/Oct, 1976	Poplar Cr Mile 0 - 6.0	Elwood, 1984	1976, Poplar Creek, Bigmouth buffalo	0.06	1.36	0.71	ND
May/June/Oct, 1976	Poplar Cr Mile 0 - 6.0	Elwood, 1984	1976, Poplar Creek, Bluegill	---	---	0.40	118
May/June/Oct, 1976	Poplar Cr Mile 0 - 6.0	Elwood, 1984	1976, Poplar Creek, Carp	0.25	0.71	0.48	ND
May/June/Oct, 1976	Poplar Cr Mile 0 - 6.0	Elwood, 1984	1976, Poplar Creek, Largemouth bass	---	---	0.73	210
May/June/Oct, 1976	Poplar Cr Mile 0 - 6.0	Elwood, 1984	1976, Poplar Creek, Sucker	0.13	0.41	0.27	ND
May/June/Oct, 1976	Poplar Cr Mile 0 - 6.0	Elwood, 1984	1976, Poplar Creek, White crappie	0.2	0.64	0.42	ND
			Poplar Creek average (1976)		**1.4**	**0.50**	
April, 1977	Poplar Cr Mile 11.0	Loar et al., 1981a	1977, Poplar Creek, Bluegill	0.03	0.32	0.10	27
April/May, 1977	Poplar Cr Mile 0.5	Loar et al., 1981a	1977, Poplar Creek, Bluegill	0.07	0.39	0.19	42.3
April/May, 1977	Poplar Cr Mile 5.5	Loar et al., 1981a	1977, Poplar Creek, Bluegill	0.04	0.38	0.17	31
April, 1977	Poplar Cr Mile 11.0	Loar et al., 1981a	1977, Poplar Creek, Channel catfish	---	0.04	0.04	39
April/May, 1977	Poplar Cr Mile 0.5	Loar et al., 1981a	1977, Poplar Creek, Channel catfish	0.08	0.44	0.24	757
April/May, 1977	Poplar Cr Mile 5.5	Loar et al., 1981a	1977, Poplar Creek, Channel catfish	0.34	0.61	0.52	926
April, 1977	Poplar Cr Mile 11.0	Loar et al., 1981a	1977, Poplar Creek, Freshwater drum	---	0.15	0.15	144
April/May, 1977	Poplar Cr Mile 5.5	Loar et al., 1981a	1977, Poplar Creek, Freshwater drum	0.16	0.18	0.17	348
April, 1977	Poplar Cr Mile 11.0	Loar et al., 1981a	1977, Poplar Creek, Gizzard shad	0.03	0.05	0.04	191
April/May, 1977	Poplar Cr Mile 0.5	Loar et al., 1981a	1977, Poplar Creek, Gizzard shad	0.02	0.21	0.05	275
April/May, 1977	Poplar Cr Mile 5.5	Loar et al., 1981a	1977, Poplar Creek, Gizzard shad	0.03	0.08	0.04	299
April, 1977	Poplar Cr Mile 11.0	Loar et al., 1981a	1977, Poplar Creek, Largemouth bass	---	0.2	0.2	221
April/May, 1977	Poplar Cr Mile 0.5	Loar et al., 1981a	1977, Poplar Creek, Largemouth bass	0.04	0.51	0.20	74.1
April/May, 1977	Poplar Cr Mile 5.5	Loar et al., 1981a	1977, Poplar Creek, Largemouth bass	1.67	2.14	1.9	189
November, 1977	Poplar Cr Mile 0.5	Loar et al., 1981a	1977, Poplar Creek, Largemouth bass	0.55	0.87	0.71	45.1
April, 1977	Poplar Cr Mile 11.0	Loar et al., 1981a	1977, Poplar Creek, Lepomis	0.02	0.06	0.04	13
April/May, 1977	Poplar Cr Mile 0.5	Loar et al., 1981a	1977, Poplar Creek, Lepomis	---	0.10	0.10	77.9
April/May, 1977	Poplar Cr Mile 5.5	Loar et al., 1981a	1977, Poplar Creek, Lepomis	0.06	0.51	0.29	28

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Date	Location	Study	Yr-Loc-Fish	Minimum (mg/kg, fresh)	Maximum (mg/kg, fresh)	Mean (mg/kg, fresh)	Mean Wt (g)
November, 1977	Poplar Cr Mile 0.5	Loar et al., 1981a	1977, Poplar Creek, Lepomis	0.29	1.1	0.62	52.1
November, 1977	Poplar Cr Mile 5.5	Loar et al., 1981a	1977, Poplar Creek, Lepomis	0.11	0.98	0.43	53.5
April/May, 1977	Poplar Cr Mile 0.5	Loar et al., 1981a	1977, Poplar Creek, Longnose gar	0.32	0.98	0.67	2015
April/May, 1977	Poplar Cr Mile 5.5	Loar et al., 1981a	1977, Poplar Creek, Longnose gar	---	0.62	0.62	2384
April/May, 1977	Poplar Cr Mile 0.5	Loar et al., 1981a	1977, Poplar Creek, Silver redhorse	0.15	0.16	0.16	498
April, 1977	Poplar Cr Mile 11.0	Loar et al., 1981a	1977, Poplar Creek, Spotted bass	0.02	0.3	0.16	5
April/May, 1977	Poplar Cr Mile 0.5	Loar et al., 1981a	1977, Poplar Creek, Spotted gar	0.30	0.52	0.41	1022
April/May, 1977	Poplar Cr Mile 5.5	Loar et al., 1981a	1977, Poplar Creek, Spotted gar	---	0.37	0.37	1589
April/May, 1977	Poplar Cr Mile 0.5	Loar et al., 1981a	1977, Poplar Creek, Spotted sucker	0.07	0.09	0.08	409
April/May, 1977	Poplar Cr Mile 0.5	Loar et al., 1981a	1977, Poplar Creek, Striped bass	0.08	0.21	0.14	167
April, 1977	Poplar Cr Mile 11.0	Loar et al., 1981a	1977, Poplar Creek, White bass	0.10	0.21	0.17	410
April/May, 1977	Poplar Cr Mile 0.5	Loar et al., 1981a	1977, Poplar Creek, White bass	0.06	0.23	0.17	370
April/May, 1977	Poplar Cr Mile 5.5	Loar et al., 1981a	1977, Poplar Creek, White bass	0.13	0.59	0.19	492
November, 1977	Poplar Cr Mile 0.5	Loar et al., 1981a	1977, Poplar Creek, White bass	0.04	0.30	0.16	92.1
April/May, 1977	Poplar Cr Mile 0.5	Loar et al., 1981a	1977, Poplar Creek, White crappie	0.04	0.14	0.08	82.2
April/May, 1977	Poplar Cr Mile 5.5	Loar et al., 1981a	1977, Poplar Creek, White crappie	0.19	0.37	0.28	111
November, 1977	Poplar Cr Mile 0.5	Loar et al., 1981a	1977, Poplar Creek, White crappie	---	0.13	0.13	300.2
November, 1977	Poplar Cr Mile 5.5	Loar et al., 1981a	1977, Poplar Creek, White crappie	0.29	0.81	0.66	65.4
			Poplar Creek average (1977)		**2.1**	**0.30**	
1982	"PC-2"	Stiff, 1982	1982, Poplar Creek, Blue catfish	0.06	0.07	0.065	416.5
1982	"PC-3"	Stiff, 1982	1982, Poplar Creek, Blue catfish	---	0.18	0.18	1313
1982	"PC-1"	Stiff, 1982	1982, Poplar Creek, Bluegill	0.07	0.32	0.20	55.9
1982	"PC-2"	Stiff, 1982	1982, Poplar Creek, Bluegill	0.33	0.69	0.44	40.1
1982	"PC-3"	Stiff, 1982	1982, Poplar Creek, Bluegill	0.21	0.78	0.39	90.2
1982	"PC-1"	Stiff, 1982	1982, Poplar Creek, Channel catfish	---	1.34	1.34	1256
1982	"PC-2"	Stiff, 1982	1982, Poplar Creek, Channel catfish	0.29	1.07	0.62	1100
1982	"PC-3"	Stiff, 1982	1982, Poplar Creek, Channel catfish	0.11	0.12	0.12	295
1982	"PC-2"	Stiff, 1982	1982, Poplar Creek, Crappie	0.31	0.63	0.44	128
1982	"PC-3"	Stiff, 1982	1982, Poplar Creek, Crappie	0.11	0.48	0.28	109
1982	"PC-1"	Stiff, 1982	1982, Poplar Creek, Drum	0.07	0.08	0.075	85.7
1982	"PC-2"	Stiff, 1982	1982, Poplar Creek, Drum	---	0.52	0.52	165.8
1982	"PC-3"	Stiff, 1982	1982, Poplar Creek, Drum	0.08	0.30	0.18	116
1982	"PC-1"	Stiff, 1982	1982, Poplar Creek, Hybrid	---	0.28	0.28	817
1982	"PC-2"	Stiff, 1982	1982, Poplar Creek, Largemouth bass	0.64	1.03	0.84	85.4
1982	"PC-3"	Stiff, 1982	1982, Poplar Creek, Largemouth bass	0.38	0.59	0.47	105
1982	"PC-3"	Stiff, 1982	1982, Poplar Creek, Sauger	0.24	0.70	0.45	613
1982	"PC-2"	Stiff, 1982	1982, Poplar Creek, Small mouth bass	---	0.58	0.58	29
1982	"PC-1"	Stiff, 1982	1982, Poplar Creek, Spotted bass	---	0.11	0.11	35.7
1982	"PC-1"	Stiff, 1982	1982, Poplar Creek, Striped bass	<0.05	0.08	0.053	88.5
1982	"PC-1"	Stiff, 1982	1982, Poplar Creek, White bass	---	<0.05	<0.05	315
1982	"PC-1"	Stiff, 1982	1982, Poplar Creek, Yellow bass	0.06	0.25	0.134	49.2
1982	"PC-2"	Stiff, 1982	1982, Poplar Creek, Yellow bass	0.07	0.52	0.29	40.5
1982	"PC-3"	Stiff, 1982	1982, Poplar Creek, Yellow catfish	0.06	0.15	0.11	606

Table J-3: Summary of Mercury Concentrations Measured in Fish Downstream from Y-12

Date	Location	Study	Yr-Loc-Fish	Minimum (mg/kg, fresh)	Maximum (mg/kg, fresh)	Mean (mg/kg, fresh)	Mean Wt (g)
			Poplar Creek (1982)		**1.3**	**0.35**	
May/June 1984	Poplar Cr. Mile 0.2	TVA, 1985e	1984, Poplar Creek, Bluegill	0.2	0.4	0.3	ND
May/June 1984	Poplar Cr. Mile 0.2	TVA, 1985e	1984, Poplar Creek, Carp	0.1	0.2	0.15	ND
May/June 1984	Poplar Cr. Mile 0.2	TVA, 1985e	1984, Poplar Creek, Channel catfish	<0.1	0.42	0.16	816
			Poplar Creek average (1984)		**0.42**	**0.20**	
1990	Poplar Cr Mile 5.3	Cook et al., 1992	1990, Poplar Creek, Bluegill, Channel catfish, Largemouth bass	0.202	0.88	0.57	ND
1990	Poplar Cr Mile 4.6	Cook et al., 1992	1990, Poplar Creek, Bluegill, Channel catfish, Largemouth bass	0.086	0.75	0.55	ND
1990	Poplar Cr Mile 1.4	Cook et al., 1992	1990, Poplar Creek, Bluegill, Channel catfish, Largemouth bass	0.072	0.56	0.34	ND
			Poplar Creek average (1990)		**0.88**	**0.49**	
May/June 1984	Tennessee River Mile 572.0	TVA, 1985e	1984, Watts Bar, Bluegill	<0.10	0.17	0.062	86.2
May/June 1984	Tennessee River Mile 558.0	TVA, 1985e	1984, Watts Bar, Bluegill	<0.10	0.18	0.078	67.6
May/June 1984	Tennessee River Mile 572.0	TVA, 1985e	1984, Watts Bar, Largemouth bass	<0.10	0.45	0.168	1508
May/June 1984	Tennessee River Mile 558.0	TVA, 1985e	1984, Watts Bar, Largemouth bass	<0.10	0.14	0.081	733
May/June 1984	Tennessee River Mile 572.0	TVA, 1985e	1984, Watts Bar, Paddel fish	---	<0.10	<0.10	449
May/June 1984	Tennessee River Mile 572.0	TVA, 1985e	1984, Watts Bar, Sauger	0.30	0.30	0.30	984
			Watts Bar average (1984)		**0.45**	**0.14**	
Dec-87	Clinch R Mile 20.0 (Watts Bar)	TVA, 1989	1987, Watts Bar, Channel catfish	---	---	<0.10	831
			Watts Bar average (1987)			**<0.10**	
1990	Tennessee River Mile 557.0	Cook et al., 1992	1990, Watts Bar, Bluegill, Channel catfish, Largemouth bass	0.033	0.16	0.06	ND
1990	Tennessee River Mile 530.5	Cook et al., 1992	1990, Watts Bar, Bluegill, Channel catfish, Largemouth bass	0.032	0.25	0.10	ND
			Watts Bar average (1990)		**0.25**	**0.080**	

Table J-4: Concentrations of Mercury Measured in Aquatic Biota (Other than Fish) Downstream from Y-12

Date	Location	Study	Type/ Species of Biota	Number of Samples	Minimum (mg/kg, fresh)	Maximum (mg/kg, fresh)	Mean (mg/kg, fresh)	Comments
1983	EFPC (btwn New Hope Pond & Tulsa Ave.)	Blaylock, 1983	Bullfrog	10	0.17	1.22	0.60	Mean wt = 216.1 g
1983	Golf Course Pond (nr EFPC)	Blaylock, 1983	Bullfrog	7	0.051	0.38	0.13	Mean wt = 54.2 g
1983	Scarboro Pond (nr EFPC)	Blaylock, 1983	Bullfrog	2	0.023	0.031	0.027	Mean wt = 54.4 g
1983	EFPC Mile 12.3	Blaylock, 1983	Crayfish	1	---	0.92	0.92	Mean wt = 14.4 g
1983	EFPC Mile 13.8	Blaylock, 1983	Crayfish	3	2.2	3.05	2.5	Mean wt = 12.0 g
1983	Golf Course Pond (nr EFPC)	Blaylock, 1983	Eastern painted turtle	1	---	0.056	0.056	Mean wt = 425 g
1983	EFPC (btwn New Hope Pond & Tulsa Ave.)	Blaylock, 1983	Snapping turtle	1	---	0.46	0.46	Mean wt = 406 g
1983	Lower Tuskegee Crk (nr EFPC)	Blaylock, 1983	Snapping turtle	1	---	0.058	0.058	Mean wt = 1183 g
1983	Upper Tuskegee Crk (nr EFPC)	Blaylock, 1983	Snapping turtle	1	---	0.12	0.12	Mean wt = 2438 g
June, 1983	E. Boundary Rd (btwn 0.8-2.5 miles from gate	Hibbitts, 1984	Turtle	2	0.0019	0.14	0.071	Muscle tissue
June, 1983	E. Boundary Rd (btwn 0.8-2.5 miles from gate	Hibbitts, 1984	Turtle	2	5.0	5.1	5.1	Liver tissue
October, 1983	Confluence of EFPC and Poplar Cr	Hibbitts, 1984	Turtle	7	0.0002	0.3	0.12	Muscle tissue
October, 1983	Confluence of EFPC and Poplar Cr	Hibbitts, 1984	Turtle	7	0.072	0.91	0.39	Liver tissue
May/June, 1984	EFPC Mile 8.8	TVA, 1985e	Snapping turtle	6	0.54	1.1	0.65	Mean wt = 2248 g
May/June, 1984	EFPC Mile 8.8	TVA, 1985e	Crayfish	1	---	0.62	0.62	Mean wt = 27.2 g
May/June, 1984	EFPC Mile 4.0	TVA, 1985e	Snapping turtle	5	0.41	1.4	1.0	Mean wt = 5444 g
May/June, 1984	EFPC Mile 4.0	TVA, 1985e	Crayfish	1	---	0.29	0.29	Mean wt = 22.7 g

Table J-5: Concentrations of Mercury Measured in Plants Downstream from Y-12 [a]

Date	Location	Study	Number of Samples	Minimum (mg/kg, fresh wt)	Maximum (mg/kg, fresh wt)	Mean (mg/kg, fresh wt)	Comments
May-82	EFPC Mile 8.3; 5 m from creek edge	Van Winkle et al., 1984	3	3.2	5.4	4.4	Dead foliage
May-82	EFPC Mile 8.3; 30 m from creek edge	Van Winkle et al., 1984	3	1.8	2.8	2.1	Dead foliage
May-82	EFPC Mile 8.3; 100 m from creek edge	Van Winkle et al., 1984	3	0.1	0.8	0.36	Dead foliage
May-82	EFPC Mile 8.3; 5 m from creek edge	Van Winkle et al., 1984	3	0.16	0.36	0.23	Live foliage
May-82	EFPC Mile 5.5; 30 m from creek edge	Van Winkle et al., 1984	3	<0.1	0.21	0.13	Live foliage
May-82	EFPC Mile 5.5; 5 m from creek edge	Van Winkle et al., 1984	3	6.3	7.8	7.0	Dead foliage
May-82	EFPC Mile 5.5; 30 m from creek edge	Van Winkle et al., 1984	3	0.29	0.68	0.42	Dead foliage
May-82	EFPC Mile 5.5; 5 m from creek edge	Van Winkle et al., 1984	3	<0.1	0.11	0.07	Live foliage
May-82	EFPC Mile 5.5; 30 m from creek edge	Van Winkle et al., 1984	3	<0.1	<0.1	<0.1	Live foliage

[a] Includes vegetation other than vegetables or pasture grass. Vegetation and pasture grass data collected by ORAU and SAIC are presented in Appendix T.

APPENDIX K

SUMMARY OF STUDIES OF MERCURY SPECIATION IN SOIL NEAR THE ORR

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APPENDIX K

SUMMARY OF STUDIES OF MERCURY SPECIATION IN SOIL NEAR THE ORR

This appendix describes several studies that have been conducted to attempt to identify the distribution of mercury species in soil in the East Fork Poplar Creek (EFPC) floodplain. Each study followed a different protocol, and the outcomes present somewhat differing conclusions regarding the species of mercury in floodplain soil. The study protocols and results are summarized briefly below and in Tables K-1 and K-2.

K.1 1984 Investigation of Mercury Speciation in EFPC Floodplain Soil, Revis et al. (1989)

The first study of mercury speciation in EFPC floodplain soil was conducted by Revis et al. (1989). In 1984, soil samples were collected from transects across the EFPC floodplain located at approximately EFPC Miles 10.8, 11.2, and 13.7. Along each transect, soil samples were collected at six sites (three sites on each side of the creek) and at each site, surface (0 to 15 cm) and subsurface (15 to 25 cm) soil samples were collected. Each sample was homogenized, and following sequential extraction, analyzed for total mercury, methylmercury, elemental mercury, and mercuric sulfide.

Total mercury was determined by digesting the samples with acid (Feldman, 1974). The mean recovery of mercury from soil spiked with mercuric chloride or mercuric sulfide was 98 ± 7% and 96 ± 9%, respectively.

Methylmercury was extracted using the method of Furutani and Rudd (1980). Based on this method, it was concluded that 0.003 to 0.01% of mercury was organic. The mean recovery of methylmercury from soil spiked with 100 ppb methyl mercuric iodide was 75% ± 14.

Mercuric sulfide was determined based on the assumption that while most species and compounds of mercury are soluble in nitric acid (HNO_3), mercuric sulfide is insoluble in nitric acid and in aqueous solution. The soil was extracted with strong nitric acid (12 N HNO_3) and the residue, assumed to be mercuric sulfide, was extracted using a saturated solution of sodium sulfide (Na_2S). Based on this method, it was determined that an average of 92% (range 84 to 98%) of mercury was mercuric sulfide. To determine the efficiency of this method, soils were spiked with mercuric sulfide or mercuric chloride. Nitric acid extracted 95% of mercuric chloride and less than 1% of mercuric sulfide. Sodium sulfide extracted 98% of mercuric sulfide and less than 1% of mercuric chloride.

Elemental mercury was determined by the loss of mercury vapors after heating soil at 150ᴺC for five days. After five days, the soil sample was digested with acids and total mercury was determined by cold vapor technique. These results were compared to the total mercury concentration in soil prior to heating. Based on this method, it was concluded that an average of 6% (range 3 to 8%) of mercury in soil was elemental mercury. The mean loss of elemental mercury added to soil was 95 ± 10%.

K.2 1993 Investigation of Mercury Speciation in EFPC Floodplain Soil by USEPA's Environmental Monitoring Systems Laboratory (EMSL) (1994)

In 1993, the USEPA's Environmental Monitoring Systems Laboratory (EMSL) assisted DOE in speciation studies of mercury in EFPC floodplain soil (DOE/SAIC, 1994). Similar to the Revis et al. (1989) method, the EMSL method used sequential/selective extraction of mercury; however, different extractive solutions were used. The analyses were conducted using a different set of soils than used in the Revis study. However, the EMSL study used the same set of soil samples evaluated in the Barnett and Turner (1995) study of the bioaccessibility of mercury in floodplain soil (designed to simulate the human digestive system). Splits of the 20 soil samples used in the bioaccessibility study were dried at 113 to 122 F, pulverized, sequentially extracted, and the extracts analyzed for mercury by inductively coupled plasma-mass spectrometry (ICP-MS). Mercury concentrations measured in each step were summed and compared to total mercury concentration determined by cold vapor atomic absorption spectroscopy. At the end of the extraction procedures, XRF analysis showed 98-99% extraction of mercury from samples with 2,000 to 3,000 mg kg^{-1} mercury. Results are presented in Table K-1.

Organic mercury and water soluble forms (e.g., mercuric chloride) were extracted using toluene and potassium sulfate and chloride solution. Organic mercury constituted less than 0.01% of total mercury. Water soluble forms constituted less than 1%.

Acid soluble mercury (e.g., mercuric oxide) was extracted using weak nitric acid (0.2 M HNO_3). Acid soluble mercury constituted an average of 17% (range 0 to 71%) of mercury in the surface interval (0 to 3 inches below ground surface) and 11% (range 1 to 25%) of mercury in the deeper interval (8 to 16 inches below ground surface).

Nitric acid soluble mercury (e.g., metallic and amalgamated mercury), extracted using 4 M HNO_3, constituted an average of 74% (range 21 to 94%) of mercury in the surface interval and 47% (range 25 to 76%) of mercury in the deeper interval.

Aqua regia (HCl + HNO_3) soluble mercury (e.g., mercuric sulfide) constituted a average of 9.3% (range 6 to 26%) of mercury in the surface interval. Mercuric sulfide in all but one sample from this interval constituted <10% of total mercury. Mercuric sulfide constituted an average of 11% (range 5 to 69%) of mercury in the deeper interval.

These results suggest that metallic/amalgamated mercury is the dominant form of mercury in floodplain soils.

K.3 1994 Investigation of Mercury Speciation in EFPC Floodplain Soil by ORNL Environmental Science Division (1994)

In an effort to resolve the discordance between the Revis et al. (1989) and EMSL results, ORNL's Environmental Sciences Division (ESD) initiated a study in 1994 using the Revis and EMSL extraction procedures on splits of EFPC floodplain soil samples (Barnett et al., 1994 in DOE/SAIC, 1994). An extraction procedure developed by Sakamoto et al. (1992) was also evaluated. Five floodplain soil samples were used in the procedure. These samples were taken from the set of 20 used in the original EMSL (1994) study (see Table K-1). The samples were selected on the basis of the range of total and speciated mercury concentrations and location and depth contrasts (DOE/SAIC 1994). Mercury analyses were performed by the Y-12 Plant Laboratory.

Samples were analyzed moist. The EMSL protocol specifies analysis of dried and pulverized soils; however, ESD believed that drying the soils at 45-50 C and machine pulverizing might alter the mercury speciation. Methylmercury was not included in the analyses, since previous analyses had concurred that methylmercury constituted less than 0.01% of mercury in floodplain soils. Results from the three protocols are presented in Table K-1 and are summarized below.

Revis Protocol

Results using the Revis protocol were incomplete. However, a larger percentage of mercury was released from soils using strong nitric acid (12 M HNO_3; average 54%, range 19 to 99%), assumed to represent soluble mercury species including mercuric chloride, mercuric oxide, and amalgamated mercury, than in the previous iteration. Results from the extraction with sodium sulfide (Na_2S), intended to extract mercuric sulfide, were unavailable due to difficulties with analysis of the sodium sulfide extract. However, the low residue fractions remaining in the soil after extraction using nitric acid and sodium sulfide (average 4.2%) suggest that the bulk of the mercury not extracted by the nitric acid or remaining in the soil as a residue (i.e., 1 to 76% of the total mercury) should have been present in the sodium sulfide extract.

Although strong nitric acid (12 M HNO_3) was not intended to extract mercuric sulfide, approximately 12 to 31% of the mercuric sulfide added to spiked samples was extracted using this solution. This was significantly higher than the spike recovery reported in the first Revis protocol iteration (i.e., <1%). These results suggest that the higher percentage of mercury released from soils by this extractant in the second iteration may be due to release of a greater fraction of mercuric sulfide.

USEPA EMSL Protocol

Results using the USEPA EMSL protocol generally agreed with results from the earlier iteration. Almost no water soluble mercury (e.g., mercuric chloride) was extracted using the potassium sulfate/chloride solution (<0.1%). Weak acid (0.2 M HNO_3) extracted an average of 6% (range 0.03 to 22%) of the mercury (assumed to be mercuric oxide). Both solutions extracted less than 1% of mercury in soils spiked with mercuric sulfide.

An average of 72% (range 36 to >100%) of soil mercury was extracted using nitric acid (4 M HNO_3), intended to extract elemental/amalgamated mercury. However, 45% of mercury in soil spiked with mercuric sulfide was also extracted using this solution, suggesting that some mercury extracted by the nitric acid was mercuric sulfide. The fraction of soil mercury extracted by aqua regia, intended to extract mercuric sulfide, averaged 25% (range 6.1 to 46%). 84% of the mercury in a mercuric sulfide spike was extracted by this solution.

Results using this protocol suggest that less than 25% of the soil mercury is water soluble (e.g., mercuric chloride) or weak-acid soluble (e.g., mercuric oxide). Based on this method, the predominant mercury forms appear to be elemental/amalgamated mercury or mercuric sulfide.

Sakamoto Protocol

Using the Sakamoto protocol, a 0.05 molar solution of mercuric sulfide (H_2SO_4) was used to extract mercuric oxide. Analysis of this extractant suggested that less than 0.04% of mercury was mercuric oxide. Cuprous chloride (CuCl) in a 1 molar solution of hydrochloric acid (HCl) was used to extract mercuric sulfide. Results from this procedure suggested that 63 to 112% of soil mercury was mercuric sulfide; however, only 24% of mercury in a mercuric sulfide spike was extracted using this method, suggesting that this extractant was not effective for the form of mercury it was intended to extract. The effectiveness of cuprous chloride in extracting metallic/amalgamated mercury was not evaluated. Total recoveries of mercury ranged from 70 to 122%. Since the selectiveness of the different extractants in this protocol was not validated, speciation results reported using this method are questionable.

K.4 Investigation of Methylmercury in EFPC Floodplain Soil by Brooks Rand (1994)

Three soil samples from areas of the floodplain with the highest mercury concentrations were analyzed for methylmercury by Brooks Rand Laboratory (DOE/SAIC, 1994). The reported methylmercury concentrations ranged from 0.0008 to 0.0044% of total mercury.

K.5 References

Barnett et al., 1994. M.O. Barnett, R.R. Turner, and K. Misra. Comparison of Mercury Speciation Methods. *Appendix A in Addendum to the East Fork Poplar Creek- Sewer Line Beltway Remedial Investigation Report*, prepared by Science Applications International Corporation. Submitted to the U.S. Department of Energy. DOE/OR/02-1119&D2/A1/R1.

DOE/SAIC, 1994. *Addendum to the East Fork Poplar Creek- Sewer Line Beltway Remedial Investigation Report.* Prepared by Science Applications International Corporation. Submitted to the U.S. Department of Energy. DOE/OR/02-1119&D2/A1/R1.

Revis et al., 1989. N.W. Revis, T.R. Osborne, G. Holdsworth, and C. Hadden. Distribution of mercury species in soil from a mercury-contaminated site. *Water, Air, Soil Pollut*. 45: 105-113.

Table K-1: Results of Analyses of Speciation and Bioaccessibility of Mercury in EFPC Floodplain Soil

Study	Sample ID	Location (EFPC Mile)	Top Depth (in.)	Bottom Depth (in.)	Total Hg (mg/kg)	Water-Sol Hg ($HgCl_2$) %	Acid-Sol Hg (HgO) %	HNO_3-Sol Hg (Elemental) %	Insoluble Hg (HgS) %	Bioaccessible (Barnett & Turner 1995) %
Revis et al., 1989 (1)	NA	10.8	0	2	121	12		8	88	NA
Revis et al., 1989 (1)	NA	10.8	8	10	300	3		4	97	NA
Revis et al., 1989 (1)	NA	11.2	0	2	265	10		9	90	NA
Revis et al., 1989 (1)	NA	11.2	8	10	178	2		3	98	NA
Revis et al., 1989 (1)	NA	13.7	0	2	177	16		8	84	NA
Revis et al., 1989 (1)	NA	13.7	8	10	100	9		6	91	NA
EMSL, 1994 (1)	13	4.5	0	3	34	0.1	71	21	8	1.1
EMSL, 1994 (1)	13	4.5	0	3	28	0.1	71	21	7.7	1.1
EMSL protocol- ORNL ESD (1994) (2)	13	4.5	0	3	42	<0.1	<0.1	58	6.1	1.1
Revis protocol- ORNL ESD (1994) (2)	13	4.5	0	3	36	82			ND (18)	1.1
Sakamoto protocol- ORNL ESD (1994) (2	13	4.5	0	3	42	NA	<0.1	NA	66	1.1
EMSL, 1994 (1)	25	4.5	8	16	477	0.1	25	36	38	2.9
EMSL, 1994 (1)	115	14.3	0	3	325	0.1	19	74	7	0.9
EMSL, 1994 (1)	127	14.3	8	16	3036	0.1	7	35	57	45.9
EMSL, 1994 (1)	127	14.3	13	19	2700	0.3	7.1	35	57	45.9
EMSL protocol- ORNL ESD (1994) (2)	127	14.3	13	19	2400	<0.1	22	36	41	45.9
Revis protocol- ORNL ESD (1994) (2)	127	14.3	13	19	2350	47			ND (53)	45.9
Sakamoto protocol- ORNL ESD (1994) (2	127	14.3	13	19	2400	NA	<0.1	NA	63	45.9
EMSL, 1994 (1)	211	14.0	0	3	350	0.1	<0.1	92	8	0.8
EMSL, 1994 (1)	211	14.0	0	3	270	<0.1	<0.1	92	8.4	0.8
EMSL protocol- ORNL ESD (1994) (2)	211	14.0	0	3	270	<0.1	<0.1	95	7.5	0.8
Revis protocol- ORNL ESD (1994) (2)	211	14.0	0	3	270	92			ND (8)	0.8
Sakamoto protocol- ORNL ESD (1994) (2	211	14.0	0	3	270	NA	<0.1	NA	105	0.8
EMSL, 1994 (1)	223	14	8	16	2045	0.1	6	25	69	6.9
EMSL, 1994 (1)	224	14	8	16	2420	0.1	6	36	57	2.6
EMSL, 1994 (1)	312	14	0	3	304	0.1	<0.1	94	7	1.2
EMSL, 1994 (1)	412	11.3	0	3	76	0.1	3	88	9	0.9
EMSL, 1994 (1)	424	11.3	8	16	1226	0.1	14	49	37	9.1
EMSL, 1994 (1)	424	11.3	10	20	1300	0.1	14	49	37	9.1
EMSL protocol- ORNL ESD (1994) (2)	424	11.3	10	20	1300	<0.1	5.5	68	46	9.1

Table K-1: Results of Analyses of Speciation and Bioaccessibility of Mercury in EFPC Floodplain Soil

Study	Sample ID	Location (EFPC Mile)	Top Depth (in.)	Bottom Depth (in.)	Total Hg (mg/kg)	Water-Sol Hg ($HgCl_2$) %	Acid-Sol Hg (HgO) %	HNO_3-Sol Hg (Elemental) %	Insoluble Hg (HgS) %	Bioaccessible (Barnett & Turner 1995) %
Revis protocol- ORNL ESD (1994) (2)	424	11.3	10	20	1200		20		ND (80)	9.1
Sakamoto protocol- ORNL ESD (1994) (2)	424	11.3	10	20	1300	NA	<0.1	NA	83	9.1
EMSL, 1994 (1)	512	11	0	3	69	0.1	1	91	8	5.4
EMSL, 1994 (1)	524	11	8	16	1962	0.1	3	32	65	2.2
EMSL, 1994 (1)	619	10.9	0	3	190	0.1	4	90	6	0.3
EMSL, 1994 (1)	621	10.9	8	16	1667	0.1	1	57	42	1.8
EMSL, 1994 (1)	717	10.5	0	3	242	0.1	11	83	6	2.6
EMSL, 1994 (1)	729	10.5	5	8	900	0.1	11	56	33	2.5
EMSL, 1994 (1)	729	10.5	8	16	1002	0.1	11	56	33	2.5
EMSL protocol- ORNL ESD (1994) (2)	729	10.5	5	8	840	<0.1	1.9	102	26	2.5
Revis protocol- ORNL ESD (1994) (2)	729	10.5	5	8	825		31		ND (69)	2.5
Sakamoto protocol- ORNL ESD (1994) (2)	729	10.5	5	8	840	NA	<0.1	NA	100	2.5
EMSL, 1994 (1)	810	6.2	0	3	581	0.1	11	81	8	1.1
EMSL, 1994 (1)	822	6.2	8	16	271	0.1	19	76	5	14.2
EMSL, 1994 (1)	918	6.1	0	3	82	0.1	49	26	26	1
EMSL, 1994 (1)	920	6.1	8	16	813	0.1	13	66	20	3.4

(1) Soils dried and pulverized
(2) Soils in naturally moist state
NA Not analyzed
ND Not determined-- Results not available

TABLE K-2: SUMMARY OF MERCURY SPECIATION STUDIES FOR EAST FORK POPLAR CREEK FLOODPLAIN SOIL

Mercury Species	Revis et al. (1989)	ORNL ESD: Revis protocol (1994)	EMSL (1994)	ORNL ESD: EMSL protocol (1994)	ORNL ESD: Sakamoto protocol (1994)	Brooks-Rand (1994)
Methylmercury	0.003 to 0.01% [a]	NA	<0.01% [g]	NA	NA	0.0008-0.0044%
Mercuric chloride	8% (range 2-16%) [b]	54% (range 20-92%) [e]	<1% [h]	<0.1% [l]	NA	NA
Mercuric oxide			21% (range <1-71%) [i]	6% (range <0.1 - 22%) [m]	<0.1% [p]	NA
Elemental mercury or Amalgamated mercury			51% (range 21-92%) [j]	72% (range 36 - 102%) [n]	NA	NA
Mercuric sulfide	92% (range 84-98%) [c]	range 1-76% [f]	29% (range 7.7-57%) [k]	25% (range 6.1-25%) [o]	83%(range 63-105%) [q]	NA
Elemental mercury (vapor)	6% (range 3 - 9%) [d]	NA	NA	NA	NA	NA

NA Not analyzed for this species
a Extracted using the method of Furutani and Rudd (1980).
b Fraction assumed extracted in 12 N nitric acid (i.e., 100% - fraction extracted by sodium sulfide from residue remaining after extraction with 12 N nitric acid). 12 N nitric acid extracted 95% of mercuric chloride spike and <1% of mercuric sulfide spike.
c Fraction extracted with sodium sulfide from residue remaining after extraction with 12 N nitric acid. Sodium sulfide extracted 98% of mercuric sulfide spike and <1% of mercuric chloride spike.
d Fraction lost by heating soil at 150 deg. C for five days. This method resulted in loss of 95% of mercury from an elemental mercury spike.
e Fraction extracted with 12 N nitric acid. This solution extracted 12-31% of mercuric sulfide spike.
f Results of analysis of sodium sulfide extract not available. Range represents fraction remaining in residue (i.e., 100% - (fraction extracted with nitric acid + fraction remaining in residue after extraction with sodium sulfide)).
g Fraction extracted with toluene.
h Fraction extracted with potassium sulfate and chloride solution.
i Fraction extracted with 0.2 M nitric acid.
j Fraction extracted with 4 M nitric acid.
k Fraction extracted with aqua regia.
l Fraction extracted with potassium sulfate and chloride solution. This solution extracted <1% of a mercuric sulfide spike.
m Fraction extracted with 0.2 M nitric acid. This solution extracted <1% of a mercuric sulfide spike.
n Fraction extracted with 4 M nitric acid. This solution extracted 45% of a mercuric sulfide spike.
o Fraction extracted with aqua regia. This solution extracted 84% of a mercuric sulfide spike.
p Fraction extracted with 0.05 M mercuric sulfide solution.
q Fraction extracted with cuprous chloride in 1 M hydrochloric acid solution. This solution extracted 24% of a mercuric sulfide spike.

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APPENDIX L

FISH CONSUMPTION DISTRIBUTIONS
FOR POPULATIONS OF INTEREST
FOR THE DOSE RECONSTRUCTION

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APPENDIX L

FISH CONSUMPTION DISTRIBUTIONS FOR POPULATIONS OF INTEREST FOR THE DOSE RECONSTRUCTION

The following discussion, prepared by Ellen Ebert of ChemRisk (Portland, Maine) describes the assumptions used in developing distributions to characterize fish consumption by the following receptors:

- Watts Bar Commercial Angler
- Clinch River/ Poplar Creek Commercial Angler
- Watts Bar Recreational Angler
- Clinch River/ Poplar Creek Recreational Angler
- East Fork Poplar Creek Angler

Commercial Anglers

Historic information indicates that commercial fishing harvest in the Tennessee River Valley has increased steadily since the 1940s (Eschmeyer and Tarzwell 1941, TVA 1944, 1945, 1947, 1959, 1960, 1961, 1962, 1963, 1967, Morgan and Hubert 1974, and Todd 1990). Reports on commercial fishing activities in the 1970s and 1980s indicated that there were two types of individuals who held commercial fishing licenses (Hargis 1968, Morgan and Hubert 1974, Hubert et al. 1975, Todd 1990): full-time anglers who fished as a primary source of income, and part-time anglers who fished for supplemental income or to use commercial gear during their recreational activity. For this analysis of commercial anglers, only data concerning full-time anglers are considered.

<u>Watts Bar Reservoir</u>

Data reported by Todd (1990) and Hubert et al. (1975) provide the best bases for deriving estimated consumption rates for full-time commercial anglers using Watts Bar. While Todd's (1990) data are specific to Watts Bar and would normally be preferable to the regional data reported by Hubert et al., fish consumption advisories issued prior to Todd's study may have affected consumption behavior, resulting in lower levels of consumption after the implementation of advisories. In order to avoid underestimating potential consumption by commercial anglers, it is recommended that the distribution of consumption rates for commercial anglers be based on the Hubert et al. data which were collected prior to the issuance of consumption advisories.

Hubert et al. (1975) reported on commercial activity in Upper East Tennessee during 1973. While the report did not provide specific data for commercial activity at Watts Bar Reservoir, it did indicate that some of the anglers interviewed for the survey fished Watts Bar Reservoir. Overall, Hubert et al. reported that of a total of 206,975 lbs (94,079 kg) of fish commercially harvested by 29 anglers in Upper East Tennessee that year, 201,111 lbs were sold to dealers or individuals, leaving 5,864 lbs (2,665 kg) potentially available for personal use. If these fish are evenly distributed over 29 anglers, are assumed to have edible portions of 30 percent (EPA, 1989), and are assumed to be consumed by 3.2 individuals (average family size in Roane County in 1970), the resulting average consumption rate is 24 g/person-day.

The available data are not sufficient to develop a distribution (by percentiles). However, studies of fish consumption have indicated that, in general, fish consumption distributions are likely skewed (Puffer et al. 1981; Landolt et al. 1985; Ebert et al. 1993, 1994, SCCWRP and MBC Applied Environmental Sciences 1994). For this reason, it is recommended that a truncated lognormal distribution be used for the distribution of fish consumption rates for this and other populations. A truncated lognormal distribution model is appropriate for a situation where there are both minimum and maximum bounds and where most observations are not symmetrically distributed about a central value but rather are nearer the minimum than the maximum (i.e., observations are positively skewed). Fish consumption rates are well-suited to this type of model because negative fish consumption rates are not possible (i.e., a minimum of zero is required) and because an upper bound based on total daily food intakes can reasonably be established. Using the truncated lognormal model requires that the minimum, maximum, arithmetic mean, and standard deviation be specified.

Although a minimum value could be set at zero, it is best to limit the distribution to individuals who actually consume fish. For this reason, it is recommended that the minimum value be set at a reasonable minimum, positive value of consumption. It is likely that the least that an individual consumer might consume would be a single meal of small size. If the size selected were two ounces (57 g), the annualized daily rate of consumption could be estimated to be 0.16 g/day. This rate is recommended as the minimum value for commercial anglers.

EPA (1989) guidance has suggested that a consumption rate of 180 g/day might be representative if one were to assume that an individual's dietary protein was composed primarily of fish. This rate is equal to the rate for combined consumption of red meat, poultry, fish, and shellfish in the United States population and is based on the assumption that some individuals never include any meat or poultry in their diets. If such a rate were applied to anglers fishing Watts Bar Reservoir, it would reflect the assumptions that the individual never eats meat or poultry, never purchases fish or shellfish from a supermarket, and fishes only in Watts Bar Reservoir. While these conditions are unlikely to exist within a population, it is conceivable that a few individuals might engage in such behavior.

Although many anglers have indicated that they may consume as much as 1/2 lb (227 g) of fish at a single meal (Cox et al., 1985, 1987; West et al., 1989; Connelly et al., 1992; Puffer et al., 1981; Landolt et al., 1985; and Pierce, et al, 1981), there is little data to indicate that many individuals eat fish in this quantity over long periods of time. Evidence of this can be seen in the data reported by Rupp et al. (1980). This study evaluated rates of fish consumption throughout the United States, based on data collected during a monthly dietary recall survey of 24,652 individuals. For the East South Central region, which includes Tennessee, the maximum rate of freshwater fish consumption reported was 24.64 kg/yr (68 g/day); over all regions of the U.S., the maximum rate of freshwater fish consumption reported was 57.68 kg/yr (158 g/day). The maximum rate of consumption of any type of fish was 65.38 kg/yr (179 g/day) for saltwater finfish in the Pacific region. Thus, this national survey of all types of fish consumption (commercially obtained and recreationally caught) by 24,652 individuals indicates that daily consumption did not exceed the USEPA's recommended rate of 180 g/day. For this reason, it is recommended that 180 g/day be set as the upper bound of the consumption rate distribution for commercial anglers using Watts Bar Reservoir.

The mean value for this and subsequent subpopulations will be based on relevant, site- or region-specific data. For commercial anglers using Watts Bar Reservoir, the mean value of 24 g/person-day, based on the Hubert et al. (1975) data and discussed above, will be used.

While a standard deviation cannot be derived using the Hubert et al. data, a value can be derived based on the relationship between the means and standard deviations reported for other fish consumption studies. The fish consumption study reported by Ebert et al. (1993) resulted in a mean consumption rate of 6.4 with a standard deviation of 16, resulting in a coefficient of variance of 2.5. A similar relationship exists between the mean (6.36) and standard deviation (14.32) reported by Connelly et al. (1996), resulting in a coefficient of variance of 2.25. Averaging these two coefficients of variance results in a value of 2.38. If this average of the coefficients of variance from the Ebert et al. and Connelly et al. studies is multiplied by the mean consumption rate estimated for Watts Bar Reservoir commercial anglers, 24 g/person-day, the result is an estimated standard deviation of 57. This is the value that will be specified for use in developing the distribution of consumption rates for this population.

Species

While the species targeted by commercial anglers have been primarily driven by fluctuations in the market values of various fish (TVA, 1959, 1960, 1961, 1962; and Alexander and Peterson, 1982), the principal species that have been targeted by commercial anglers since the 1940s are catfish, paddlefish (flesh and roe), buffalo fish, carpsucker, carp, and drum (TVA, 1959; Hargis, 1968; Alexander and Peterson, 1982; and Todd, 1990; Hubert et al., 1975). It is recommended that any available sampling data available for these species be used as the basis for evaluating potential exposure for this group.

Population Size

The number of full-time commercial anglers fishing Watts Bar Reservoir is very small. Although there no records of the numbers of full-time commercial anglers who might have fished Watts Bar Reservoir before the 1960s, Hargis (1968) reported that in 1967, there were a total of seven full-time commercial anglers in Rhea, Meigs, Roane, Anderson, and Loudon Counties, combined. Todd (1990) reported that there were four full-time commercial anglers using Watts Bar Reservoir in 1989. Other sources indicate that the numbers of commercial anglers fishing the TVA reservoirs in the eastern portion of Tennessee were very small (Hargis, 1968; Hubert et al., 1975, Morgan and Hubert, 1974). Because commercial fishing activity may have been affected by the advisories that were issued in the 1980s, it is reasonable to assume that the numbers reported by Hargis may have been more representative of commercial fishing activity prior to the advisories. If it is conservatively assumed that there were a total of 7 full-time commercial anglers fishing Watts Bar Reservoir in a given year, and that each year one angler stopped activity and another commenced activity, the resulting estimate of the total commercial angler population potentially exposed between 1945 and 1995 may have been as large as 57 anglers and their families. Assuming an average family size of 3.2 individuals results in an estimate of 180 as the total number of individuals in this population over the duration of historical ORR operations. Given the uncertainties in this estimate it is recommended that a population size range of 100 to 300 persons be used for this group.

Clinch River/Poplar Creek

As indicated in the earlier memorandum, it is unlikely that CR/PC area has been commercially fished to any great degree due to the limited access for larger boats and the proximity of the Watts Bar Reservoir commercial fishery. If these waterbodies have been fished by full-time commercial anglers, the percentage of harvest taken from them is likely to be minimal compared with the harvest from the larger, more productive, and highly accessible Watts Bar Reservoir. Todd (1990) reported that of the 166 full-time commercial anglers statewide, only 33 (20%) fished rivers and for those individuals, only about 31% of their time was spent fishing rivers.

Todd (1990) also reported that for all commercial anglers, 91 percent of catch was from reservoirs and nine percent was from rivers. If this percentage is applied to the proposed mean consumption rate for full-time commercial anglers, 24 g/day, the result is an estimated rate of consumption from Clinch River/Poplar Creek of 2.2 g/day. This is a reasonable means value to be used in generating a distribution of fish consumption rates for commercial anglers who fish CR/PC. A standard of 5.2 has been derived using this mean and coefficient of variance (2.38) discuss previously.

While it is unlikely that most commercial anglers who fish the CR/PC area would consume substantial amounts of fish from this area, given the availability of Watts Bar Reservoir, it is conceivable that there could be at least one individual who uses the area as their sole source of fish and thus may consume all of his/her fish from that area. For that reason, it is recommended that the maximum value of 180 g/day and the minimum value of 0.16 g/day be used in developing a truncated lognormal distribution for this group, as recommended for the Watts Bar Reservoir commercial angler.

Species

Because full-time commercial anglers fish primarily as a source of income, they would have targeted species that were commercially marketable and would have used techniques suitable for catching those species. For this reason it is very likely that the fish harvested would have been the same species as those harvested from Watts Bar Reservoir. It is reasonable to assume that fish obtained from the CR/PC area consisted primarily of catfish, paddlefish, buffalo fish, carpsucker, carp, and drum.

Population Size

It is very likely that the size of the full-time commercial angler population using CR/PC is extremely small. As discussed previously, Todd (1990) reported that only 20% of commercial anglers fished rivers. If this percentage is applied to the seven anglers estimated for Watts Bar Reservoir, the resulting estimate is that there may be one commercial angler using CR/PC in a given year. If it is conservatively assumed that every seven years another angler began to fish the area, the resulting angler population size estimate would be eight individuals between 1945 and 1995. Assuming 3.2 individuals in the typical angler family results in an estimated population size of 24 individuals for the total number of commercial anglers and family member who consumed fish from CR/PC during the operation of ORR. Given the uncertainties in this estimate, it is recommended that a population size ranging from 10 to 30 individuals be estimated.

Recreational Anglers

A high percentage of those individuals who hold commercial licenses are, in fact, part-time recreational anglers who are willing to pay higher license fees in order to gain the use of commercial fishing gear. For this reason, this analysis of recreational anglers includes part-time commercial anglers as well as individuals who hold recreational licenses.

Watts Bar Reservoir

Watts Bar Reservoir has been used by recreational anglers since it was impounded. Eschmeyer and Tarzwell (1941) reported a total of 8,045 angler days for Watts Bar Reservoir. While little information is available on the early years of recreational fishing at Watts Bar Reservoir, available data indicate that the Tennessee Valley reservoirs and their tailwaters have always been productive recreational fisheries. A 1944 report on Guntersville Dam tailwater (TVA, 1944) indicated that within five days of opening the area to fishing, 1,000 anglers had fished there and that one area had received 300 anglers daily. More recently, Todd (1990) reported that a total of 26,681 lbs (12,128 kg) of fish were harvested from Watts Bar Reservoir by the 33 part-time commercial anglers who fished there. Although specific information on percent of harvest retained for consumption was not provided for those anglers, it can be estimated, based on data that were provided by Todd (1990), that they retained 11 percent of their harvest for personal use.

The Tennessee Wildlife Resources Agency (TWRA, Unk.) reported statistics for the Watts Bar Reservoir recreational fishery between the years of 1977 and 1991. That report includes 15 years of data on a species-specific basis concerning catch rates, mean weights of catch, and the number of fish harvested. Because catch rates (fish/hour) were not reported for the years prior to 1988, it is not possible to calculate and compare consumption rates on a year by year basis. However, while the estimated hours per trip, trips per acre, and hours per acre were variable over this time period, there was no discernable trend in the intensity of fishing activity; consequently, there is no indication that the data from a particular year would be preferable to the data for other years. For this reason, it is appropriate to average the data over the 15-year period to develop a mean consumption rate for recreational anglers using Watts Bar Reservoir.

Averaging the data over 15 years results in the average weights per fish and average number of fish harvested per hour for each species reported (Table 1). Using these data and the average trip length of 4.5 hours, estimates of weight of fish per trip can be derived. Using the average number of trips to lakes and reservoirs (14.6 trips per year) reported for Tennessee anglers by the U.S. Fish and Wildlife Service (USFWS) (USDOI, 1993) and a 30 percent edibility factor, results in estimates of edible mass of fish per year for each species. Dividing that by an average family size of 2.7 individuals (average of the mean household sizes in Loudon, Meigs, Rhea, and Roane Counties for 1980 and 1990), results in species-specific consumption rates ranging from 0.022 to 7.2 g/day.

Because anglers typically target certain species of fish during their recreational activity, and use fishing gear that is appropriate to the targeted species, an individual angler generally would not harvest all of the species of fish listed by TWRA during a fishing year. However, if one assumes that an undefined population of anglers harvested all of the species of fish listed above at the harvest rates listed, the result is a total edible fish mass harvested of 27 kg/year. If again it is assumed that the average family size is 2.7 individuals, the annualized daily rate of consumption can be estimated at 28 g/day.

To define a more reasonable estimate, one could assume that a typical angler might harvest the most frequently harvested species (largemouth bass, channel catfish, white crappie, and white bass were consistently harvested in the greatest numbers each year) at the rates reported during the year and derive a consumption rate based on those species alone. Summing the annualized daily consumption rates for largemouth bass (1.4 g/day), channel catfish (4.6 g/day), white crappie (4.0) and white bass (7.2 g/day) results in a total annualized consumption rate of 17 g/day.

In order to provide an upper bound estimate to ensure that consumption by the recreational angler population is not being underestimated, the data for 1991, the year for which the highest level of harvest was reported, have been evaluated. Using those data, along with the assumptions outlined above, it is estimated that if an angler were assumed to consume all of the species listed, the consumption rate would be 37 g/day. If, however, it is assumed that a single angler would not consume all species listed but instead only consumed the most harvested species (largemouth bass at 1.5 g/day, channel catfish at 7.2 g/day, blue catfish at 7.2 g/day, and white bass at 13 g/day) the resulting consumption rate would be 29 g/day.

Based on available data, it appears that 30 g/day is a reasonable and conservative mean consumption rate to be used in evaluating recreational anglers at Watts Bar Reservoir. It is recommended that this value be used as the mean for the truncated lognormal distribution of consumption rates for this population. Multiplying the derived coefficient of variance (2.38), based on Ebert et al. (1993) and Connelly et al. (1996), by the mean of 30 g/day results in an estimated standard deviation of 71. This will be specified in defining the distribution of rates for this population.

The same lower and upper bounds discussed for commercial anglers can be set for the recreational angler population. Thus, it is recommended that 0.16 and 180 g/day be used for minimum and maximum values, respectively, for recreational anglers who used Watts Bar Reservoir.

Species

Eschmeyer and Tarzwell (1941) reported that just after the impoundment of Watts Bar Reservoir, the catch consisted primarily of bass, white bass, bluegill, crappie, and food fish. Data from 1977 to 1991 at Watts Bar Reservoir (TWRA, unk) indicate that the primary species harvested during that period were largemouth bass, smallmouth bass, spotted bass, catfish, crappie, bluegill, sauger, and white fish. As it appears that there may have been a wide variety of fish species available in Watts Bar Reservoir over the past 50 years, it is recommended that all available fish tissue data from game species, panfish, and food fish be used in evaluating this population.

Population Size

There are no data available to estimate the actual population size for recreational anglers using Watts Bar Reservoir. While data are available on the small number of part-time commercial anglers who use the reservoir (Hubert et al., 1975; Todd, 1990), there are no reported estimates of the numbers of sport-licensed anglers. This is due to the fact that fisheries managers are generally not concerned with the number of anglers using a resource but rather are interested in the total amount of effort expended, regardless of the number of individuals exerting that effort. Thus, it is not unusual that such estimates are not available.

The only way in which such estimates might be made is to apportion the level of effort (total trips) over an estimate of the number of trips that the average angler might take in a year in order to estimate the population size. TWRA (Unk.) reported 133,887 trips in 1990 for Watts Bar Reservoir. According to U.S. Fish and Wildlife statistics for 1990 (USDOI, 1993), Tennessee anglers took an average of 14.6 trips per year to fish lakes and reservoirs. If the total number of trips taken to Watts Bar Reservoir in 1990 (133,887 trips/year) is divided by 14.6 trips/year-angler, the result is an estimated 9,170 anglers using the reservoir that year.

The total population of Anderson, Loudon, Meigs, Rhea, and Roane Counties (the counties adjacent to Watts Bar Reservoir) during 1990 was 179,109 individuals. Thus, the estimated number of individuals who fished Watts Bar Reservoir, 9,170 anglers, represented approximately five percent of the nearby population. A slightly higher percentage of the local population is estimated if one evaluates the data available for 1980, the previous census year. In that year, TWRA reported 150,698 fishing trips to Watts Bar Reservoir. Assuming again that anglers who fished Watts Bar Reservoir averaged 14.6 trips per year, it can be estimated that a total of 10,321 anglers fished Watts Bar Reservoir that year. When comparing this estimate to the total estimated population for the five counties of interest, 168,780 persons, it appears that Watts Bar Reservoir anglers represented approximately six percent of the local population. This higher percentage of the population will be used to estimate population sizes at various times, based on census data.

Assuming that six percent of the relevant county-wide populations fished Watts Bar Reservoir in a given year, the number of anglers who may have fished Watts Bar Reservoir during each census year can be estimated. As shown in Table 2, population sizes for each of the relevant counties have increased steadily since 1950 and the total population of the five counties combined has increased from 136,375 in 1950 to 179,109 in 1990. Applying a factor of 0.06 to the population sizes in 1950 and 1960 results in estimated angler population sizes of 8,183 and 8,637 for those years, respectively. Thus, it appears that the total angler population size during that decade increased by 454 anglers. Similar increases of 115, 1,375, and 620 new anglers, based on general increases in regional population, can be estimated for 1970, 1980, and 1990, respectively. If all of these anglers are summed, the result is an estimated 9,764 anglers between 1950 and 1990. If estimates of the number of new anglers in each of the 10-year census periods are then multiplied by the appropriate mean household sizes of the counties of interest to estimate a total exposed population of fish consumers, that is each angler and his or her family, the result is an estimated 40,482 individuals who may have consumed recreationally-caught Watts Bar Reservoir over the period of interest.

It is not reasonable, however, to assume that every angler who begins to fish Watts Bar Reservoir in a given year will continue to fish it every year thereafter. Anglers may die, move away, or cease fishing for a number of reasons. Thus, the above estimate does not likely provide an accurate picture of the total number of individuals who may have consumed recreationally-obtained Watts Bar Reservoir fish since 1945. Rather, it is appropriate that there is a certain level of turnover in the angler population and that anglers who have ceased their angling activities are replaced by other anglers, so that the actual number of anglers who used Watts Bar Reservoir over time is substantially larger than the above estimate.

Watts Bar Reservoir is a large fishery which is accessible from many counties. Thus, even if an angler moved from one county to another, that angler may have continued to fish Watts Bar Reservoir. As a result, their duration of fishing effort may have been substantially longer than occurs on smaller, localized fisheries. As a conservative measure, the residence times reported by Israeli and Nelson (1992) for farm families have been doubled to reflect the lower rate of inter-regional mobility to generate a distribution of mobility rates for this population. After truncating the distribution at a reasonable maximum of 75 years, the distribution results in a mean exposure duration of 31 years. Thus, it can be assumed that in any given year, 1/31 of the population may turn over. If it is assumed that 1/31 of the populations estimated (including new additions in each ten-year period) turn over, it can be estimated that approximately 132,000 individuals may have consumed recreationally-caught fish from Watts Bar Reservoir between 1945 and 1995 (Table 3). A population size range of 100,000 to 300,000 persons is therefore recommended for this analysis.

Clinch River/Poplar Creek

In the information provided to date there has only been anecdotal information concerning recreational fishing activities and practices on the Clinch River or Poplar Creek. However, because access to the CR/PC is considerably less than that afforded by the many public areas of Watts Bar Reservoir, it can be expected that angler activity on these two waterbodies would be less than that on the reservoir. Statistics from the 1991 USFWS survey (USDOI, 1993) indicate that Tennessee anglers in general made an average of 8.9 trips per year to rivers and streams in the state. If the consumption rate recommended for the most harvested species by Watts Bar Reservoir anglers is multiplied by 0.6, the ratio of river trips over lake trips (8.9/14.6), the resulting consumption rate is 17 g/day. It is recommended that 17 g/person-day be used as the mean for the truncated lognormal distribution of consumption rates for CR/PC recreational anglers. A standard derivation of 40, based on the product of this mean and the coefficient of variance (2.38) discussed previously, will be used to define this distribution.

The basis for the minimum value established for Watts Bar Reservoir commercial and recreational anglers is also reasonable for recreational anglers using CR/PC. As a result, it is recommended that the same value, 0.16 g/day, be used as the minimum value for this distribution.

Because it is unlikely that a recreational angler would obtain all of his/her fish from CR/PC, due to the availability of Watts Bar Reservoir, other TVA reservoirs, and other smaller rivers and streams in the area, 180 g/day does not appear to be a reasonable maximum estimate for this distribution. Other surveys of river anglers have indicated that consumption from rivers and streams is generally lower than their total consumption. This is primarily due to the fact that it is harder to catch fish in rivers and streams, there are fewer species of fish available there, and the fish are generally smaller in size than in lakes and reservoirs. Ebert et al. (1993) found that while the maximum consumption value for all types of fisheries was around 217 g/day, the maximum consumption rate for river and stream fish was just under 120 g/day. For this reason, it is recommended that a value of 120 g/day be used as the maximum value for the CR/PC recreational angler distribution.

Species

Both of these rivers are of substantial size and could be expected to contain many of the same species contained in Watts Bar Reservoir. For this reason, it is recommended that location-specific fish data for the same species indicated for Watts Bar Reservoir recreational anglers be used in this analysis.

Population Size

There are no data available to provide estimates of the number of anglers who may have used CR/PC as a fishery. U.S. Fish and Wildlife (USDOI, 1993) data for Tennessee indicate that a total of 479,600 state residents fished large lakes or reservoirs during 1991. In that same year, 338,300 anglers fished the state's rivers or streams. Based on those data, it appears that the number of anglers who fished rivers and streams was approximately 70 percent of the number of anglers who fished lakes and reservoirs. Applying this percentage to the estimated 132,000 persons consuming recreationally-caught fish from Watts Bar Reservoir, results in an estimated population size of 92,000. It is recommended that a population size ranging from 30,000 to 100,000 individuals be used for the population of individuals who consumed fish as a result of recreational angling on CR/PC during the years ORR was in operation.

<u>EFPC</u>

While it is possible that recreational anglers could spend a portion of their fishing activity at EFPC, the level of activity is likely to be low due to the limited access, the nature of the creek itself, and the ready availability of higher quality fisheries nearby. It is possible, however, that an angler might have used the creek on an infrequent basis, particularly if that angler lived near the creek. In its draft *Estimating Exposures to Dioxin-Like Substances*, USEPA (1994) recommends using fish ingestion rates ranging from 1.2 to 4.1 for estimating consumption by recreational anglers fishing small ponds or streams. Due to the small size and limited habitat of the creek, it is recommended that the lower end of the range, 1.2 g/day, be used as the mean for the truncated lognormal distribution of recreational anglers using EFPC. Multiplying this mean by the coefficient of variance discussed above (2.38), yields an estimated standard deviation of 2.9.

Because the fish in EFPC are substantially smaller and fewer than the fish available in CR/PC or Watts Bar Reservoir, and because access to the creek is limited, it is unlikely that a recreational angler would spend a substantial amount of time fishing the EFPC. As a result, it is reasonable to assume that a sport angler might, as a maximum, obtain one meal per month from the creek. Assuming that he/she is able to obtain 227g of fish for that meal, the estimated annualized consumption rate would be 7 g/day. It is recommended that this value be used as the maximum value for the EFPC recreational angler distribution. The minimum value of 0.16 g/day discussed for the other distributions is a reasonable minimum for the distribution and is also recommended for use here.

Species

The species that have been reported by individuals who historically fished EFPC tended to be crappie, sunfish varieties, and carp. It is recommended that location-specific data for these species be used to evaluate consumption by this population.

Population size

Given the size and characteristics of EFPC and its low productivity, it is unlikely that more than 100 recreational anglers have used it as a fishery over the years. In addition, anecdotal information from interviews of local residents appears to indicate that most individuals who fished here were boys who played in the creek during their adolescent years but stopped once they finished high school. If it is assumed that the average family size was 3.2, the estimated number of individuals who consumed fish from EFPC as the result of recreational angling is 320 persons. It is recommended that an estimated population ranging from 100 to 300 individuals be used for this group.

Summary

The consumption rate estimates provided in this memo are generally based on data collected since 1970. While it would have been preferable to also use data obtained between 1945 and 1970, it does not appear that adequately detailed data are available from that period. It is likely, however, that the use of more recent data has overestimated consumption in some situations or is comparable to what might have been in earlier years.

The estimates provided for commercial anglers are generally based on data collected during the past 25 years. While it cannot be stated with certainty, it is likely that the harvesting success of commercial anglers has remained fairly constant over the years and that commercial anglers have always sold as much of their harvest as possible. Thus, there is not reason to suspect that they may have eaten substantially greater amounts of fish in earlier years.

Similarly, it is likely that consumption by recreational anglers may have increased over earlier years, due to the fact that the fishing season is longer now than it was just after impoundment, that fishing gear is always improving, and that people generally have more recreational time now than they did 50 years ago. In addition, family sizes have decreased steadily. Similar amounts of fish harvested by anglers will yield larger portion sizes for the smaller number of family members who consume them. For these reasons, it is likely that consumption rate estimates may be overestimated for recreational anglers who have used the resources over the last 50 years, and thus provide adequately conservative estimates of consumption.

Based on the data available, the values in Table L-1 are recommended for use in developing truncated lognormal distributions of fish consumption rates for the populations of interest at the ORR.

Table L-1: Distributions for Characterization of Fish Consumption Rates for the Populations of Interest at the ORR

Population	Mean Consumption Rate (g d^{-1})	St. Dev.	Minimum Consumption Rate (g d^{-1})	Maximum Consumption Rate (g d^{-1})	Population Size
Watts Bar Reservoir Commercial Angler	24	57	0.16	180	100-300
Clinch River/ Poplar Creek Commercial Angler	2.2	5.2	0.16	180	10-30
Watts Bar Reservoir Recreational Angler	30	71	0.16	180	100,000-300,000
Clinch River/ Poplar Creek Recreational Angler	17	40	0.16	120	30,000-100,000
East Fork Poplar Creek Angler	1.2	2.9	0.16	7	100-300

REFERENCES

Alexander, C.M. and D.C. Peterson. 1982. Feasibility of a commercial paddlefish harvest from Norris Reservoir, Tennessee. *Proc. Annu. Conf. Southeast. Assoc. Fish. Wildl. Agencies* 36:202-212.

Anderson, A.C. and J.C. Rice. 1993. Survey of fish and shellfish consumption by residents of the greater New Orleans area. *Bull. Environ. Contam. Toxicol.* 51:508-514.

Bureau of the Census. 1952. U.S. Census of Population: 1950. Volume II. Characteristics of the population: Tennessee. U.S. Department of Commerce.

Bureau of the Census. 1963a. U.S. Census of Population: 1960. General population characteristics: Tennessee. U.S. Department of Commerce.

Bureau of the Census. 1963b. U.S. Census of Population: 1960. General social and economic characteristics: Tennessee. U.S. Department of Commerce.

Bureau of the Census. 1973. 1970 Census of Population. Characteristics of the population: Tennessee. U.S. Department of Commerce.

Bureau of the Census. 1983a. 1980 Census of Population. General population characteristics: Tennessee. U.S. Department of Commerce.

Bureau of the Census. 1983b. 1980 Census of Population. General social and economic characteristics: Tennessee. U.S. Department of Commerce.

Bureau of the Census. 1992a. 1990 Census of Population. General population characteristics: Tennessee. U.S. Department of Commerce.

Bureau of the Census. 1992b. 1990 Census of Population. Social and economic characteristics: Tennessee. U.S. Department of Commerce.

Coad, S. 1994. Consumption of Fish and Wildlife by Canadian Nature Peoples: A Quantitative Assessment from the Published and Unpublished Literature. Health and Welfare Canada.

Columbia River Inter-Tribal Fish Commission (CRITFC). 1994. A fish consumption survey of the Umatilla, Nez Perce, Yakama, and Warm Springs Tribes of the Columbia River Basin. Technical Report 94-3. October.

Connelly, N.A., B.A. Knuth and C.A. Bisogni. 1992. *Effects of the Health Advisory Changes on Fishing Habits and Fish Consumption in New York Sport Fisheries.* Human Dimension Research Unit, Department of Natural Resources, New York State College of Agriculture and Life Sciences, Fernow Hall, Cornell University, Ithaca, NY. Report for the New York Sea Grant Institute Project No. R/FHD-2-PD. September.

Connelly, N.A., B.A. Knuth, and T.L. Brown. 1996. Sportfish consumption patterns of Lake Ontario anglers and the relationship to health advisories. *North American Journal of Fisheries Management 16*:90-101.

Cox, C., A. Vaillancourt, C.D. Barros, and A.F. Johnson. 1985. "*Guide to Eating Ontario Sport Fish" Questionnaire Results* No. Ontario Ministry of the Environment, Aquatic Contaminants Section, Water Resources Branch, Ontario, Canada.

Cox, C., A. Vaillancourt, and A.F. Johnson. 1987. *A Comparison of the Results from the "Guide to Eating Ontario Sport Fish" Questionnaires* No. ISBN: 0-7729-2359-0). Ontario Ministry of the Environment, Aquatic Biology Section, Water Resources Branch, Ontario, Canada.

Dewailly, E., A. Nantel, J.P. Weber and F. Meyer. 1989. High levels of PCBs in breast milk of Inuit women from arctic Quebec. *Bull. Environ. Contam. Toxicol.* 43:641-646.

Ebert, E.S., N.W. Harrington, K.J. Boyle, J.W. Knight, and R.E. Keenan. 1993. Estimating consumption of freshwater fish among Maine anglers. *N. Am. J. Fish. Mgt.* 13:737-745.

Ebert, E.S., P.S. Price, and R.E. Keenan. 1994. Selection of fish consumption estimates for use in the regulatory process. *J. Expos. Anal. Environ. Epidemiol.* 4(3):373-393.

Ebert, E.S., S.H. Su, T.J. Barry, M.N. Gray, and N.W. Harrington. 1996. Estimated Rates of fish consumption by anglers participating in the Connecticut Housatonic River creel survey. *N. Am. J. Fish. Mngt.* 16:81-89.

EPA. 1989. *Assessing Human Health Risks from Chemically Contaminated Fish and Shellfish: A Guidance Manual.* U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection, Washington, D.C. USEPA-503/8-89-002. September.

EPA. 1994. *Estimating Exposure to Dioxin-Like Compounds, Volume 3: Site-Specific Assessment Procedures.* U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC. USEPA/600/6-88/005Cc. June.

Eschmeyer, R.W. and C.M. Tarzwell. 1941. An analysis of fishing in the TVA impoundments during 1939. *Tenn. Acad. Sci.* 5(1):15-41.

Hargis, H.L. 1968. *Development of Improved Fishing Methods for Use in Southeastern and South-Central Reservoirs: Review of the Current Status of the Commercial Fishery in Tennessee.* Financed with Federal Aid Funds Under Provisions of the Commercial Fisheries Research and Development Act of 1964 (Public Law 88-309). Job Completion Report, 4-5-R-2. March.

Hubert, W.A., A.O. Smith, W.T. Morgan, W.P. Mitchell, and R.L. Warden. 1975. Summary of Commercial Fisherman Surveys 1971-1974. Tennessee Valley Authority, Fisheries and Waterfowl Resources Branch, Muscle Shoals, Alabama.

Israeli, M. and C.B. Nelson. 1992. Distribution and expected time of residence for U.S. households. *Risk Anal.* 12(1):65-72.

Javitz, H. 1980. *Seafood Consumption Data Analysis; Final Report.* Prepared by Statistical Analysis Department, SRI International, Menlo Park, CA for H.D. Kahn, U.S. Environmental Protection Agency, Office of Water Regulations and Standards, Washington, D.C. Task 11, USEPA Contract No. 68-01-3887. September 24.

Kinloch, D., H. Kuhnlein, and D.C.G. Muir. 1992. Inuit foods and diet: a preliminary assessment of benefits and risks. *Sci. Tot. Environ.* 122:247-278.

Kreiss, K., M.M. Zack, R.D. Kimbrough, L.L. Needham, A.L. Smrek, and B.T. Jones. 1981. Cross-sectional study of a community with exceptional exposure to DDT. *JAMA* 245(19):1926-1930.

Landolt, M.L., F.R. Hafer, A. Nevissi, G. van Belle, K. Van Ness, and C. Rockwell. 1985. *Potential Toxicant Exposure Among Consumers of Recreationally Caught Fish from Urban Embayments of*

Puget Sound. National Oceanic and Atmospheric Administration, National Ocean Service, Rockville, MD. NOAA Tech. Memo. NOS OMA 23. November.

Morgan, W.T. and W.A. Hubert. 1974. *Eastern Tennessee Commercial Fisherman Survey for 1973.* Tennessee Valley Authority, Division of Forestry, Fisheries, and Wildlife Development Miscle Shoals, Alabama. May.

NYSDEC. 1990. *New York Statewide Angler Survey 1988.* New York State Department of Environmental Conservation, Division of Fish and Wildlife, Albany, NY. April.

NYSDOH. 1993. Health Risk Assessment for the Akwesasne Mohawk Population from Exposure to Chemical Contaminants in Fish and Wildlife from the St. Lawrence River Drainage on Lands of the Mohawk Nation at Akwesasne and Near the General Motors Corporation Central Foundry Division at Massena, New York. New York State Department of Health, Bureau of Toxic Substance Assessment. October.

Pierce, D., D. Noviello, and S.H. Rogers. 1981. *Commencement Bay Seafood Consumption Study*; Preliminary Report No. Tacoma-Pierce County Health Department, Seattle, WA.

Puffer, H. W., S.P. Azen, M.J. Duda, and D.R. Young. 1981. *Consumption Rates of Potentially Hazardous Marine Fish Caught in the Metropolitan Los Angeles Area.* Grant No. R 807 120010). Prepared by the University of Southern California School of Medicine for the U.S. Environmental Protection Agency, Office of Research and Development, Environmental Research Laboratory, Corvallis, OR.

Richardson, G.M. and D.J. Currie. 1993. Estimating fish consumption rates for Ontario Amerindians. *J. Expos. Anal. Environ. Epi.* 3(1):23-37.

Rupp, E. M., Miller, F. L., & Baes, C. F. (1980). Some results of recent surveys of fish and shellfish consumption by age and region os U.S. residents. *Health Phys., 39,* 165-175.

Southern California Coastal Water Research Project (SCCWRP) and MBC Applied Environmental Sciences. 1994. Santa Monica Bay Seafood Consumption Study. Prepared for Santa Monica Bay Restoration Project, Monterey Park, CA. June

Todd, R.M. 1990. *Commercial Fishing Survey 1989.* Tennessee Wildlife Resources Agency, Nashville, TN. November.

TWRA. Unk. *Reports on Recreational Fishing at Watts Bar and Melton Hill Reservoirs.* Tennessee Wildlife Resources Agency, Nashville, TN. Received February, 1993.

TVA. 1944. *Annual Report Fiscal Year 1943-1944.* Tennessee Valley Authority, Biological Readjustment Division, Department of Forestry Relations, Knoxville, Tennessee.

TVA. 1945. *Annual Report Fiscal Year 1945.* Tennessee Valley Authority, Biological Readjustment Division, Knoxville, Tennessee.

TVA. 1947. *Annual Report Fiscal Year 1947.* Tennessee Valley Authority, Fish and Game Division, Knoxville, Tennessee.

TVA. 1959. *Annual Report Summaries and Tables.* Tennessee Valley Authority, Fish and Game Branch, Division of Forestry Relations, Knoxville, Tennessee.

TVA. 1960. *Annual Report Fiscal Year 1960.* Tennessee Valley Authority, Fish and Game Branch, Knoxville, Tennessee.

TVA. 1961. *Annual Report Fiscal Year 1961.* Tennessee Valley Authority, Fish and Game Branch, Knoxville, Tennessee.

TVA. 1962. *Annual Report.* Tennessee Valley Authority, Fish and Wildlife Branch, Knoxville, Tennessee.

TVA. 1963. *Annual Report.* Tennessee Valley Authority, Fish and Wildlife Branch, Knoxville, Tennessee.

TVA. 1967. *Annual Report Fiscal Year 1967.* Tennessee Valley Authority, Fish and Wildlife Branch, Knoxville, Tennessee.

USDA. 1941. *Family Food Consumption and Dietary Levels: Five Regions.* U.S. Department of Agriculture, Washington, D.C. Miscellaneous Publication No. 405.

USDA. 1950. *Diets of Families in the Open Country A Georgia and an Ohio County Summer 1945.* U.S. Department of Agriculture, Washington, D.C. Miscellaneous Publication No. 704.

USDA. 1955. *Dietary Levels if Households in the South.* U.S. Department of Agriculture, Washington, D.C. Report No. 9.

USDA. 1959. *Consumption of Food in the United States 1909-48.* U.S. Department of Agriculture, Bureau of Agricultural Economics, Washington, D.C. August.

USDOI. 1993. *1991 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation - Tennessee.* U.S. Department of the Interior, Fish and Wildlife Service, and U.S. Department of Commerce, Bureau of the Census. July.

Wendt, M.E. 1986. Low income families' consumption of freshwater fish caught from New York State waters. Masters Thesis. Cornell University. August.

West, P.C., J.M. Fly, R. Marans, and F. Larkin. 1989. *Michigan Sport Anglers Fish Consumption Survey. A Report to the Michigan Toxic Substance Control Commission.* University of Michigan, School of Natural Resources, Ann Arbor, MI. Technical Report No. 1. May.

West, P.C., J.M. Fly, F. Larkin, and R. Marans. 1991. Minority anglers and toxic fish consumption: Evidence from a state-wide survey of Michigan. *In:* Proceedings of the Michigan conference on race and the incidence of environmental hazards (Bryan and Mohai, eds.).

Wolfe, R.J. and R.J. Walker. 1987. Subsistence economies in Alaska: Productivity, geography, and development impacts. *Arctic Anthropology* 24(2):56-81.

APPENDIX M

DETERMINATION OF DILUTION FACTORS FOR ESTIMATING SURFACE WATER CONCENTRATIONS IN EAST FORK POPLAR CREEK DOWNSTREAM OF Y-12

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APPENDIX M

DETERMINATION OF DILUTION FACTORS FOR ESTIMATING SURFACE WATER CONCENTRATIONS IN EAST FORK POPLAR CREEK DOWNSTREAM OF Y-12

This appendix presents the calculations used to determine dilution factors for estimating average mercury concentrations in surface water at reference population locations downstream from Y-12. This methodology assumes that mercury concentrations in water released from Y-12 are diluted by inflow to EFPC below Y-12.

The effect of dilution is approximated based on the ratio of the initial discharge volume (at Y-12) to the estimated water volume in the creek at the receptor location (assumed to be equal to the initial discharge volume plus the additional volume from inflows into the creek), as follows:

$$\textit{Dilution Ratio (\% of Original Release Conc.)} = \frac{\textit{Y-12 discharge (cfs)}}{\textit{Y-12 discharge (cfs)} + \textit{EFPC inflow (cfs)}}$$

EFPC inflow was calculated as follows:

$$\textit{EFPC inflow (cfs)} = \textit{Drainage basin area } (mi^2) \times \textit{Precip (in.)} \times \textit{Runoff (\%)} \times \frac{0.07367\ ft^2/mi^2}{sec/yr}$$

Uncertainties in the dilution ratio were evaluated based on uncertainties in concentrations and volumes of Y-12 discharge to EFPC, as well as assumptions to reflect uncertainties in the size of the drainage basin, average precipitation and runoff rates, and discharge volumes from the Oak Ridge waste water treatment plant. Values for specific years were used to calculate composite uncertainty factors to bound the Y-12 discharge concentrations used in the calculation of annual average concentrations for downstream population locations (Table 7-4).

Values used to calculate dilution ratios, and to determine uncertainties in the dilution ratio, were based on the following assumptions:

1. Values for the mass of mercury released from Y-12 to EFPC per year and the Y-12 discharge volume were determined as described in Section 4.5. Data on the precision of the analytical methods for measuring mercury concentrations in discharges to EFPC indicate uncertainties in measured concentrations range from ± 50% in 1953 to ± 10% in 1993, and data on the quality of the flow rate data, as determined by the USGS, indicate that uncertainties in measured annual average discharge volumes from Y-12 ranged from ± 15% in 1953 to ± 10% in 1993. Uncertainties specific to each year were assumed to be as follows:

Year	Y-12 Concentration Uncertainty	Y-12 Flow Rate Uncertainty
1953-56	±50%	±15%
1957-59	±15%	±15%
1960-61	±30%	±15%
1962-67	±40%	±15%
1968-82	±20%	±10%
1983-93	±10%	±10%

2. Values for precipitation were based on total annual precipitation measured at the United States Weather Bureau's Oak Ridge Station (near downtown Oak Ridge) as presented in USGS (1967) (for 1953-1964) and the Oak Ridge Annual Environmental Monitoring Reports (for 1965-1991). Annual average precipitation at this location between 1931 and 1960 was 54.71 inches. During a similar period (1935-1959), annual average precipitation measured by Union Carbide at K-25 and ORNL were 57.85 inches and 51.52 inches, respectively (USGS 1967). Based on these data, it was assumed that uncertainty/ variability in annual precipitation measurements (as applied to different reference population locations) was ± 5%.

3. Values for size of the drainage basin were based on data presented by TVA in their Instream Contaminant Study (TVA 1985b). TVA presents drainage basin areas above several points on EFPC, including upstream of New Hope Pond, at several TVA flow measuring stations, and at a USGS flow measuring station, as follows:

River Mile	Drainage Area (mi^2)	Location
EFPC Mile 14.7	1.25	New Hope Pond
EFPC Mile 14.36	1.69	TVA Gage Site
EFPC Mile 10.0	8.72	TVA Gage Site
EFPC Mile 6.89	13.9	TVA Gage Site
EFPC Mile 3.3	19.5	USGS Gage Site
EFPC Mile 0.03	29.8	TVA Gage Site

Based on these data, the estimated area of the EFPC drainage basin, downstream of New Hope Pond/ Lake Reality (at EFPC Mile 14.7), is approximately 28.6 mi^2 (29.8 - 1.25 mi^2). Runoff from the drainage area above New Hope Pond is assumed to be included in the Y-12 discharge volume. For reference population locations between the river miles listed in the table, drainage areas were extrapolated assuming a linear increase in the size of the drainage basin proceeding downstream to the next gage station site. Uncertainties in the size of the drainage basin areas, based on possible measurement errors and the accuracy of linear extrapolation to locations between the river miles listed above, were assumed to be ±10%.

4. Values for runoff are based on the assumption that the annual runoff is 40% of annual precipitation. The annual average precipitation in the US Weather Bureau Oak Ridge station between 1931 and 1960 was 54.71 inches (USGS 1967). During a similar period (1936-1960), the estimated annual average runoff at the USGS EFPC gaging station area was 21.7 inches (USGS 1967), or about 40% of the annual precipitation. These USGS estimates of runoff were based on measurements of water flow in EFPC at Mile 3.3 less inputs to EFPC from Y-12 and Oak Ridge waste water treatment plant releases. Measurements of runoff to other creeks near EFPC, including Emory Valley Creek, Scarboro Creek, Poplar Creek, and Bear Creek, between 1936 and 1960 ranged from 21.7 to 25.2 inches (USGS 1967), or about 37% to 46% of annual precipitation. Based on these measurements, the uncertainty/ variability in the percent runoff for each year as applied to different reference population locations was assumed to be ±10%.

5. Discharge from the Oak Ridge waste water treatment plant was assumed to impact flow below the treatment plant's discharge into the creek (EFPC Mile 8.3) after 1958, when the plant was built. Discharge from the sewage treatment plant between 1961 and 1964 ranged from 3 to 10 cfs (USGS 1967)**S** this range was used to estimate the dilution ratio for application to the EFPC/ Poplar Creek junction. A uniform distribution was assumed. The EFPC reference populations evaluated in this assessment resided upstream of the sewage treatment plant. Therefore, discharges from the treatment plant were assumed not to contribute to dilution at these locations.

Spreadsheets showing the results of the dilution ratio calculations follow. The average uncertainty about the estimated dilution ratios (at the 5^{th} and 95^{th} percentiles of the distributions) ranged from ±15 to ±20%.

CALCULATION OF DILUTION IN EAST FORK POPLAR CREEK

DILUTION AT JUNCTION

Source of Data/ Assumptions:

Measured Precip. (in.)	=	Annual precipitation at the Oak Ridge Station (1953-1964, USGS 1839-N (Table 1); 1965-1990, MMES, 1991)
Calculated Runoff (in.)	=	[Precip. (in.)] x [21.7 in. (annual avg. runoff, USGS 1839-N)/ 53.90 in. (annual avg. precip., USGS 1839-N)]
Calculated EFPC Inflow (ft^3/sec)	=	[Runoff (in.)] x [(29.8 - 1.25)(dge area dwnstrm frm NHP to junction w/ PC (TVA, 1985b))] x 0.0736682 (ft2/mi2)/(s/yr)
Y-12 Release Volume (MGD)	=	Annual average release volume from Y-12 in Millions of Gallons per day (UCCND, 1983)
Y-12 Release Volume (ft^3/sec)	=	ft^3/sec = MGD/0.64632
WWT Release Volume (ft^3/sec)	=	ft^3/sec from Waste Water Treatment plant (USGS 1839-N)
Junction Flow Volume (ft^3/sec)	=	Runoff (ft^3/sec) + Y-12 Release Volume (ft^3/sec) + WWT Release Volume (ft^3/sec)
Dilution Ratio (at Junction)	=	Y-12 Release Volume (ft^3/sec) / Junction Flow Volume (ft^3/sec)
Junction Conc.--Dilution only (mg/L)	=	Dilution Ratio * Y-12 Conc. (mg/L)

Year	Measured Precip. (in.)	Precip Dist	Calculated Runoff (in.)	Calculated EFPC Inflow (ft^3/sec)	Y-12 Release Volume (MGD)	Y-12 Vol Dist	Y-12 Release Volume (ft^3/sec)	WWT Release Volume (ft^3/sec)	Junction Flow Volume (ft^3/sec)	Dilution ratio (at Junction)	Y-12 Conc. (mg/L)	Junction Conc. -- Dilution only (mg/L)
1953	46.3	46.3	18.7	39.2	11	11	17.0	ND	56.3	0.30	0.47	0.14
1954	56.7	56.7	22.8	48.0	10.3	10.3	15.9	ND	63.9	0.25	0.22	0.055
1955	56.1	56.1	22.6	47.5	11.1	11.1	17.2	ND	64.7	0.27	1.06	0.28
1956	67.1	67.1	27.0	56.9	11.4	11.4	17.6	ND	74.5	0.24	0.85	0.20
1957	67.9	67.9	27.3	57.5	11	11	17.0	ND	74.5	0.23	2.22	0.51
1958	37.4	37.4	15.1	31.7	8.7	8.7	13.5	6.5	51.7	0.26	2.33	0.61
1959	50.5	50.5	20.3	42.8	9.6	9.6	14.9	6.5	64.1	0.23	0.68	0.16
1960	54.3	54.3	21.9	46.0	9.7	9.7	15.0	6.5	67.5	0.22	0.24	0.053
1961	60.9	60.9	24.5	51.6	11	11	17.0	6.5	75.1	0.23	0.2	0.045
1962	61.1	61.1	24.6	51.7	12.5	12.5	19.3	6.5	77.6	0.25	0.12	0.030
1963	44.7	44.7	18.0	37.9	11.9	11.9	18.4	6.5	62.8	0.29	0.086	0.025
1964	49.9	49.9	20.1	42.3	8.8	8.8	13.6	6.5	62.4	0.22	0.044	0.010
1965	47.2	47.2	19.0	40.0	8.7	8.7	13.5	6.5	60.0	0.22	0.095	0.021
1966	46.1	46.1	18.5	39.0	10.3	10.3	15.9	6.5	61.4	0.26	0.043	0.011
1967	67.7	67.7	27.3	57.3	9.3	9.3	14.4	6.5	78.2	0.18	0.031	0.0057
1968	38.6	38.6	15.5	32.7	10.1	10.1	15.6	6.5	54.8	0.29	0.005	0.0014
1969	49.2	49.2	19.8	41.7	9.4	9.4	14.5	6.5	62.7	0.23	0.006	0.0014
1970	52.0	52.0	20.9	44.0	8.9	8.9	13.8	6.5	64.3	0.21	0.026	0.0056
1971	52.4	52.4	21.1	44.3	9	9	13.9	6.5	64.8	0.22	0.006	0.0013
1972	63.0	63.0	25.4	53.3	7.7	7.7	11.9	6.5	71.8	0.17	0.001	0.00017
1973	75.6	75.6	30.4	64.0	8.7	8.7	13.5	6.5	84.0	0.16	0.065	0.010
1974	56.7	56.7	22.8	48.0	6.2	6.2	9.6	6.5	64.1	0.15	0.015	0.0022
1975	60.2	60.2	24.3	51.0	6.8	6.8	10.5	6.5	68.0	0.15	0.001	0.00015
1976	52.4	52.4	21.1	44.3	8	8	12.4	6.5	63.2	0.20	0.001	0.00020
1977	62.2	62.2	25.0	52.7	8.6	8.6	13.3	6.5	72.5	0.18	0.002	0.00037
1978	47.2	47.2	19.0	40.0	6.1	6.1	9.4	6.5	55.9	0.17	0.001	0.00017
1979	68.5	68.5	27.6	58.0	7.8	7.8	12.1	6.5	76.6	0.16	0.002	0.00032
1980	39.4	39.4	15.9	33.3	8.5	8.5	13.2	6.5	53.0	0.25	0.002	0.00050
1981	41.3	41.3	16.6	35.0	7.2	7.2	11.1	6.5	52.6	0.21	0.002	0.00042
1982	59.4	59.4	23.9	50.3	9	9	13.9	6.5	70.8	0.20	0.003	0.00059
1983	46.9	46.9	18.9	39.7	9	9	13.9	6.5	60.1	0.23	0.002	0.00046
1984	55.9	55.9	22.5	47.3	9.2	9.2	14.2	6.5	68.1	0.21	0.0016	0.00033
1985	46.1	46.1	18.5	39.0	9.6	9.6	14.9	6.5	60.4	0.25	0.0018	0.00044
1986	38.6	38.6	15.5	32.7	9.4	9.4	14.5	6.5	53.7	0.27	0.0022	0.00060
1987	39.8	39.8	16.0	33.7	8.2	8.2	12.7	6.5	52.9	0.24	0.0028	0.00067
1988	50.0	50.0	20.1	42.3	6.8	6.8	10.5	6.5	59.4	0.18	0.0019	0.00034
1989	66.1	66.1	26.6	56.0	7.4	7.4	11.4	6.5	74.0	0.15	0.0017	0.00026
1990	59.4	59.4	23.9	50.3	9.8	9.8	15.2	6.5	72.0	0.21	0.0017	0.00036
1991	53.6	53.6	21.6	45.4	5.5	5.5	8.5	6.5	60.4	0.14	0.0014	0.000197
1992	53.6	53.6	21.6	45.4	4.3	4.3	6.7	6.5	58.5	0.11	0.0017	0.000193
1993	53.6	53.6	21.6	45.4	5	5	7.7	6.5	59.6	0.13	0.0016	0.000208

AVERAGE	**0.22**
STD	**0.041**

CALCULATION OF DILUTION IN EAST FORK POPLAR CREEK

DILUTION AT EFPC MILE 10 (EFPC FARM FAMILY):

Source of Data/ Assumptions:

Measured Precip. (in.)	=	Annual precipitation at the Oak Ridge Station (1953-1964, USGS 1839-N (Table 1); 1965-1990, MMES, 1991)
Calculated Runoff (in.)	=	[Precip. (in.)] x [21.7 in. (annual avg. runoff, USGS 1839-N)/ 53.90 in. (annual avg. precip., USGS 1839-N)]
Calculated EFPC Inflow (ft^3/sec)	=	[Runoff (in.)] x [(8.72 mi2 - 1.25 mi2)(drainage area dwnstrm frm NHP to EFPCM 10 (TVA, 1985b))] x 0.0736682 (ft2/mi2)/(s/yr)
Y-12 Release Volume (MGD)	=	Annual average release volume from Y-12 in Millions of Gallons per day (UCCND, 1983)
Y-12 Release Volume (ft^3/sec)	=	ft^3/sec = MGD/0.64632
Mile 10 Flow Volume (ft^3/sec)	=	Runoff (ft^3/sec) + Y-12 Release Volume (ft^3/sec)
Dilution Ratio (at Mile 10)	=	Y-12 Release Volume (ft^3/sec) / Mile 10 Flow Volume (ft^3/sec)
Mile 10 Conc.--Dilution only (mg/L)	=	Dilution Ratio * Y-12 Conc. (mg/L)

Year	Measured Precip. (in.)	Precip Dist	Calculated Runoff (in.)	Calculated EFPC Inflow (ft^3/sec)	Y-12 Release Volume (MGD)	Y-12 Vol Dist	Y-12 Release Volume (ft^3/sec)	Mile 10 Flow Volume (ft^3/sec)	Dilution Ratio (at Mile 10)		Y-12 Conc. (mg/L)	Mile 10 Conc. -- Dilution only (mg/L)
1950	61.55	61.6	24.8	13.6								
1951	60.2	60.2	24.2	13.3								
1952	39.41	39.4	15.9	8.7								
1953	46.3	46.3	18.7	10.3	11.0	11	17.0	27.3	0.62		0.47	0.29
1954	56.7	56.7	22.8	12.6	10.3	10.3	15.9	28.5	0.56		0.22	0.12
1955	56.1	56.1	22.6	12.4	11.1	11.1	17.2	29.6	0.58		1.06	0.61
1956	67.1	67.1	27.0	14.9	11.4	11.4	17.6	32.5	0.54		0.85	0.46
1957	67.9	67.9	27.3	15.0	11.0	11	17.0	32.1	0.53		2.22	1.2
1958	37.4	37.4	15.1	8.3	8.7	8.7	13.5	21.8	0.62		2.33	1.4
1959	50.5	50.5	20.3	11.2	9.6	9.6	14.9	26.1	0.57		0.68	0.39
1960	54.3	54.3	21.9	12.0	9.7	9.7	15.0	27.0	0.55		0.24	0.13
1961	60.9	60.9	24.5	13.5	11.0	11	17.0	30.5	0.56		0.2	0.11
1962	61.1	61.1	24.6	13.5	12.5	12.5	19.3	32.9	0.59		0.12	0.071
1963	44.7	44.7	18.0	9.9	11.9	11.9	18.4	28.3	0.65		0.086	0.056
1964	49.9	49.9	20.1	11.1	8.8	8.8	13.6	24.7	0.55		0.044	0.024
1965	47.2	47.2	19.0	10.5	8.7	8.7	13.5	23.9	0.56		0.095	0.053
1966	46.1	46.1	18.5	10.2	10.3	10.3	15.9	26.1	0.61		0.043	0.026
1967	67.7	67.7	27.3	15.0	9.3	9.3	14.4	29.4	0.49		0.031	0.015
1968	38.6	38.6	15.5	8.5	10.1	10.1	15.6	24.2	0.65		0.005	0.0032
1969	49.2	49.2	19.8	10.9	9.4	9.4	14.5	25.4	0.57		0.006	0.0034
1970	52.0	52.0	20.9	11.5	8.9	8.9	13.8	25.3	0.54		0.026	0.014
1971	52.4	52.4	21.1	11.6	9.0	9	13.9	25.5	0.55		0.006	0.0033
1972	63.0	63.0	25.4	14.0	7.7	7.7	11.9	25.9	0.46		0.001	0.00046
1973	75.6	75.6	30.4	16.7	8.7	8.7	13.5	30.2	0.45		0.065	0.029
1974	56.7	56.7	22.8	12.6	6.2	6.2	9.6	22.2	0.43		0.015	0.0065
1975	60.2	60.2	24.3	13.3	6.8	6.8	10.5	23.9	0.44		0.001	0.00044
1976	52.4	52.4	21.1	11.6	8.0	8	12.4	24.0	0.52		0.001	0.00052
1977	62.2	62.2	25.0	13.8	8.6	8.6	13.3	27.1	0.49		0.002	0.0010
1978	47.2	47.2	19.0	10.5	6.1	6.1	9.4	19.9	0.47		0.001	0.00047
1979	68.5	68.5	27.6	15.2	7.8	7.8	12.1	27.2	0.44		0.002	0.00089
1980	39.4	39.4	15.9	8.7	8.5	8.5	13.2	21.9	0.60		0.002	0.0012
1981	41.3	41.3	16.6	9.2	7.2	7.2	11.1	20.3	0.55		0.002	0.0011
1982	59.4	59.4	23.9	13.2	9.0	9	13.9	27.1	0.51		0.003	0.0015
1983	46.9	46.9	18.9	10.4	9.0	9	13.9	24.3	0.57		0.002	0.0011
1984	55.9	55.9	22.5	12.4	9.2	9.2	14.2	26.6	0.53		0.0016	0.00086
1985	46.1	46.1	18.5	10.2	9.6	9.6	14.9	25.1	0.59		0.0018	0.0011
1986	38.6	38.6	15.5	8.5	9.4	9.4	14.5	23.1	0.63		0.0022	0.0014
1987	39.8	39.8	16.0	8.8	8.2	8.2	12.7	21.5	0.59		0.0028	0.0017
1988	50.0	50.0	20.1	11.1	6.8	6.8	10.5	21.6	0.49		0.0019	0.00093
1989	66.1	66.1	26.6	14.7	7.4	7.4	11.4	26.1	0.44		0.0017	0.00075
1990	59.4	59.4	23.9	13.2	9.8	9.8	15.2	28.3	0.54		0.0017	0.00091
1991	53.6	53.6	21.6	11.9	5.5	5.5	8.5	20.4	0.42		0.0014	0.00058
1992	53.6	53.6	21.6	11.9	4.3	4.3	6.7	18.5	0.36		0.0017	0.00061
1993	53.6	53.6	21.6	11.9	5.0	5	7.7	19.6	0.39		0.0016	0.00063

AVERAGE **0.54**
STDEV **0.061**

CALCULATION OF DILUTION IN EAST FORK POPLAR CREEK

DILUTION AT EFPC MILE 12 (ROBERTSVILLE SCHOOL):

Source of Data/ Assumptions:

Measured Precip. (in.)	=	Annual precipitation at the Oak Ridge Station (1953-1964, USGS 1839-N (Table 1); 1965-1990, MMES, 1991)
Calculated Runoff (in.)	=	[Precip. (in.)] x [21.7 in. (annual avg. runoff, USGS 1839-N)/ 53.90 in. (annual avg. precip., USGS 1839-N)]
Calculated EFPC Inflow (ft^3/sec)	=	[Runoff (in.)] x [(5.5 mi2 - 1.25 mi2)(drainage area dwnstrm frm NHP to EFPCM 11.85 (TVA, 1985b))] x 0.0736682 (ft2/mi2)/(s/yr)
Y-12 Release Volume (MGD)	=	Annual average release volume from Y-12 in Millions of Gallons per day (UCCND, 1983)
Y-12 Release Volume (ft^3/sec)	=	ft^3/sec = MGD/0.64632
Mile 12 Flow Volume (ft^3/sec)	=	Runoff (ft^3/sec) + Y-12 Release Volume (ft^3/sec)
Dilution Ratio (at Mile 12)	=	Y-12 Release Volume (ft^3/sec) / Mile 12 Flow Volume (ft^3/sec)
Mile 12 Conc.--Dilution only (mg/L)		Dilution Ratio * Y-12 Conc. (mg/L)

Year	Measured Precip. (in.)	Precip Dist	Calculated Runoff (in.)	Calculated EFPC Inflow (ft^3/sec)	Y-12 Release Volume (MGD)	Y-12 Vol Dist	Y-12 Release Volume (ft^3/sec)	Mile 12 Flow Volume (ft^3/sec)	Dilution Ratio (at Mile 12)		Y-12 Conc. (mg/L)	Mile 12 Conc. -- Dilution only (mg/L)
1953	46.3	46.3	18.7	5.84	11	11	17.0	22.9	0.74		0.47	0.35
1954	56.7	56.7	22.8	7.15	10.3	10.3	15.9	23.1	0.69		0.22	0.15
1955	56.1	56.1	22.6	7.07	11.1	11.1	17.2	24.2	0.71		1.06	0.75
1956	67.1	67.1	27.0	8.46	11.4	11.4	17.6	26.1	0.68		0.85	0.57
1957	67.9	67.9	27.3	8.56	11	11	17.0	25.6	0.67		2.22	1.48
1958	37.4	37.4	15.1	4.72	8.7	8.7	13.5	18.2	0.74		2.33	1.73
1959	50.5	50.5	20.3	6.37	9.6	9.6	14.9	21.2	0.70		0.68	0.48
1960	54.3	54.3	21.9	6.85	9.7	9.7	15.0	21.9	0.69		0.24	0.16
1961	60.9	60.9	24.5	7.68	11	11	17.0	24.7	0.69		0.2	0.14
1962	61.1	61.1	24.6	7.70	12.5	12.5	19.3	27.0	0.72		0.12	0.086
1963	44.7	44.7	18.0	5.63	11.9	11.9	18.4	24.0	0.77		0.086	0.066
1964	49.9	49.9	20.1	6.30	8.8	8.8	13.6	19.9	0.68		0.044	0.030
1965	47.2	47.2	19.0	5.96	8.7	8.7	13.5	19.4	0.69		0.095	0.066
1966	46.1	46.1	18.5	5.81	10.3	10.3	15.9	21.7	0.73		0.043	0.032
1967	67.7	67.7	27.3	8.54	9.3	9.3	14.4	22.9	0.63		0.031	0.019
1968	38.6	38.6	15.5	4.86	10.1	10.1	15.6	20.5	0.76		0.005	0.0038
1969	49.2	49.2	19.8	6.20	9.4	9.4	14.5	20.7	0.70		0.006	0.0042
1970	52.0	52.0	20.9	6.55	8.9	8.9	13.8	20.3	0.68		0.026	0.018
1971	52.4	52.4	21.1	6.60	9	9	13.9	20.5	0.68		0.006	0.0041
1972	63.0	63.0	25.4	7.94	7.7	7.7	11.9	19.9	0.60		0.001	0.00060
1973	75.6	75.6	30.4	9.53	8.7	8.7	13.5	23.0	0.59		0.065	0.038
1974	56.7	56.7	22.8	7.15	6.2	6.2	9.6	16.7	0.57		0.015	0.0086
1975	60.2	60.2	24.3	7.59	6.8	6.8	10.5	18.1	0.58		0.001	0.00058
1976	52.4	52.4	21.1	6.60	8	8	12.4	19.0	0.65		0.001	0.00065
1977	62.2	62.2	25.0	7.84	8.6	8.6	13.3	21.1	0.63		0.002	0.0013
1978	47.2	47.2	19.0	5.96	6.1	6.1	9.4	15.4	0.61		0.001	0.0006
1979	68.5	68.5	27.6	8.64	7.8	7.8	12.1	20.7	0.58		0.002	0.0012
1980	39.4	39.4	15.9	4.96	8.5	8.5	13.2	18.1	0.73		0.002	0.0015
1981	41.3	41.3	16.6	5.21	7.2	7.2	11.1	16.4	0.68		0.002	0.0014
1982	59.4	59.4	23.9	7.49	9	9	13.9	21.4	0.65		0.003	0.0020
1983	46.9	46.9	18.9	5.91	9	9	13.9	19.8	0.70		0.002	0.0014
1984	55.9	55.9	22.5	7.05	9.2	9.2	14.2	21.3	0.67		0.0016	0.0011
1985	46.1	46.1	18.5	5.81	9.6	9.6	14.9	20.7	0.72		0.0018	0.0013
1986	38.6	38.6	15.5	4.86	9.4	9.4	14.5	19.4	0.75		0.0022	0.0016
1987	39.8	39.8	16.0	5.01	8.2	8.2	12.7	17.7	0.72		0.0028	0.0020
1988	50.0	50.0	20.1	6.30	6.8	6.8	10.5	16.8	0.63		0.0019	0.0012
1989	66.1	66.1	26.6	8.34	7.4	7.4	11.4	19.8	0.58		0.0017	0.00098
1990	59.4	59.4	23.9	7.49	9.8	9.8	15.2	22.7	0.67		0.0017	0.0011
1991	53.6	53.6	21.6	6.76	5.5	5.5	8.5	15.3	0.56		0.0014	0.00078
1992	53.6	53.6	21.6	6.76	4.3	4.3	6.7	13.4	0.50		0.0017	0.00084
1993	53.6	53.6	21.6	6.76	5	5	7.7	14.5	0.53		0.0016	0.00085

AVERAGE **0.67**
STDEV **0.054**

CALCULATION OF DILUTION IN EAST FORK POPLAR CREEK

DILUTION AT EFPC MILE 14 (SCARBORO)

Source of Data/ Assumptions:

Measured Precip. (in.)	=	Annual precipitation at the Oak Ridge Station (1953-1964, USGS 1839-N (Table 1); 1965-1990, MMES, 1991)
Calculated Runoff (in.)	=	[Precip. (in.)] x [21.7 in. (annual avg. runoff, USGS 1839-N)/ 53.90 in. (annual avg. precip., USGS 1839-N)]
Calculated EFPC Inflow (ft3/sec)	=	[Runoff (in.)] x [(2.27-1.25 mi2)(drainage area dwnstrm from NHP to EFPCM 14 (TVA, 1985b))] x 0.0736682 (ft2/mi2)/(s/yr)
Y-12 Release Volume (MGD)	=	Annual average release volume from Y-12 in Millions of Gallons per day (UCCND, 1983)
Y-12 Release Volume (ft3/sec)	=	ft3/sec = MGD/0.64632
Mile 14 Flow Volume (ft3/sec)	=	Runoff (ft3/sec) + Y-12 Release Volume (ft3/sec)
Dilution Ratio (at Mile 14)	=	Y-12 Release Volume (ft3/sec) / Mile 14 Flow Volume (ft3/sec)
Mile 14 Conc.--Dilution only (mg/L)		Dilution Ratio * Y-12 Conc. (mg/L)

Year	Measured Precip. (in.)	Precip Dist	Calculated Runoff (in.)	Calculated EFPC Inflow (ft3/sec)	Y-12 Release Volume (MGD)	Y-12 Vol Dist	Y-12 Release Volume (ft3/sec)	Mile 14 Flow Volume (ft3/sec)	Dilution Ratio (at Mile 14)		Y-12 Conc. (mg/L)	Mile 14 Conc. -- Dilution only (mg/L)
1953	46.3	46.3	18.7	1.40	11	11	17.0	18.4	0.92		0.47	0.43
1954	56.7	56.7	22.8	1.72	10.3	10.3	15.9	17.7	0.90		0.22	0.20
1955	56.1	56.1	22.6	1.70	11.1	11.1	17.2	18.9	0.91		1.06	0.96
1956	67.1	67.1	27.0	2.03	11.4	11.4	17.6	19.7	0.90		0.85	0.76
1957	67.9	67.9	27.3	2.05	11	11	17.0	19.1	0.89		2.22	2.0
1958	37.4	37.4	15.1	1.13	8.7	8.7	13.5	14.6	0.92		2.33	2.1
1959	50.5	50.5	20.3	1.53	9.6	9.6	14.9	16.4	0.91		0.68	0.62
1960	54.3	54.3	21.9	1.64	9.7	9.7	15.0	16.7	0.90		0.24	0.22
1961	60.9	60.9	24.5	1.84	11	11	17.0	18.9	0.90		0.2	0.18
1962	61.1	61.1	24.6	1.85	12.5	12.5	19.3	21.2	0.91		0.12	0.11
1963	44.7	44.7	18.0	1.35	11.9	11.9	18.4	19.8	0.93		0.086	0.080
1964	49.9	49.9	20.1	1.51	8.8	8.8	13.6	15.1	0.90		0.044	0.040
1965	47.2	47.2	19.0	1.43	8.7	8.7	13.5	14.9	0.90		0.095	0.086
1966	46.1	46.1	18.6	1.39	10.3	10.3	15.9	17.3	0.92		0.043	0.040
1967	67.7	67.7	27.3	2.05	9.3	9.3	14.4	16.4	0.88		0.031	0.027
1968	38.6	38.6	15.5	1.17	10.1	10.1	15.6	16.8	0.93		0.005	0.0047
1969	49.2	49.2	19.8	1.49	9.4	9.4	14.5	16.0	0.91		0.006	0.0054
1970	52.0	52.0	20.9	1.57	8.9	8.9	13.8	15.3	0.90		0.026	0.023
1971	52.4	52.4	21.1	1.59	9	9	13.9	15.5	0.90		0.006	0.0054
1972	63.0	63.0	25.4	1.91	7.7	7.7	11.9	13.8	0.86		0.001	0.00086
1973	75.6	75.6	30.4	2.29	8.7	8.7	13.5	15.7	0.85		0.065	0.056
1974	56.7	56.7	22.8	1.72	6.2	6.2	9.6	11.3	0.85		0.015	0.013
1975	60.2	60.2	24.2	1.82	6.8	6.8	10.5	12.3	0.85		0.001	0.00085
1976	52.4	52.4	21.1	1.59	8	8	12.4	14.0	0.89		0.001	0.00089
1977	62.2	62.2	25.0	1.88	8.6	8.6	13.3	15.2	0.88		0.002	0.0018
1978	47.2	47.2	19.0	1.43	6.1	6.1	9.4	10.9	0.87		0.001	0.00087
1979	68.5	68.5	27.6	2.07	7.8	7.8	12.1	14.1	0.85		0.002	0.0017
1980	39.4	39.4	15.9	1.19	8.5	8.5	13.2	14.3	0.92		0.002	0.0018
1981	41.3	41.3	16.6	1.25	7.2	7.2	11.1	12.4	0.90		0.002	0.0018
1982	59.4	59.4	23.9	1.80	9	9	13.9	15.7	0.89		0.003	0.0027
1983	46.9	46.9	18.9	1.42	9	9	13.9	15.3	0.91		0.002	0.0018
1984	55.9	55.9	22.5	1.69	9.2	9.2	14.2	15.9	0.89		0.0016	0.0014
1985	46.1	46.1	18.6	1.39	9.6	9.6	14.9	16.2	0.91		0.0018	0.0016
1986	38.6	38.6	15.5	1.17	9.4	9.4	14.5	15.7	0.93		0.0022	0.0020
1987	39.8	39.8	16.0	1.20	8.2	8.2	12.7	13.9	0.91		0.0028	0.0026
1988	50.0	50.0	20.1	1.51	6.8	6.8	10.5	12.0	0.87		0.0019	0.0017
1989	66.1	66.1	26.6	2.00	7.4	7.4	11.4	13.4	0.85		0.0017	0.0014
1990	59.4	59.4	23.9	1.80	9.8	9.8	15.2	17.0	0.89		0.0017	0.0015
1991	53.6	53.6	21.6	1.62	5.5	5.5	8.5	10.1	0.84		0.0014	0.0012
1992	53.6	53.6	21.6	1.62	4.3	4.3	6.7	8.3	0.80		0.0017	0.0014
1993	53.6	53.6	21.6	1.62	5	5	7.7	9.4	0.83		0.0016	0.0013

AVERAGE **0.90**
STDEV **0.024**

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APPENDIX N

ESTIMATION OF OFF-SITE MERCURY AIR CONCENTRATIONS

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APPENDIX N
ESTIMATION OF OFF-SITE MERCURY AIR CONCENTRATIONS

N.1 Introduction

This appendix describes the methods used to estimate emission rates and off-site air concentrations for direct mercury releases from Y-12. Emission rates were estimated using the following sources of information:

- Locations and volume flow rates (in cubic feet per minute) for whole buildings and individual building sources (e.g., fans, louvers, stacks) presented in Appendix G.

- Emission rates (in lbs yr^{-1}) for each building (estimated in the characterization of source terms presented in Section 4.0 and Appendix H), and

The most recent version of the USEPA-approved Industrial Source Complex Short Term (ISCST3) computer model was used to simulate the air dispersion of mercury emissions from the ORR (USEPA 1995). Ground-level air concentrations were estimated at a number of receptor locations, including the locations of trees analyzed for mercury content and ambient air monitoring stations.

Inputs to the air dispersion model were as follows:

- Emission rates for each source
- Source-specific parameters (i.e., location, height, release direction, velocity, and temperature)
- Meteorological data
- Critical receptor locations

Each of these inputs to the emissions model is summarized in the following sections.

N.2 Identification of Emission Sources and Emission Rate Estimation

Emission rates of mercury from ORR operations were developed based on an extensive review of operations records, environmental monitoring data, and interviews with site personnel. Specifically, mercury releases to air were estimated using the following information:

- Air concentrations of mercury measured in production buildings and pilot plants,
- Design of building ventilation systems, and
- Process information on mercury losses from specific operations related to production (i.e., mercury recovery furnace, scrap metal smelting, coal burning).

Process information indicated that mercury released to air at the ORR was primarily in the form of metallic mercury vapor.

Emissions from eight buildings and 113 individual sources (e.g., stacks, fans, and vents) were modeled. The primary source of mercury emissions include the Colex production facilities (Buildings 9201-4 and 9201-5), two lithium separation pilot plants (Buildings 9204-4 and 9201-2), steam plants (Buildings 9401-1, 9401-2, 9401-3), a mercury recovery furnace (Building 81-10), and a smelting operation near Buildings 9204-4 and 9720-26. Locations of the buildings described above are presented in Figure 3-1 of this report. Locations of individual point sources are shown in Figure 7-1 in the main text. Point sources of mercury emissions were identified from a review of building ventilation system drawings by a former Y-12 ventilation engineer. This review is presented in Appendix G of this report.

Volume flow rates of stacks, fans, and vents associated with each building point source release are summarized in Table N-1.

Total mercury released from each building, due to volatilization of metallic mercury escaping to the ambient air through existing stacks, fans, and vents, was estimated for each year of operation. Mercury emissions from individual point sources were estimated by assuming the individual source was proportional to the fractional volume flow rate of each building source:

$$\textit{Fraction emitted by individual source } (f) = \frac{\textit{Volume flow rate of individual source } (cfm)}{\textit{Total building ventilation rate } (cfm)} = \frac{Q_i}{Q_t}$$

or

$$Q_i = f \times Q_T$$

Where:

Q_i	=	Individual source mercury emission rate (lb yr^{-1})
f	=	Fraction of mercury emitted by individual source (unitless)
Q_T	=	Total building mercury emission rate (lb yr^{-1})

Table N-2 summarizes the source-specific parameters used to characterize emissions for air dispersion modeling, including stack height, stack diameter, exit velocity or volume flow rate, and exit temperature. The results of the emission rate calculations for each source are presented in Table N-3.

N.3 Estimation of Ambient Mercury Concentrations

Air dispersion modeling was conducted to estimate ground-level concentrations at off-site locations based on source emission rates, emission parameters, and local meteorological data. The ISCST3 air dispersion model (USEPA 1995, Version 96113) is accepted by the United States Environmental Protection Agency (USEPA) for use in relatively flat terrains such as that upwind and downwind of the ORR. The ISCST3 model is a Gaussian air dispersion model capable of handling multiple sources including point, volume, area, line, and open pit source types. The general Gaussian equation used to calculate ground-level concentrations located downwind from a source is given by the following equation:

$$\chi(x,y,z) = \frac{Q}{2\pi\sigma_y\sigma_z u}\exp\left[-0.5\left(\frac{y}{\sigma_y}\right)^2\right]\left\{\exp\left[-0.5\left(\frac{z-H}{\sigma_z}\right)^2\right]+\exp\left[-0.5\left(\frac{z+H}{\sigma_z}\right)^2\right]\right\}$$

Where:

χ	=	Ground-level concentration (µg m^{-3})
Q	=	Source emission rate (g s^{-1})
σ_y, σ_z	=	Standard deviations of lateral and vertical concentrations along the centerline of the plume (m)
u	=	Mean wind speed (m s^{-1}) at release height
x	=	Downwind distance along the centerline of the plume (m)
y	=	Horizontal distance from the centerline of the plume (m)
z	=	Vertical distance from ground level (m)
H	=	Plume height (m)

The height, length, and width of all above-ground structures at the facility were characterized based on the facility plot plan. Because a building near an emission source can create a wake effect known as downwash, effects of building downwash on air dispersion were included using USEPA's Building Profile Input Program (BPIP).

Meteorological data obtained from the Y-12 MTE Station for the year 1987 were used to provide hourly wind speed, wind direction, temperature, stability class, and mixing height information for the model. No comprehensive meteorological data from the Oak Ridge area for the 1950s were available. Data from 1987 were used as representative of the five year period 1985-1989 and the historical meteorological conditions.

Discrete receptor locations used in the model included locations of trees on and near the ORR analyzed for mercury content in tree rings and airborne mercury monitoring stations, as well as the location of the nearest downwind residents in Union Valley. Table N-4 presents a summary of the discrete receptors and their corresponding Universal Transverse Mercator (UTM) coordinates.

N.4 Modeling Results

The ISCST3 model was run to determine average ambient concentrations at each of the receptors on an annual basis, based on a unit emission rate (1 g s^{-1}) from each source. The contribution to the annual average air concentration at each receptor from a given source is obtained by multiplying the contribution from a unit release at the source by the emission rate (*Q*) for that source for each year of emission. The contribution at receptor *j* from source *i* in year *n* is

$$C_{ij} = Q_{i,n} \times C_{1,ij}$$

Where:

$Q_{i,n}$	=	Mercury emission rate from source *i* for the year *n* (g s^{-1})
C_{1ijj}	=	Concentration at receptor *j* due to unit emission (1 g s^{-1}) from source *i* (µg m^{-3})/(1 g s^{-1})
i	=	Source number
j	=	Receptor number
n	=	Year of emission

The total annual average airborne concentration at each receptor is then calculated by summing the contributions from all sources. Then, the total concentration in (µg m^{-3}) at receptor *j* in year *n* is:

$$C_{j,n} = \sum_{i=1}^{m} C_{i,j}$$

where *m* is the total number of sources.

The air concentrations calculated at each receptor for each year are summarized in Table N-5.

N.5 References

USEPA 1995. United Stated Environmental Protection Agency. *User's Guide for the Industrial Source Complex (ISC) Dispersion Models.* Research Triangle Park, North Carolina, March. ISCST3 version 96113. (EPA-454/B-95-003)

Table N-1: Summary of Volume Flow Rates for Mercury Emissions Sources

Building	Source Type	Quantity	Location	Volume Flow Rate (cfm)
9201-4	Stack	8	top	35,000
	Stack	4	top	107,200
	Stack	4	top	26,000
	Stack	8	top	73,851.25
	Fan	2	side	143,000
	Fan	6	side	70,200
	Fan	2	side	143,000
	Fan	3	side	22,500
	Fan	2	side	45,000
	Fan	2	side	70,200
	Fan	4	side	143,000
	Fan	6	side	70,200
9201-5	Stack	4	top	76,000
	Stack	4	top	46,550
	Stack	4	top	75,355
	Stack	4	top	114,223.13
	Stack	4	top	64,267.5
	Stack	4	top	31,750
	Fan	2	side	89,500
	Fan	4	side	45,300
	Fan	2	side	89,500
	Fan	1	side	40,000
9204-4	Stack	2	top	60,000
	Vent	6	top	20,000
	Vent	3	top	24,800
	Fan	6	side	40,000
9201-2	Stack	1	top	15,000
	Stack	2	top	2,000
	Stack	1	top	16,000
	Stack	1	top	32,000
81-10	Stack	1	top	1,300
9401-1	Stack	1	top	62,209
	Stack	1	top	110,593.95
9401-2	Stack	1	top	270,000
9401-3	Stack	1	top	270,000
	Stack	1	top	388,806.87

Table N-2: Stack Parameters

STACK I.D.	X-UTM (m)	Y-UTM (m)	SOURCE BASE ELEVATION (m)	HEIGHT (m)	TEMPERATURE (K)	DIAMETER (m)	EXIT VERTICAL VELOCITY* (m/s)	VOLUME FLOW RATE (cfm)	ORIENTATION*
STACKS									
S9201-21	747997.56	3985865.09	0	11.58	293.15	0.90	11.15	15,000.00	Vertical
S9201-22	747995.51	3985868.30	0	11.58	293.15	0.33	11.09	2,000.00	Vertical
S9201-23	747992.72	3985873.04	0	11.58	293.15	0.33	11.09	2,000.00	Vertical
S9201-24	747982.99	3985889.04	0	22.86	293.15	0.93	11.20	16,000.00	Vertical
S9201-25	747976.94	3985898.98	0	22.86	293.15	1.31	11.19	32,000.00	Vertical
S9201-41	747019.55	3985468.79	0	26.82	293.15	1.37	11.18	35,000.00	Vertical
S9201-42	747009.73	3985484.94	0	26.82	293.15	1.37	11.18	35,000.00	Vertical
S9201-43	746999.91	3985501.08	0	26.82	293.15	1.37	11.18	35,000.00	Vertical
S9201-44	746990.09	3985517.23	0	26.82	293.15	1.37	11.18	35,000.00	Vertical
S9201-45	746933.27	3985416.30	0	26.82	293.15	1.37	11.18	35,000.00	Vertical
S9201-46	746923.45	3985432.45	0	26.82	293.15	1.37	11.18	35,000.00	Vertical
S9201-47	746913.63	3985448.60	0	26.82	293.15	1.37	11.18	35,000.00	Vertical
S9201-48	746903.81	3985464.74	0	26.82	293.15	1.37	11.18	35,000.00	Vertical
S9201-49	746891.82	3985439.50	0	20.42	293.15	2.40	11.17	107,200.00	Vertical
S9201-410	746927.51	3985473.77	0	20.42	293.15	2.40	11.17	107,200.00	Vertical
S9201-411	746971.13	3985500.39	0	20.42	293.15	2.40	11.17	107,200.00	Vertical
S9201-412	747017.94	3985516.30	0	20.42	293.15	2.40	11.17	107,200.00	Vertical
S9201-413	746905.46	3985417.16	0	20.42	293.15	1.18	11.17	26,000.00	Vertical
S9201-414	746946.06	3985443.28	0	20.42	293.15	1.18	11.17	26,000.00	Vertical
S9201-415	746989.64	3985469.96	0	20.42	293.15	1.18	11.17	26,000.00	Vertical
S9201-416	747031.58	3985493.88	0	20.42	293.15	1.18	11.17	26,000.00	Vertical
S9201-417	746936.96	3985507.40	0	26.82	293.15	1.99	11.17	72,851.25	Vertical
S9201-418	746943.14	3985497.24	0	26.82	293.15	1.99	11.17	72,851.25	Vertical
S9201-419	746949.32	3985487.08	0	26.82	293.15	1.99	11.17	72,851.25	Vertical
S9201-420	746955.50	3985476.93	0	26.82	293.15	1.99	11.17	72,851.25	Vertical
S9201-421	746961.67	3985466.78	0	26.82	293.15	1.99	11.17	72,851.25	Vertical
S9201-422	746967.85	3985456.62	0	26.82	293.15	1.99	11.17	72,851.25	Vertical
S9201-423	746974.03	3985446.47	0	26.82	293.15	1.99	11.17	72,851.25	Vertical
S9201-424	746980.21	3985436.31	0	26.82	293.15	1.99	11.17	72,851.25	Vertical
S9201-51	746783.36	3985336.40	0	26.82	293.15	1.37	24.28	76,000.00	Vertical
S9201-52	746773.54	3985352.55	0	26.82	293.15	1.37	24.28	76,000.00	Vertical
S9201-53	746763.71	3985368.69	0	26.82	293.15	1.37	24.28	76,000.00	Vertical
S9201-54	746753.89	3985384.84	0	26.82	293.15	1.37	24.28	76,000.00	Vertical
S9201-55	746697.08	3985283.91	0	26.82	293.15	1.37	14.87	46,550.00	Vertical
S9201-56	746687.26	3985300.06	0	26.82	293.15	1.37	14.87	46,550.00	Vertical

Table N-2: Stack Parameters

STACK I.D.	X-UTM (m)	Y-UTM (m)	SOURCE BASE ELEVATION (m)	HEIGHT (m)	TEMPERATURE (K)	DIAMETER (m)	EXIT VERTICAL VELOCITY* (m/s)	VOLUME FLOW RATE (cfm)	ORIENTATION*
S9201-57	746677.44	3985316.21	0	26.82	293.15	1.37	14.87	46,550.00	Vertical
S9201-58	746667.61	3985332.35	0	26.82	293.15	1.37	14.87	46,550.00	Vertical
S9201-59	746647.69	3985320.24	0	20.42	293.15	1.83	13.54	75,355.00	Vertical
S9201-510	746657.52	3985304.09	0	20.42	293.15	1.83	13.54	75,355.00	Vertical
S9201-511	746667.34	3985287.94	0	20.42	293.15	1.83	13.54	75,355.00	Vertical
S9201-512	746677.16	3985271.80	0	20.42	293.15	1.83	13.54	75,355.00	Vertical
S9201-513	746687.56	3985344.49	0	20.42	293.15	2.74	9.12	114,223.13	Vertical
S9201-514	746697.38	3985328.34	0	20.42	293.15	2.74	9.12	114,223.13	Vertical
S9201-515	746707.20	3985312.19	0	20.42	293.15	2.74	9.12	114,223.13	Vertical
S9201-516	746717.03	3985296.05	0	20.42	293.15	2.74	9.12	114,223.13	Vertical
S9201-517	746733.94	3985372.71	0	20.42	293.15	1.83	11.55	64,267.50	Vertical
S9201-518	746743.77	3985356.56	0	20.42	293.15	1.83	11.55	64,267.50	Vertical
S9201-519	746753.59	3985340.41	0	20.42	293.15	1.83	11.55	64,267.50	Vertical
S9201-520	746763.41	3985324.26	0	20.42	293.15	1.83	11.55	64,267.50	Vertical
S9201-521	746773.81	3985396.96	0	20.42	293.15	1.37	10.14	31,750.00	Vertical
S9201-522	746783.63	3985380.81	0	20.42	293.15	1.37	10.14	31,750.00	Vertical
S9201-523	746793.46	3985364.66	0	20.42	293.15	1.37	10.14	31,750.00	Vertical
S9201-524	746803.27	3985348.52	0	20.42	293.15	1.37	10.14	31,750.00	Vertical
S9401-11	748011.15	3986017.52	0	30.48	422.04	1.83	11.18	62,200.00	Vertical
S9401-12	748030.68	3986029.40	0	30.48	422.04	2.44	11.18	110,593.95	Vertical
S9401-21	747083.59	3985385.07	0	30.48	422.04	3.81	11.18	270,000.00	Vertical
S9401-31	746929.02	3985306.16	0	57.91	422.04	3.81	11.18	270,000.00	Vertical
S9401-32	746962.56	3985326.57	0	57.91	422.04	4.57	11.18	388,800.00	Vertical
S81-101	747175.14	3985329.55	0	5.88	366.48	0.36	6.17	1,300.00	Vertical
S9204-41	746501.30	3985191.05	0	21.64	293.15	2.06	8.47	60,000.00	Vertical
S9204-42	746524.04	3985204.88	0	21.64	293.15	2.06	8.47	60,000.00	Vertical
S9720-26	746246.97	3984850.99	0	6.10	477.59	1.00	5.00	8,320.82	Vertical

Table N-2: Stack Parameters

STACK I.D.	X-UTM (m)	Y-UTM (m)	SOURCE BASE ELEVATION (m)	HEIGHT (m)	TEMPERATURE (K)	DIAMETER (m)	EXIT VERTICAL VELOCITY* (m/s)	VOLUME FLOW RATE (cfm)	ORIENTATION*
FANS									
F9201-44	746936.94	3985396.41	0	17.37	293.15	2.74	1.00	143,000.00	Horizontal
F9201-46	746949.25	3985403.90	0	17.37	293.15	2.74	1.00	143,000.00	Horizontal
F9201-47	746959.21	3985409.96	0	17.37	293.15	1.83	1.00	70,200.00	Horizontal
F9201-48	746963.02	3985412.27	0	17.37	293.15	1.83	1.00	70,200.00	Horizontal
F9201-49	746966.82	3985414.59	0	17.37	293.15	1.83	1.00	70,200.00	Horizontal
F9201-410	747005.66	3985438.21	0	17.37	293.15	1.83	1.00	70,200.00	Horizontal
F9201-411	747009.46	3985440.52	0	17.37	293.15	1.83	1.00	70,200.00	Horizontal
F9201-412	747013.26	3985442.84	0	17.37	293.15	1.83	1.00	70,200.00	Horizontal
F9201-413	747023.22	3985448.90	0	17.37	293.15	2.74	1.00	143,000.00	Horizontal
F9201-415	747035.53	3985456.39	0	17.37	293.15	2.74	1.00	143,000.00	Horizontal
F9201-416	747035.81	3985504.05	0	11.28	293.15	1.07	1.00	22,500.00	Horizontal
F9201-417	747033.50	3985507.85	0	11.28	293.15	1.07	1.00	22,500.00	Horizontal
F9201-418	747031.19	3985511.65	0	11.28	293.15	1.07	1.00	22,500.00	Horizontal
F9201-419	747028.87	3985515.45	0	11.28	293.15	1.07	1.00	22,500.00	Horizontal
F9201-420	747026.21	3985519.83	0	5.18	293.15	1.52	1.00	45,000.00	Horizontal
F9201-421	747023.90	3985523.64	0	5.18	293.15	1.52	1.00	45,000.00	Horizontal
F9201-423	747004.30	3985538.72	0	17.37	293.15	1.83	1.00	70,200.00	Horizontal
F9201-424	747000.50	3985536.41	0	17.37	293.15	1.83	1.00	70,200.00	Horizontal
F9201-425	746986.42	3985537.12	0	17.37	293.15	2.74	1.00	143,000.00	Horizontal
F9201-427	746974.11	3985529.63	0	17.37	293.15	2.74	1.00	143,000.00	Horizontal
F9201-428	746900.14	3985484.64	0	17.37	293.15	2.74	1.00	143,000.00	Horizontal
F9201-430	746887.83	3985477.14	0	17.37	293.15	2.74	1.00	143,000.00	Horizontal
F9201-431	746917.16	3985393.65	0	17.37	293.15	1.83	1.00	70,200.00	Horizontal
F9201-432	746920.96	3985395.96	0	17.37	293.15	1.83	1.00	70,200.00	Horizontal
F9201-434	746964.92	3985413.43	0	17.37	293.15	1.83	1.00	70,200.00	Horizontal
F9201-436	747011.36	3985441.68	0	17.37	293.15	1.83	1.00	70,200.00	Horizontal
F9201-437	747006.20	3985539.88	0	17.37	293.15	1.83	1.00	70,200.00	Horizontal
F9201-438	747002.40	3985537.57	0	17.37	293.15	1.83	1.00	70,200.00	Horizontal
F9201-54	746700.75	3985264.02	0	23.47	293.15	(40'x15')	1.00	89,500.00	Horizontal
F9201-56	746713.06	3985271.51	0	23.47	293.15	(40'x15')	1.00	89,500.00	Horizontal
F9201-513	746787.03	3985316.51	0	23.47	293.15	(40'x15')	1.00	45,300.00	Horizontal
F9201-515	746799.34	3985324.00	0	23.47	293.15	(40'x15')	1.00	45,300.00	Horizontal
F9201-525	746750.23	3985404.73	0	23.47	293.15	(40'x15')	1.00	45,300.00	Horizontal
F9201-527	746737.91	3985397.24	0	23.47	293.15	(40'x15')	1.00	45,300.00	Horizontal
F9201-528	746663.95	3985352.25	0	23.47	293.15	(40'x15')	1.00	89,500.00	Horizontal

Table N-2: Stack Parameters

STACK I.D.	X-UTM (m)	Y-UTM (m)	SOURCE BASE ELEVATION (m)	HEIGHT (m)	TEMPERATURE (K)	DIAMETER (m)	EXIT VERTICAL VELOCITY* (m/s)	VOLUME FLOW RATE (cfm)	ORIENTATION*
F9201-529	746657.79	3985348.50	0	11.28	293.15	1.52	1.00	40,000.00	Horizontal
F9201-530	746651.63	3985344.75	0	23.47	293.15	(40'x15')	1.00	89,500.00	Horizontal
F9204-41	746489.929	3985184.13	0	19.81	293.15	1.52	1.00	40,000.00	Horizontal
F9204-42	746512.67	3985197.96	0	19.81	293.15	1.52	1.00	40,000.00	Horizontal
F9204-43	746535.412	3985211.8	0	19.81	293.15	1.52	1.00	40,000.00	Horizontal
F9204-44	746519.924	3985237.26	0	19.81	293.15	1.52	1.00	40,000.00	Horizontal
F9204-45	746497.183	3985223.42	0	19.81	293.15	1.52	1.00	40,000.00	Horizontal
F9204-46	746474.441	3985209.59	0	19.81	293.15	1.52	1.00	40,000.00	Horizontal
VENTS									
V9204-41	746541.31	3985232.83	0	21.64	293.15	0.91	14.37	20,000.00	Vertical
V9204-42	746532.51	3985227.47	0	21.64	293.15	0.91	14.37	20,000.00	Vertical
V9204-43	746523.29	3985221.87	0	21.64	293.15	0.91	17.82	24,800.00	Vertical
V9204-44	746514.20	3985216.33	0	21.64	293.15	0.91	14.37	20,000.00	Vertical
V9204-45	746504.99	3985210.73	0	21.64	293.15	0.91	17.82	24,800.00	Vertical
V9204-46	746496.06	3985205.30	0	21.64	293.15	0.91	14.37	20,000.00	Vertical
V9204-47	746486.85	3985199.69	0	21.64	293.15	0.91	17.82	24,800.00	Vertical
V9204-48	746477.75	3985194.16	0	21.64	293.15	0.91	14.37	20,000.00	Vertical
V9204-49	746468.54	3985188.56	0	21.64	293.15	0.91	14.37	20,000.00	Vertical

* A default vertical exit velocity of 1 m/s is assigned to horizontal emissions

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1953)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	MERCURY EMISSION g/s
TOTAL MERCURY EMISSIONS FROM 9201-2 FOR THE YEAR 1953 (lb/yr)			**162.00**	
S9201-21	15000	0.22388	36.26866	0.00052
S9201-22	2000	0.02985	4.83582	0.00007
S9201-23	2000	0.02985	4.83582	0.00007
S9201-24	16000	0.23881	38.68657	0.00056
S9201-25	32000	0.47761	77.37313	0.00111
TOTAL FLOW RATE (cfm)	**67000**			
TOTAL MERCURY EMISSIONS FROM 9201-4 FOR THE YEAR 1953 (lb/yr)			**0.00**	
S9201-41	35000	0.00949	0.00000	0.00000
S9201-42	35000	0.00949	0.00000	0.00000
S9201-43	35000	0.00949	0.00000	0.00000
S9201-44	35000	0.00949	0.00000	0.00000
S9201-45	35000	0.00949	0.00000	0.00000
S9201-46	35000	0.00949	0.00000	0.00000
S9201-47	35000	0.00949	0.00000	0.00000
S9201-48	35000	0.00949	0.00000	0.00000
S9201-49	107200	0.02907	0.00000	0.00000
S9201-410	107200	0.02907	0.00000	0.00000
S9201-411	107200	0.02907	0.00000	0.00000
S9201-412	107200	0.02907	0.00000	0.00000
S9201-413	26000	0.00705	0.00000	0.00000
S9201-414	26000	0.00705	0.00000	0.00000
S9201-415	26000	0.00705	0.00000	0.00000
S9201-416	26000	0.00705	0.00000	0.00000
S9201-417	73851.25	0.02003	0.00000	0.00000
S9201-418	73851.25	0.02003	0.00000	0.00000
S9201-419	73851.25	0.02003	0.00000	0.00000
S9201-420	73851.25	0.02003	0.00000	0.00000
S9201-421	73851.25	0.02003	0.00000	0.00000
S9201-422	73851.25	0.02003	0.00000	0.00000
S9201-423	73851.25	0.02003	0.00000	0.00000
S9201-424	73851.25	0.02003	0.00000	0.00000
F9201-44	143000	0.03878	0.00000	0.00000
F9201-46	143000	0.03878	0.00000	0.00000
F9201-47	70200	0.01904	0.00000	0.00000
F9201-48	70200	0.01904	0.00000	0.00000
F9201-49	70200	0.01904	0.00000	0.00000
F9201-410	70200	0.01904	0.00000	0.00000
F9201-411	70200	0.01904	0.00000	0.00000
F9201-412	70200	0.01904	0.00000	0.00000
F9201-413	143000	0.03878	0.00000	0.00000
F9201-415	143000	0.03878	0.00000	0.00000
F9201-416	22500	0.00610	0.00000	0.00000

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1953)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	MERCURY EMISSION g/s
F9201-417	22500	0.00610	0.00000	0.00000
F9201-418	22500	0.00610	0.00000	0.00000
F9201-420	45000	0.01220	0.00000	0.00000
F9201-421	45000	0.01220	0.00000	0.00000
F9201-423	70200	0.01904	0.00000	0.00000
F9201-424	70200	0.01904	0.00000	0.00000
F9201-425	143000	0.03878	0.00000	0.00000
F9201-427	143000	0.03878	0.00000	0.00000
F9201-428	143000	0.03878	0.00000	0.00000
F9201-430	143000	0.03878	0.00000	0.00000
F9201-431	70200	0.01904	0.00000	0.00000
F9201-432	70200	0.01904	0.00000	0.00000
F9201-434	70200	0.01904	0.00000	0.00000
F9201-436	70200	0.01904	0.00000	0.00000
F9201-437	70200	0.01904	0.00000	0.00000
F9201-438	70200	0.01904	0.00000	0.00000
TOTAL FLOW RATE (cfm)	**3687910**			
TOTAL MERCURY EMISSIONS FROM 9201-5 FOR THE YEAR 1953 (lb/yr)			**0.00**	
S9201-51	76000	0.03436	0.00000	0.00000
S9201-52	76000	0.03436	0.00000	0.00000
S9201-53	76000	0.03436	0.00000	0.00000
S9201-54	76000	0.03436	0.00000	0.00000
S9201-55	46550	0.02105	0.00000	0.00000
S9201-56	46550	0.02105	0.00000	0.00000
S9201-57	46550	0.02105	0.00000	0.00000
S9201-58	46550	0.02105	0.00000	0.00000
S9201-59	75355	0.03407	0.00000	0.00000
S9201-510	75355	0.03407	0.00000	0.00000
S9201-511	75355	0.03407	0.00000	0.00000
S9201-512	75355	0.03407	0.00000	0.00000
S9201-513	114223.13	0.05164	0.00000	0.00000
S9201-514	114223.13	0.05164	0.00000	0.00000
S9201-515	114223.13	0.05164	0.00000	0.00000
S9201-516	114223.13	0.05164	0.00000	0.00000
S9201-517	64267.5	0.02906	0.00000	0.00000
S9201-518	64267.5	0.02906	0.00000	0.00000
S9201-519	64267.5	0.02906	0.00000	0.00000
S9201-520	64267.5	0.02906	0.00000	0.00000
S9201-521	31750	0.01435	0.00000	0.00000
S9201-522	31750	0.01435	0.00000	0.00000
S9201-523	31750	0.01435	0.00000	0.00000
S9201-524	31750	0.01435	0.00000	0.00000
F9201-54	89500	0.04047	0.00000	0.00000
F9201-56	89500	0.04047	0.00000	0.00000

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1953)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	MERCURY EMISSION g/s
F9201-513	45300	0.02048	0.00000	0.00000
F9201-515	45300	0.02048	0.00000	0.00000
F9201-525	45300	0.02048	0.00000	0.00000
F9201-527	45300	0.02048	0.00000	0.00000
F9201-528	89500	0.04047	0.00000	0.00000
F9201-529	40000	0.01808	0.00000	0.00000
F9201-530	89500	0.04047	0.00000	0.00000
TOTAL FLOW RATE (cfm)	**2211782.52**			
TOTAL MERCURY EMISSIONS FROM STEAM PLANT 1 FOR THE YEAR 1953 (lb/yr)			**39**	
S9401-11 (Steam Plant 1)*	62209	0.36000	13.85999	0.00020
S9401-12 (Steam Plant 1)*	110593.95	0.64000	24.64001	0.00035
TOTAL FLOW RATE (cfm)	**172802.95**			
TOTAL MERCURY EMISSIONS FROM STEAM PLANT 2 FOR THE YEAR 1953 (lb/yr)			**39**	
S9401-21 (Steam Plant 2)*	270000	NA	38.50000	0.00055
* The emissions for steam plants 1 & 2 are assumed to be equal				
TOTAL MERCURY EMISSION FROM 81-10 FOR THE YEAR 1953 (lb/yr)			**0.00**	
S81-101	1300	NA	0.00000	0.00000
TOTAL MERCURY EMISSIONS FROM STEAM PLANT 3 FOR THE YEAR 1953 (lb/yr)			**0**	
S9401-31	270000	0.40983	0.00000	0.00000
S9401-32	388806.87	0.59017	0.00000	0.00000
TOTAL FLOW RATE (cfm)	**658806.87**			
TOTAL MERCURY EMISSION FROM 9204-4 FOR THE YEAR 1953 (lb/yr)			**1142.10**	
S9204-41	60000	0.10823	123.60390	0.00178
S9204-42	60000	0.10823	123.60390	0.00178
V9204-41	20000	0.03608	41.20130	0.00059
V9204-42	20000	0.03608	41.20130	0.00059
V9204-43	24800	0.04473	51.08961	0.00073
V9204-44	20000	0.03608	41.20130	0.00059
V9204-45	24800	0.04473	51.08961	0.00073
V9204-46	20000	0.03608	41.20130	0.00059
V9204-47	24800	0.04473	51.08961	0.00073
V9204-48	20000	0.03608	41.20130	0.00059
V9204-49	20000	0.03608	41.20130	0.00059
F9204-41	40000	0.07215	82.40260	0.00119
F9204-42	40000	0.07215	82.40260	0.00119

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1953)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	MERCURY EMISSION g/s
F9204-43	40000	0.07215	82.40260	0.00119
F9204-44	40000	0.07215	82.40260	0.00119
F9204-45	40000	0.07215	82.40260	0.00119
F9204-46	40000	0.07215	82.40260	0.00119
TOTAL FLOW RATE (cfm)	**554400**			

Notes:

(1) Volume Flow Rates are based on information provided by Ernie Choat and on engineering judgement based on similarity of operations and fan sizes.
(2) Fraction of Mercury Emitted = Volume flow rate / Total volume flow rate
(3) Mercury Emission = Fraction of mercury emitted * Total mercury emissions

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1954)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	MERCURY EMISSION g/s
TOTAL MERCURY EMISSIONS FROM 9201-2 FOR THE YEAR 1954 (lb/yr)			**200.00**	
S9201-21	15000	0.22388	44.77612	0.00064
S9201-22	2000	0.02985	5.97015	0.00009
S9201-23	2000	0.02985	5.97015	0.00009
S9201-24	16000	0.23881	47.76119	0.00069
S9201-25	32000	0.47761	95.52239	0.00137
TOTAL FLOW RATE (cfm)	**67000**			
TOTAL MERCURY EMISSIONS FROM 9201-4 FOR THE YEAR 1954 (lb/yr)			**0.00**	
S9201-41	35000	0.00949	0.00000	0.00000
S9201-42	35000	0.00949	0.00000	0.00000
S9201-43	35000	0.00949	0.00000	0.00000
S9201-44	35000	0.00949	0.00000	0.00000
S9201-45	35000	0.00949	0.00000	0.00000
S9201-46	35000	0.00949	0.00000	0.00000
S9201-47	35000	0.00949	0.00000	0.00000
S9201-48	35000	0.00949	0.00000	0.00000
S9201-49	107200	0.02907	0.00000	0.00000
S9201-410	107200	0.02907	0.00000	0.00000
S9201-411	107200	0.02907	0.00000	0.00000
S9201-412	107200	0.02907	0.00000	0.00000
S9201-413	26000	0.00705	0.00000	0.00000
S9201-414	26000	0.00705	0.00000	0.00000
S9201-415	26000	0.00705	0.00000	0.00000
S9201-416	26000	0.00705	0.00000	0.00000
S9201-417	73851.25	0.02003	0.00000	0.00000
S9201-418	73851.25	0.02003	0.00000	0.00000
S9201-419	73851.25	0.02003	0.00000	0.00000
S9201-420	73851.25	0.02003	0.00000	0.00000
S9201-421	73851.25	0.02003	0.00000	0.00000
S9201-422	73851.25	0.02003	0.00000	0.00000
S9201-423	73851.25	0.02003	0.00000	0.00000
S9201-424	73851.25	0.02003	0.00000	0.00000
F9201-44	143000	0.03878	0.00000	0.00000
F9201-46	143000	0.03878	0.00000	0.00000
F9201-47	70200	0.01904	0.00000	0.00000
F9201-48	70200	0.01904	0.00000	0.00000
F9201-49	70200	0.01904	0.00000	0.00000
F9201-410	70200	0.01904	0.00000	0.00000
F9201-411	70200	0.01904	0.00000	0.00000
F9201-412	70200	0.01904	0.00000	0.00000
F9201-413	143000	0.03878	0.00000	0.00000
F9201-415	143000	0.03878	0.00000	0.00000
F9201-416	22500	0.00610	0.00000	0.00000

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1954)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	g/s
F9201-417	22500	0.00610	0.00000	0.00000
F9201-418	22500	0.00610	0.00000	0.00000
F9201-420	45000	0.01220	0.00000	0.00000
F9201-421	45000	0.01220	0.00000	0.00000
F9201-423	70200	0.01904	0.00000	0.00000
F9201-424	70200	0.01904	0.00000	0.00000
F9201-425	143000	0.03878	0.00000	0.00000
F9201-427	143000	0.03878	0.00000	0.00000
F9201-428	143000	0.03878	0.00000	0.00000
F9201-430	143000	0.03878	0.00000	0.00000
F9201-431	70200	0.01904	0.00000	0.00000
F9201-432	70200	0.01904	0.00000	0.00000
F9201-434	70200	0.01904	0.00000	0.00000
F9201-436	70200	0.01904	0.00000	0.00000
F9201-437	70200	0.01904	0.00000	0.00000
F9201-438	70200	0.01904	0.00000	0.00000
TOTAL FLOW RATE (cfm)	**3687910**			
TOTAL MERCURY EMISSIONS FROM 9201-5 FOR THE YEAR 1954 (lb/yr)			**0.00**	
S9201-51	76000	0.03436	0.00000	0.00000
S9201-52	76000	0.03436	0.00000	0.00000
S9201-53	76000	0.03436	0.00000	0.00000
S9201-54	76000	0.03436	0.00000	0.00000
S9201-55	46550	0.02105	0.00000	0.00000
S9201-56	46550	0.02105	0.00000	0.00000
S9201-57	46550	0.02105	0.00000	0.00000
S9201-58	46550	0.02105	0.00000	0.00000
S9201-59	75355	0.03407	0.00000	0.00000
S9201-510	75355	0.03407	0.00000	0.00000
S9201-511	75355	0.03407	0.00000	0.00000
S9201-512	75355	0.03407	0.00000	0.00000
S9201-513	114223.13	0.05164	0.00000	0.00000
S9201-514	114223.13	0.05164	0.00000	0.00000
S9201-515	114223.13	0.05164	0.00000	0.00000
S9201-516	114223.13	0.05164	0.00000	0.00000
S9201-517	64267.5	0.02906	0.00000	0.00000
S9201-518	64267.5	0.02906	0.00000	0.00000
S9201-519	64267.5	0.02906	0.00000	0.00000
S9201-520	64267.5	0.02906	0.00000	0.00000
S9201-521	31750	0.01435	0.00000	0.00000
S9201-522	31750	0.01435	0.00000	0.00000
S9201-523	31750	0.01435	0.00000	0.00000
S9201-524	31750	0.01435	0.00000	0.00000
F9201-54	89500	0.04047	0.00000	0.00000
F9201-56	89500	0.04047	0.00000	0.00000

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1954)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	MERCURY EMISSION g/s
F9201-513	45300	0.02048	0.00000	0.00000
F9201-515	45300	0.02048	0.00000	0.00000
F9201-525	45300	0.02048	0.00000	0.00000
F9201-527	45300	0.02048	0.00000	0.00000
F9201-528	89500	0.04047	0.00000	0.00000
F9201-529	40000	0.01808	0.00000	0.00000
F9201-530	89500	0.04047	0.00000	0.00000
TOTAL FLOW RATE (cfm)	**2211782.52**			
TOTAL MERCURY EMISSIONS FROM STEAM PLANT 1 FOR THE YEAR 1954 (lb/yr)			**39**	
S9401-11 (Steam Plant 1)*	62209	0.36000	13.85999	0.00020
S9401-12 (Steam Plant 1)*	110593.95	0.64000	24.64001	0.00035
TOTAL FLOW RATE (cfm)	**172802.95**			
TOTAL MERCURY EMISSIONS FROM STEAM PLANT 2 FOR THE YEAR 1954 (lb/yr)			**39**	
S9401-21 (Steam Plant 2)*	270000	NA	38.50000	0.00055
* The emissions for steam plants 1 & 2 are assumed to be equal				
TOTAL MERCURY EMISSION FROM 81-10 FOR THE YEAR 1954 (lb/yr)			**0.00**	
S81-101	1300	NA	0.00000	0.00000
TOTAL MERCURY EMISSIONS FROM STEAM PLANT 3 FOR THE YEAR 1954 (lb/yr)			**0**	
S9401-31	270000	0.40983	0.00000	0.00000
S9401-32	388806.87	0.59017	0.00000	0.00000
TOTAL FLOW RATE (cfm)	**658806.87**			
TOTAL MERCURY EMISSION FROM 9204-4 FOR THE YEAR 1954 (lb/yr)			**3045.60**	
S9204-41	60000	0.10823	329.61039	0.00474
S9204-42	60000	0.10823	329.61039	0.00474
V9204-41	20000	0.03608	109.87013	0.00158
V9204-42	20000	0.03608	109.87013	0.00158
V9204-43	24800	0.04473	136.23896	0.00196
V9204-44	20000	0.03608	109.87013	0.00158
V9204-45	24800	0.04473	136.23896	0.00196
V9204-46	20000	0.03608	109.87013	0.00158
V9204-47	24800	0.04473	136.23896	0.00196
V9204-48	20000	0.03608	109.87013	0.00158
V9204-49	20000	0.03608	109.87013	0.00158
F9204-41	40000	0.07215	219.74026	0.00316
F9204-42	40000	0.07215	219.74026	0.00316

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1954)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION	
			lb/yr	g/s
F9204-43	40000	0.07215	219.74026	0.00316
F9204-44	40000	0.07215	219.74026	0.00316
F9204-45	40000	0.07215	219.74026	0.00316
F9204-46	40000	0.07215	219.74026	0.00316
TOTAL FLOW RATE (cfm)	**554400**			

Notes:

(1) Volume Flow Rates are based on information provided by Ernie Choat and on engineering judgement based on similarity of operations and fan sizes.

(2) Fraction of Mercury Emitted = Volume flow rate / Total volume flow rate

(3) Mercury Emission = Fraction of mercury emitted * Total mercury emissions

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1955)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	g/s
TOTAL MERCURY EMISSIONS FROM 9201-2 FOR THE YEAR 1955 (lb/yr)			**0.00**	
S9201-21	15000	0.22388	0.00000	0.00000
S9201-22	2000	0.02985	0.00000	0.00000
S9201-23	2000	0.02985	0.00000	0.00000
S9201-24	16000	0.23881	0.00000	0.00000
S9201-25	32000	0.47761	0.00000	0.00000
TOTAL FLOW RATE (cfm)	**67000**			
TOTAL MERCURY EMISSIONS FROM 9201-4 FOR THE YEAR 1955 (lb/yr)			**9280.00**	
S9201-41	35000	0.00949	88.07156	0.00127
S9201-42	35000	0.00949	88.07156	0.00127
S9201-43	35000	0.00949	88.07156	0.00127
S9201-44	35000	0.00949	88.07156	0.00127
S9201-45	35000	0.00949	88.07156	0.00127
S9201-46	35000	0.00949	88.07156	0.00127
S9201-47	35000	0.00949	88.07156	0.00127
S9201-48	35000	0.00949	88.07156	0.00127
S9201-49	107200	0.02907	269.75062	0.00388
S9201-410	107200	0.02907	269.75062	0.00388
S9201-411	107200	0.02907	269.75062	0.00388
S9201-412	107200	0.02907	269.75062	0.00388
S9201-413	26000	0.00705	65.42459	0.00094
S9201-414	26000	0.00705	65.42459	0.00094
S9201-415	26000	0.00705	65.42459	0.00094
S9201-416	26000	0.00705	65.42459	0.00094
S9201-417	73851.25	0.02003	185.83414	0.00267
S9201-418	73851.25	0.02003	185.83414	0.00267
S9201-419	73851.25	0.02003	185.83414	0.00267
S9201-420	73851.25	0.02003	185.83414	0.00267
S9201-421	73851.25	0.02003	185.83414	0.00267
S9201-422	73851.25	0.02003	185.83414	0.00267
S9201-423	73851.25	0.02003	185.83414	0.00267
S9201-424	73851.25	0.02003	185.83414	0.00267
F9201-44	143000	0.03878	359.83525	0.00518
F9201-46	143000	0.03878	359.83525	0.00518
F9201-47	70200	0.01904	176.64639	0.00254
F9201-48	70200	0.01904	176.64639	0.00254
F9201-49	70200	0.01904	176.64639	0.00254
F9201-410	70200	0.01904	176.64639	0.00254
F9201-411	70200	0.01904	176.64639	0.00254
F9201-412	70200	0.01904	176.64639	0.00254
F9201-413	143000	0.03878	359.83525	0.00518
F9201-415	143000	0.03878	359.83525	0.00518
F9201-416	22500	0.00610	56.61743	0.00081

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1955)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	MERCURY EMISSION g/s
F9201-417	22500	0.00610	56.61743	0.00081
F9201-418	22500	0.00610	56.61743	0.00081
F9201-420	45000	0.01220	113.23487	0.00163
F9201-421	45000	0.01220	113.23487	0.00163
F9201-423	70200	0.01904	176.64639	0.00254
F9201-424	70200	0.01904	176.64639	0.00254
F9201-425	143000	0.03878	359.83525	0.00518
F9201-427	143000	0.03878	359.83525	0.00518
F9201-428	143000	0.03878	359.83525	0.00518
F9201-430	143000	0.03878	359.83525	0.00518
F9201-431	70200	0.01904	176.64639	0.00254
F9201-432	70200	0.01904	176.64639	0.00254
F9201-434	70200	0.01904	176.64639	0.00254
F9201-436	70200	0.01904	176.64639	0.00254
F9201-437	70200	0.01904	176.64639	0.00254
F9201-438	70200	0.01904	176.64639	0.00254
TOTAL FLOW RATE (cfm)	**3687910**			
TOTAL MERCURY EMISSIONS FROM 9201-5 FOR THE YEAR 1955 (lb/yr)			**9212.00**	
S9201-51	76000	0.03436	316.53745	0.00455
S9201-52	76000	0.03436	316.53745	0.00455
S9201-53	76000	0.03436	316.53745	0.00455
S9201-54	76000	0.03436	316.53745	0.00455
S9201-55	46550	0.02105	193.87919	0.00279
S9201-56	46550	0.02105	193.87919	0.00279
S9201-57	46550	0.02105	193.87919	0.00279
S9201-58	46550	0.02105	193.87919	0.00279
S9201-59	75355	0.03407	313.85105	0.00451
S9201-510	75355	0.03407	313.85105	0.00451
S9201-511	75355	0.03407	313.85105	0.00451
S9201-512	75355	0.03407	313.85105	0.00451
S9201-513	114223.13	0.05164	475.73550	0.00684
S9201-514	114223.13	0.05164	475.73550	0.00684
S9201-515	114223.13	0.05164	475.73550	0.00684
S9201-516	114223.13	0.05164	475.73550	0.00684
S9201-517	64267.5	0.02906	267.67198	0.00385
S9201-518	64267.5	0.02906	267.67198	0.00385
S9201-519	64267.5	0.02906	267.67198	0.00385
S9201-520	64267.5	0.02906	267.67198	0.00385
S9201-521	31750	0.01435	132.23768	0.00190
S9201-522	31750	0.01435	132.23768	0.00190
S9201-523	31750	0.01435	132.23768	0.00190
S9201-524	31750	0.01435	132.23768	0.00190
F9201-54	89500	0.04047	372.76450	0.00536
F9201-56	89500	0.04047	372.76450	0.00536

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1955)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	MERCURY EMISSION g/s
F9201-513	45300	0.02048	188.67298	0.00271
F9201-515	45300	0.02048	188.67298	0.00271
F9201-525	45300	0.02048	188.67298	0.00271
F9201-527	45300	0.02048	188.67298	0.00271
F9201-528	89500	0.04047	372.76450	0.00536
F9201-529	40000	0.01808	166.59866	0.00240
F9201-530	89500	0.04047	372.76450	0.00536
TOTAL FLOW RATE (cfm)	**2211782.52**			
TOTAL MERCURY EMISSIONS FROM STEAM PLANT 1 FOR THE YEAR 1955 (lb/yr)			**39**	
S9401-11 (Steam Plant 1)*	62209	0.36000	13.85999	0.00020
S9401-12 (Steam Plant 1)*	110593.95	0.64000	24.64001	0.00035
TOTAL FLOW RATE (cfm)	**172802.95**			
TOTAL MERCURY EMISSIONS FROM STEAM PLANT 2 FOR THE YEAR 1955 (lb/yr)			**39**	
S9401-21 (Steam Plant 2)*	270000	NA	38.50000	0.00055
* The emissions for steam plants 1 & 2 are assumed to be equal				
TOTAL MERCURY EMISSION FROM 81-10 FOR THE YEAR 1955 (lb/yr)			**0.00**	
S81-101	1300	NA	0.00000	0.00000
TOTAL MERCURY EMISSIONS FROM STEAM PLANT 3 FOR THE YEAR 1955 (lb/yr)			**0**	
S9401-31	270000	0.40983	0.00000	0.00000
S9401-32	388806.87	0.59017	0.00000	0.00000
TOTAL FLOW RATE (cfm)	**658806.87**			
TOTAL MERCURY EMISSION FROM 9204-4 FOR THE YEAR 1955 (lb/yr)			**3807.00**	
S9204-41	60000	0.10823	412.01299	0.00593
S9204-42	60000	0.10823	412.01299	0.00593
V9204-41	20000	0.03608	137.33766	0.00198
V9204-42	20000	0.03608	137.33766	0.00198
V9204-43	24800	0.04473	170.29870	0.00245
V9204-44	20000	0.03608	137.33766	0.00198
V9204-45	24800	0.04473	170.29870	0.00245
V9204-46	20000	0.03608	137.33766	0.00198
V9204-47	24800	0.04473	170.29870	0.00245
V9204-48	20000	0.03608	137.33766	0.00198
V9204-49	20000	0.03608	137.33766	0.00198
F9204-41	40000	0.07215	274.67532	0.00395
F9204-42	40000	0.07215	274.67532	0.00395

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1955)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	MERCURY EMISSION g/s
F9204-43	40000	0.07215	274.67532	0.00395
F9204-44	40000	0.07215	274.67532	0.00395
F9204-45	40000	0.07215	274.67532	0.00395
F9204-46	40000	0.07215	274.67532	0.00395
TOTAL FLOW RATE (cfm)	**554400**			

Notes:

(1) Volume Flow Rates are based on information provided by Ernie Choat and on engineering judgement based on similarity of operations and fan sizes.

(2) Fraction of Mercury Emitted = Volume flow rate / Total volume flow rate

(3) Mercury Emission = Fraction of mercury emitted * Total mercury emissions

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1956)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	g/s
TOTAL MERCURY EMISSIONS FROM 9201-2 FOR THE YEAR 1956 (lb/yr)			**79.40**	
S9201-21	15000	0.22388	17.77612	0.00026
S9201-22	2000	0.02985	2.37015	0.00003
S9201-23	2000	0.02985	2.37015	0.00003
S9201-24	16000	0.23881	18.96119	0.00027
S9201-25	32000	0.47761	37.92239	0.00055
TOTAL FLOW RATE (cfm)	**67000**			
TOTAL MERCURY EMISSIONS FROM 9201-4 FOR THE YEAR 1956 (lb/yr)			**6012.00**	
S9201-41	35000	0.00949	57.05671	0.00082
S9201-42	35000	0.00949	57.05671	0.00082
S9201-43	35000	0.00949	57.05671	0.00082
S9201-44	35000	0.00949	57.05671	0.00082
S9201-45	35000	0.00949	57.05671	0.00082
S9201-46	35000	0.00949	57.05671	0.00082
S9201-47	35000	0.00949	57.05671	0.00082
S9201-48	35000	0.00949	57.05671	0.00082
S9201-49	107200	0.02907	174.75654	0.00251
S9201-410	107200	0.02907	174.75654	0.00251
S9201-411	107200	0.02907	174.75654	0.00251
S9201-412	107200	0.02907	174.75654	0.00251
S9201-413	26000	0.00705	42.38498	0.00061
S9201-414	26000	0.00705	42.38498	0.00061
S9201-415	26000	0.00705	42.38498	0.00061
S9201-416	26000	0.00705	42.38498	0.00061
S9201-417	73851.25	0.02003	120.39169	0.00173
S9201-418	73851.25	0.02003	120.39169	0.00173
S9201-419	73851.25	0.02003	120.39169	0.00173
S9201-420	73851.25	0.02003	120.39169	0.00173
S9201-421	73851.25	0.02003	120.39169	0.00173
S9201-422	73851.25	0.02003	120.39169	0.00173
S9201-423	73851.25	0.02003	120.39169	0.00173
S9201-424	73851.25	0.02003	120.39169	0.00173
F9201-44	143000	0.03878	233.11740	0.00335
F9201-46	143000	0.03878	233.11740	0.00335
F9201-47	70200	0.01904	114.43945	0.00165
F9201-48	70200	0.01904	114.43945	0.00165
F9201-49	70200	0.01904	114.43945	0.00165
F9201-410	70200	0.01904	114.43945	0.00165
F9201-411	70200	0.01904	114.43945	0.00165
F9201-412	70200	0.01904	114.43945	0.00165
F9201-413	143000	0.03878	233.11740	0.00335
F9201-415	143000	0.03878	233.11740	0.00335
F9201-416	22500	0.00610	36.67931	0.00053

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1956)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	MERCURY EMISSION g/s
F9201-417	22500	0.00610	36.67931	0.00053
F9201-418	22500	0.00610	36.67931	0.00053
F9201-420	45000	0.01220	73.35862	0.00106
F9201-421	45000	0.01220	73.35862	0.00106
F9201-423	70200	0.01904	114.43945	0.00165
F9201-424	70200	0.01904	114.43945	0.00165
F9201-425	143000	0.03878	233.11740	0.00335
F9201-427	143000	0.03878	233.11740	0.00335
F9201-428	143000	0.03878	233.11740	0.00335
F9201-430	143000	0.03878	233.11740	0.00335
F9201-431	70200	0.01904	114.43945	0.00165
F9201-432	70200	0.01904	114.43945	0.00165
F9201-434	70200	0.01904	114.43945	0.00165
F9201-436	70200	0.01904	114.43945	0.00165
F9201-437	70200	0.01904	114.43945	0.00165
F9201-438	70200	0.01904	114.43945	0.00165
TOTAL FLOW RATE (cfm)	**3687910**			
TOTAL MERCURY EMISSIONS FROM 9201-5 FOR THE YEAR 1956 (lb/yr)			**5849.00**	
S9201-51	76000	0.03436	200.97998	0.00289
S9201-52	76000	0.03436	200.97998	0.00289
S9201-53	76000	0.03436	200.97998	0.00289
S9201-54	76000	0.03436	200.97998	0.00289
S9201-55	46550	0.02105	123.10024	0.00177
S9201-56	46550	0.02105	123.10024	0.00177
S9201-57	46550	0.02105	123.10024	0.00177
S9201-58	46550	0.02105	123.10024	0.00177
S9201-59	75355	0.03407	199.27429	0.00287
S9201-510	75355	0.03407	199.27429	0.00287
S9201-511	75355	0.03407	199.27429	0.00287
S9201-512	75355	0.03407	199.27429	0.00287
S9201-513	114223.13	0.05164	302.06003	0.00434
S9201-514	114223.13	0.05164	302.06003	0.00434
S9201-515	114223.13	0.05164	302.06003	0.00434
S9201-516	114223.13	0.05164	302.06003	0.00434
S9201-517	64267.5	0.02906	169.95369	0.00244
S9201-518	64267.5	0.02906	169.95369	0.00244
S9201-519	64267.5	0.02906	169.95369	0.00244
S9201-520	64267.5	0.02906	169.95369	0.00244
S9201-521	31750	0.01435	83.96203	0.00121
S9201-522	31750	0.01435	83.96203	0.00121
S9201-523	31750	0.01435	83.96203	0.00121
S9201-524	31750	0.01435	83.96203	0.00121
F9201-54	89500	0.04047	236.68037	0.00340
F9201-56	89500	0.04047	236.68037	0.00340

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1956)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	MERCURY EMISSION g/s
F9201-513	45300	0.02048	119.79464	0.00172
F9201-515	45300	0.02048	119.79464	0.00172
F9201-525	45300	0.02048	119.79464	0.00172
F9201-527	45300	0.02048	119.79464	0.00172
F9201-528	89500	0.04047	236.68037	0.00340
F9201-529	40000	0.01808	105.77894	0.00152
F9201-530	89500	0.04047	236.68037	0.00340
TOTAL FLOW RATE (cfm)	**2211782.52**			
TOTAL MERCURY EMISSIONS FROM STEAM PLANT 1 FOR THE YEAR 1956 (lb/yr)			**39**	
S9401-11 (Steam Plant 1)*	62209	0.36000	13.85999	0.00020
S9401-12 (Steam Plant 1)*	110593.95	0.64000	24.64001	0.00035
TOTAL FLOW RATE (cfm)	**172802.95**			
TOTAL MERCURY EMISSIONS FROM STEAM PLANT 2 FOR THE YEAR 1956 (lb/yr)			**39**	
S9401-21 (Steam Plant 2)*	270000	NA	38.50000	0.00055
* The emissions for steam plants 1 & 2 are assumed to be equal				
TOTAL MERCURY EMISSION FROM 81-10 FOR THE YEAR 1956 (lb/yr)			**0.00**	
S81-101	1300	NA	0.00000	0.00000
TOTAL MERCURY EMISSIONS FROM STEAM PLANT 3 FOR THE YEAR 1956 (lb/yr)			**0**	
S9401-31	270000	0.40983	0.00000	0.00000
S9401-32	388806.87	0.59017	0.00000	0.00000
TOTAL FLOW RATE (cfm)	**658806.87**			
TOTAL MERCURY EMISSION FROM 9204-4 FOR THE YEAR 1956 (lb/yr)			**1699.70**	
S9204-41	60000	0.10823	183.95022	0.00265
S9204-42	60000	0.10823	183.95022	0.00265
V9204-41	20000	0.03608	61.31674	0.00088
V9204-42	20000	0.03608	61.31674	0.00088
V9204-43	24800	0.04473	76.03276	0.00109
V9204-44	20000	0.03608	61.31674	0.00088
V9204-45	24800	0.04473	76.03276	0.00109
V9204-46	20000	0.03608	61.31674	0.00088
V9204-47	24800	0.04473	76.03276	0.00109
V9204-48	20000	0.03608	61.31674	0.00088
V9204-49	20000	0.03608	61.31674	0.00088
F9204-41	40000	0.07215	122.63348	0.00176
F9204-42	40000	0.07215	122.63348	0.00176

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1956)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION	
			lb/yr	g/s
F9204-43	40000	0.07215	122.63348	0.00176
F9204-44	40000	0.07215	122.63348	0.00176
F9204-45	40000	0.07215	122.63348	0.00176
F9204-46	40000	0.07215	122.63348	0.00176
TOTAL FLOW RATE (cfm)	**554400**			

Notes:

(1) Volume Flow Rates are based on information provided by Ernie Choat and on engineering judgement based on similarity of operations and fan sizes.
(2) Fraction of Mercury Emitted = Volume flow rate / Total volume flow rate
(3) Mercury Emission = Fraction of mercury emitted * Total mercury emissions

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1957)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	MERCURY EMISSION g/s
TOTAL MERCURY EMISSIONS FROM 9201-2 FOR THE YEAR 1957 (lb/yr)			**42.20**	
S9201-21	15000	0.22388	9.44776	0.00014
S9201-22	2000	0.02985	1.25970	0.00002
S9201-23	2000	0.02985	1.25970	0.00002
S9201-24	16000	0.23881	10.07761	0.00014
S9201-25	32000	0.47761	20.15522	0.00029
TOTAL FLOW RATE (cfm)	**67000**			
TOTAL MERCURY EMISSIONS FROM 9201-4 FOR THE YEAR 1957 (lb/yr)			**3487.00**	
S9201-41	35000	0.00949	33.09327	0.00048
S9201-42	35000	0.00949	33.09327	0.00048
S9201-43	35000	0.00949	33.09327	0.00048
S9201-44	35000	0.00949	33.09327	0.00048
S9201-45	35000	0.00949	33.09327	0.00048
S9201-46	35000	0.00949	33.09327	0.00048
S9201-47	35000	0.00949	33.09327	0.00048
S9201-48	35000	0.00949	33.09327	0.00048
S9201-49	107200	0.02907	101.35996	0.00146
S9201-410	107200	0.02907	101.35996	0.00146
S9201-411	107200	0.02907	101.35996	0.00146
S9201-412	107200	0.02907	101.35996	0.00146
S9201-413	26000	0.00705	24.58357	0.00035
S9201-414	26000	0.00705	24.58357	0.00035
S9201-415	26000	0.00705	24.58357	0.00035
S9201-416	26000	0.00705	24.58357	0.00035
S9201-417	73851.25	0.02003	69.82798	0.00100
S9201-418	73851.25	0.02003	69.82798	0.00100
S9201-419	73851.25	0.02003	69.82798	0.00100
S9201-420	73851.25	0.02003	69.82798	0.00100
S9201-421	73851.25	0.02003	69.82798	0.00100
S9201-422	73851.25	0.02003	69.82798	0.00100
S9201-423	73851.25	0.02003	69.82798	0.00100
S9201-424	73851.25	0.02003	69.82798	0.00100
F9201-44	143000	0.03878	135.20964	0.00194
F9201-46	143000	0.03878	135.20964	0.00194
F9201-47	70200	0.01904	66.37564	0.00095
F9201-48	70200	0.01904	66.37564	0.00095
F9201-49	70200	0.01904	66.37564	0.00095
F9201-410	70200	0.01904	66.37564	0.00095
F9201-411	70200	0.01904	66.37564	0.00095
F9201-412	70200	0.01904	66.37564	0.00095
F9201-413	143000	0.03878	135.20964	0.00194
F9201-415	143000	0.03878	135.20964	0.00194
F9201-416	22500	0.00610	21.27424	0.00031

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1957)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	MERCURY EMISSION g/s
F9201-417	22500	0.00610	21.27424	0.00031
F9201-418	22500	0.00610	21.27424	0.00031
F9201-420	45000	0.01220	42.54849	0.00061
F9201-421	45000	0.01220	42.54849	0.00061
F9201-423	70200	0.01904	66.37564	0.00095
F9201-424	70200	0.01904	66.37564	0.00095
F9201-425	143000	0.03878	135.20964	0.00194
F9201-427	143000	0.03878	135.20964	0.00194
F9201-428	143000	0.03878	135.20964	0.00194
F9201-430	143000	0.03878	135.20964	0.00194
F9201-431	70200	0.01904	66.37564	0.00095
F9201-432	70200	0.01904	66.37564	0.00095
F9201-434	70200	0.01904	66.37564	0.00095
F9201-436	70200	0.01904	66.37564	0.00095
F9201-437	70200	0.01904	66.37564	0.00095
F9201-438	70200	0.01904	66.37564	0.00095
TOTAL FLOW RATE (cfm)	**3687910**			
TOTAL MERCURY EMISSIONS FROM 9201-5 FOR THE YEAR 1957 (lb/yr)			**2076.00**	
S9201-51	76000	0.03436	71.33432	0.00103
S9201-52	76000	0.03436	71.33432	0.00103
S9201-53	76000	0.03436	71.33432	0.00103
S9201-54	76000	0.03436	71.33432	0.00103
S9201-55	46550	0.02105	43.69227	0.00063
S9201-56	46550	0.02105	43.69227	0.00063
S9201-57	46550	0.02105	43.69227	0.00063
S9201-58	46550	0.02105	43.69227	0.00063
S9201-59	75355	0.03407	70.72892	0.00102
S9201-510	75355	0.03407	70.72892	0.00102
S9201-511	75355	0.03407	70.72892	0.00102
S9201-512	75355	0.03407	70.72892	0.00102
S9201-513	114223.13	0.05164	107.21091	0.00154
S9201-514	114223.13	0.05164	107.21091	0.00154
S9201-515	114223.13	0.05164	107.21091	0.00154
S9201-516	114223.13	0.05164	107.21091	0.00154
S9201-517	64267.5	0.02906	60.32208	0.00087
S9201-518	64267.5	0.02906	60.32208	0.00087
S9201-519	64267.5	0.02906	60.32208	0.00087
S9201-520	64267.5	0.02906	60.32208	0.00087
S9201-521	31750	0.01435	29.80085	0.00043
S9201-522	31750	0.01435	29.80085	0.00043
S9201-523	31750	0.01435	29.80085	0.00043
S9201-524	31750	0.01435	29.80085	0.00043
F9201-54	89500	0.04047	84.00555	0.00121
F9201-56	89500	0.04047	84.00555	0.00121

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1957)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	g/s
F9201-513	45300	0.02048	42.51901	0.00061
F9201-515	45300	0.02048	42.51901	0.00061
F9201-525	45300	0.02048	42.51901	0.00061
F9201-527	45300	0.02048	42.51901	0.00061
F9201-528	89500	0.04047	84.00555	0.00121
F9201-529	40000	0.01808	37.54438	0.00054
F9201-530	89500	0.04047	84.00555	0.00121
TOTAL FLOW RATE (cfm)	**2211782.52**			
TOTAL MERCURY EMISSIONS FROM STEAM PLANT 1 FOR THE YEAR 1957 (lb/yr)			**0**	
S9401-11 (Steam Plant 1)*	62209	0.36000	0.00000	0.00000
S9401-12 (Steam Plant 1)*	110593.95	0.64000	0.00000	0.00000
TOTAL FLOW RATE (cfm)	**172802.95**			
TOTAL MERCURY EMISSIONS FROM STEAM PLANT 2 FOR THE YEAR 1957 (lb/yr)			**0**	
S9401-21 (Steam Plant 2)*	270000	NA	0.00000	0.00000
* The emissions for steam plants 1 & 2 are assumed to be equal				
TOTAL MERCURY EMISSION FROM 81-10 FOR THE YEAR 1957 (lb/yr)			**215.00**	
S81-101	1300	NA	215.00000	0.00309
TOTAL MERCURY EMISSIONS FROM STEAM PLANT 3 FOR THE YEAR 1957 (lb/yr)			**77**	
S9401-31	270000	0.40983	31.55705	0.00045
S9401-32	388806.87	0.59017	45.44295	0.00065
TOTAL FLOW RATE (cfm)	**658806.87**			
TOTAL MERCURY EMISSION FROM 9204-4 FOR THE YEAR 1957 (lb/yr)			**0.00**	
S9204-41	60000	0.10823	0.00000	0.00000
S9204-42	60000	0.10823	0.00000	0.00000
V9204-41	20000	0.03608	0.00000	0.00000
V9204-42	20000	0.03608	0.00000	0.00000
V9204-43	24800	0.04473	0.00000	0.00000
V9204-44	20000	0.03608	0.00000	0.00000
V9204-45	24800	0.04473	0.00000	0.00000
V9204-46	20000	0.03608	0.00000	0.00000
V9204-47	24800	0.04473	0.00000	0.00000
V9204-48	20000	0.03608	0.00000	0.00000
V9204-49	20000	0.03608	0.00000	0.00000
F9204-41	40000	0.07215	0.00000	0.00000
F9204-42	40000	0.07215	0.00000	0.00000

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1957)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION	
			lb/yr	g/s
F9204-43	40000	0.07215	0.00000	0.00000
F9204-44	40000	0.07215	0.00000	0.00000
F9204-45	40000	0.07215	0.00000	0.00000
F9204-46	40000	0.07215	0.00000	0.00000
TOTAL FLOW RATE (cfm)	**554400**			

Notes:

(1) Volume Flow Rates are based on information provided by Ernie Choat and on engineering judgement based on similarity of operations and fan sizes.

(2) Fraction of Mercury Emitted = Volume flow rate / Total volume flow rate

(3) Mercury Emission = Fraction of mercury emitted * Total mercury emissions

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1958)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	MERCURY EMISSION g/s
TOTAL MERCURY EMISSIONS FROM 9201-2 FOR THE YEAR 1958 (lb/yr)			**0.00**	
S9201-21	15000	0.22388	0.00000	0.00000
S9201-22	2000	0.02985	0.00000	0.00000
S9201-23	2000	0.02985	0.00000	0.00000
S9201-24	16000	0.23881	0.00000	0.00000
S9201-25	32000	0.47761	0.00000	0.00000
TOTAL FLOW RATE (cfm)	**67000**			
TOTAL MERCURY EMISSIONS FROM 9201-4 FOR THE YEAR 1958 (lb/yr)			**3466.00**	
S9201-41	35000	0.00949	32.89397	0.00047
S9201-42	35000	0.00949	32.89397	0.00047
S9201-43	35000	0.00949	32.89397	0.00047
S9201-44	35000	0.00949	32.89397	0.00047
S9201-45	35000	0.00949	32.89397	0.00047
S9201-46	35000	0.00949	32.89397	0.00047
S9201-47	35000	0.00949	32.89397	0.00047
S9201-48	35000	0.00949	32.89397	0.00047
S9201-49	107200	0.02907	100.74953	0.00145
S9201-410	107200	0.02907	100.74953	0.00145
S9201-411	107200	0.02907	100.74953	0.00145
S9201-412	107200	0.02907	100.74953	0.00145
S9201-413	26000	0.00705	24.43552	0.00035
S9201-414	26000	0.00705	24.43552	0.00035
S9201-415	26000	0.00705	24.43552	0.00035
S9201-416	26000	0.00705	24.43552	0.00035
S9201-417	73851.25	0.02003	69.40745	0.00100
S9201-418	73851.25	0.02003	69.40745	0.00100
S9201-419	73851.25	0.02003	69.40745	0.00100
S9201-420	73851.25	0.02003	69.40745	0.00100
S9201-421	73851.25	0.02003	69.40745	0.00100
S9201-422	73851.25	0.02003	69.40745	0.00100
S9201-423	73851.25	0.02003	69.40745	0.00100
S9201-424	73851.25	0.02003	69.40745	0.00100
F9201-44	143000	0.03878	134.39536	0.00193
F9201-46	143000	0.03878	134.39536	0.00193
F9201-47	70200	0.01904	65.97591	0.00095
F9201-48	70200	0.01904	65.97591	0.00095
F9201-49	70200	0.01904	65.97591	0.00095
F9201-410	70200	0.01904	65.97591	0.00095
F9201-411	70200	0.01904	65.97591	0.00095
F9201-412	70200	0.01904	65.97591	0.00095
F9201-413	143000	0.03878	134.39536	0.00193
F9201-415	143000	0.03878	134.39536	0.00193
F9201-416	22500	0.00610	21.14612	0.00030

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1958)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	MERCURY EMISSION g/s
F9201-417	22500	0.00610	21.14612	0.00030
F9201-418	22500	0.00610	21.14612	0.00030
F9201-420	45000	0.01220	42.29225	0.00061
F9201-421	45000	0.01220	42.29225	0.00061
F9201-423	70200	0.01904	65.97591	0.00095
F9201-424	70200	0.01904	65.97591	0.00095
F9201-425	143000	0.03878	134.39536	0.00193
F9201-427	143000	0.03878	134.39536	0.00193
F9201-428	143000	0.03878	134.39536	0.00193
F9201-430	143000	0.03878	134.39536	0.00193
F9201-431	70200	0.01904	65.97591	0.00095
F9201-432	70200	0.01904	65.97591	0.00095
F9201-434	70200	0.01904	65.97591	0.00095
F9201-436	70200	0.01904	65.97591	0.00095
F9201-437	70200	0.01904	65.97591	0.00095
F9201-438	70200	0.01904	65.97591	0.00095
TOTAL FLOW RATE (cfm)	**3687910**			
TOTAL MERCURY EMISSIONS FROM 9201-5 FOR THE YEAR 1958 (lb/yr)			**1382.00**	
S9201-51	76000	0.03436	47.48749	0.00068
S9201-52	76000	0.03436	47.48749	0.00068
S9201-53	76000	0.03436	47.48749	0.00068
S9201-54	76000	0.03436	47.48749	0.00068
S9201-55	46550	0.02105	29.08609	0.00042
S9201-56	46550	0.02105	29.08609	0.00042
S9201-57	46550	0.02105	29.08609	0.00042
S9201-58	46550	0.02105	29.08609	0.00042
S9201-59	75355	0.03407	47.08447	0.00068
S9201-510	75355	0.03407	47.08447	0.00068
S9201-511	75355	0.03407	47.08447	0.00068
S9201-512	75355	0.03407	47.08447	0.00068
S9201-513	114223.13	0.05164	71.37065	0.00103
S9201-514	114223.13	0.05164	71.37065	0.00103
S9201-515	114223.13	0.05164	71.37065	0.00103
S9201-516	114223.13	0.05164	71.37065	0.00103
S9201-517	64267.5	0.02906	40.15661	0.00058
S9201-518	64267.5	0.02906	40.15661	0.00058
S9201-519	64267.5	0.02906	40.15661	0.00058
S9201-520	64267.5	0.02906	40.15661	0.00058
S9201-521	31750	0.01435	19.83852	0.00029
S9201-522	31750	0.01435	19.83852	0.00029
S9201-523	31750	0.01435	19.83852	0.00029
S9201-524	31750	0.01435	19.83852	0.00029
F9201-54	89500	0.04047	55.92277	0.00080
F9201-56	89500	0.04047	55.92277	0.00080

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1958)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	MERCURY EMISSION g/s
F9201-513	45300	0.02048	28.30504	0.00041
F9201-515	45300	0.02048	28.30504	0.00041
F9201-525	45300	0.02048	28.30504	0.00041
F9201-527	45300	0.02048	28.30504	0.00041
F9201-528	89500	0.04047	55.92277	0.00080
F9201-529	40000	0.01808	24.99342	0.00036
F9201-530	89500	0.04047	55.92277	0.00080
TOTAL FLOW RATE (cfm)	**2211782.52**			
TOTAL MERCURY EMISSIONS FROM STEAM PLANT 1 FOR THE YEAR 1958 (lb/yr)			**0**	
S9401-11 (Steam Plant 1)*	62209	0.36000	0.00000	0.00000
S9401-12 (Steam Plant 1)*	110593.95	0.64000	0.00000	0.00000
TOTAL FLOW RATE (cfm)	**172802.95**			
TOTAL MERCURY EMISSIONS FROM STEAM PLANT 2 FOR THE YEAR 1958 (lb/yr)			**0**	
S9401-21 (Steam Plant 2)*	270000	NA	0.00000	0.00000
* The emissions for steam plants 1 & 2 are assumed to be equal				
TOTAL MERCURY EMISSION FROM 81-10 FOR THE YEAR 1958 (lb/yr)			**381.00**	
S81-101	1300	NA	381.00000	0.00548
TOTAL MERCURY EMISSIONS FROM STEAM PLANT 3 FOR THE YEAR 1958 (lb/yr)			**77**	
S9401-31	270000	0.40983	31.55705	0.00045
S9401-32	388806.87	0.59017	45.44295	0.00065
TOTAL FLOW RATE (cfm)	**658806.87**			
TOTAL MERCURY EMISSION FROM 9204-4 FOR THE YEAR 1958 (lb/yr)			**1459.00**	
S9204-41	60000	0.10823	157.90043	0.00227
S9204-42	60000	0.10823	157.90043	0.00227
V9204-41	20000	0.03608	52.63348	0.00076
V9204-42	20000	0.03608	52.63348	0.00076
V9204-43	24800	0.04473	65.26551	0.00094
V9204-44	20000	0.03608	52.63348	0.00076
V9204-45	24800	0.04473	65.26551	0.00094
V9204-46	20000	0.03608	52.63348	0.00076
V9204-47	24800	0.04473	65.26551	0.00094
V9204-48	20000	0.03608	52.63348	0.00076
V9204-49	20000	0.03608	52.63348	0.00076
F9204-41	40000	0.07215	105.26696	0.00151
F9204-42	40000	0.07215	105.26696	0.00151

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1958)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	MERCURY EMISSION g/s
F9204-43	40000	0.07215	105.26696	0.00151
F9204-44	40000	0.07215	105.26696	0.00151
F9204-45	40000	0.07215	105.26696	0.00151
F9204-46	40000	0.07215	105.26696	0.00151
TOTAL FLOW RATE (cfm)	**554400**			
TOTAL MERCURY EMISSION FROM 9720 FOR THE YEAR 1958 (lb/yr)			**2500.00**	
A9720-26	NA	NA	2500.0	0.03596

Notes:

(1) Volume Flow Rates are based on information provided by Ernie Choat and on engineering judgement based on similarity of operations and fan sizes.
(2) Fraction of Mercury Emitted = Volume flow rate / Total volume flow rate
(3) Mercury Emission = Fraction of mercury emitted * Total mercury emissions

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1959)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	MERCURY EMISSION g/s
TOTAL MERCURY EMISSIONS FROM 9201-2 FOR THE YEAR 1959 (lb/yr)			**0.00**	
S9201-21	15000	0.22388	0.00000	0.00000
S9201-22	2000	0.02985	0.00000	0.00000
S9201-23	2000	0.02985	0.00000	0.00000
S9201-24	16000	0.23881	0.00000	0.00000
S9201-25	32000	0.47761	0.00000	0.00000
TOTAL FLOW RATE (cfm)	**67000**			
TOTAL MERCURY EMISSIONS FROM 9201-4 FOR THE YEAR 1959 (lb/yr)			**3286.00**	
S9201-41	35000	0.00949	31.18569	0.00045
S9201-42	35000	0.00949	31.18569	0.00045
S9201-43	35000	0.00949	31.18569	0.00045
S9201-44	35000	0.00949	31.18569	0.00045
S9201-45	35000	0.00949	31.18569	0.00045
S9201-46	35000	0.00949	31.18569	0.00045
S9201-47	35000	0.00949	31.18569	0.00045
S9201-48	35000	0.00949	31.18569	0.00045
S9201-49	107200	0.02907	95.51730	0.00137
S9201-410	107200	0.02907	95.51730	0.00137
S9201-411	107200	0.02907	95.51730	0.00137
S9201-412	107200	0.02907	95.51730	0.00137
S9201-413	26000	0.00705	23.16651	0.00033
S9201-414	26000	0.00705	23.16651	0.00033
S9201-415	26000	0.00705	23.16651	0.00033
S9201-416	26000	0.00705	23.16651	0.00033
S9201-417	73851.25	0.02003	65.80291	0.00095
S9201-418	73851.25	0.02003	65.80291	0.00095
S9201-419	73851.25	0.02003	65.80291	0.00095
S9201-420	73851.25	0.02003	65.80291	0.00095
S9201-421	73851.25	0.02003	65.80291	0.00095
S9201-422	73851.25	0.02003	65.80291	0.00095
S9201-423	73851.25	0.02003	65.80291	0.00095
S9201-424	73851.25	0.02003	65.80291	0.00095
F9201-44	143000	0.03878	127.41580	0.00183
F9201-46	143000	0.03878	127.41580	0.00183
F9201-47	70200	0.01904	62.54957	0.00090
F9201-48	70200	0.01904	62.54957	0.00090
F9201-49	70200	0.01904	62.54957	0.00090
F9201-410	70200	0.01904	62.54957	0.00090
F9201-411	70200	0.01904	62.54957	0.00090
F9201-412	70200	0.01904	62.54957	0.00090
F9201-413	143000	0.03878	127.41580	0.00183
F9201-415	143000	0.03878	127.41580	0.00183
F9201-416	22500	0.00610	20.04794	0.00029

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1959)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	MERCURY EMISSION g/s
F9201-417	22500	0.00610	20.04794	0.00029
F9201-418	22500	0.00610	20.04794	0.00029
F9201-420	45000	0.01220	40.09588	0.00058
F9201-421	45000	0.01220	40.09588	0.00058
F9201-423	70200	0.01904	62.54957	0.00090
F9201-424	70200	0.01904	62.54957	0.00090
F9201-425	143000	0.03878	127.41580	0.00183
F9201-427	143000	0.03878	127.41580	0.00183
F9201-428	143000	0.03878	127.41580	0.00183
F9201-430	143000	0.03878	127.41580	0.00183
F9201-431	70200	0.01904	62.54957	0.00090
F9201-432	70200	0.01904	62.54957	0.00090
F9201-434	70200	0.01904	62.54957	0.00090
F9201-436	70200	0.01904	62.54957	0.00090
F9201-437	70200	0.01904	62.54957	0.00090
F9201-438	70200	0.01904	62.54957	0.00090
TOTAL FLOW RATE (cfm)	**3687910**			

TOTAL MERCURY EMISSIONS FROM 9201-5 FOR THE YEAR 1959 (lb/yr)			**912.00**	
S9201-51	76000	0.03436	31.33762	0.00045
S9201-52	76000	0.03436	31.33762	0.00045
S9201-53	76000	0.03436	31.33762	0.00045
S9201-54	76000	0.03436	31.33762	0.00045
S9201-55	46550	0.02105	19.19429	0.00028
S9201-56	46550	0.02105	19.19429	0.00028
S9201-57	46550	0.02105	19.19429	0.00028
S9201-58	46550	0.02105	19.19429	0.00028
S9201-59	75355	0.03407	31.07166	0.00045
S9201-510	75355	0.03407	31.07166	0.00045
S9201-511	75355	0.03407	31.07166	0.00045
S9201-512	75355	0.03407	31.07166	0.00045
S9201-513	114223.13	0.05164	47.09843	0.00068
S9201-514	114223.13	0.05164	47.09843	0.00068
S9201-515	114223.13	0.05164	47.09843	0.00068
S9201-516	114223.13	0.05164	47.09843	0.00068
S9201-517	64267.5	0.02906	26.49987	0.00038
S9201-518	64267.5	0.02906	26.49987	0.00038
S9201-519	64267.5	0.02906	26.49987	0.00038
S9201-520	64267.5	0.02906	26.49987	0.00038
S9201-521	31750	0.01435	13.09170	0.00019
S9201-522	31750	0.01435	13.09170	0.00019
S9201-523	31750	0.01435	13.09170	0.00019
S9201-524	31750	0.01435	13.09170	0.00019
F9201-54	89500	0.04047	36.90417	0.00053
F9201-56	89500	0.04047	36.90417	0.00053

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1959)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	MERCURY EMISSION g/s
F9201-513	45300	0.02048	18.67887	0.00027
F9201-515	45300	0.02048	18.67887	0.00027
F9201-525	45300	0.02048	18.67887	0.00027
F9201-527	45300	0.02048	18.67887	0.00027
F9201-528	89500	0.04047	36.90417	0.00053
F9201-529	40000	0.01808	16.49348	0.00024
F9201-530	89500	0.04047	36.90417	0.00053
TOTAL FLOW RATE (cfm)	**2211782.52**			
TOTAL MERCURY EMISSIONS FROM STEAM PLANT 1 FOR THE YEAR 1959 (lb/yr)			**0**	
S9401-11 (Steam Plant 1)*	62209	0.36000	0.00000	0.00000
S9401-12 (Steam Plant 1)*	110593.95	0.64000	0.00000	0.00000
TOTAL FLOW RATE (cfm)	**172802.95**			
TOTAL MERCURY EMISSIONS FROM STEAM PLANT 2 FOR THE YEAR 1959 (lb/yr)			**0**	
S9401-21 (Steam Plant 2)*	270000	NA	0.00000	0.00000
* The emissions for steam plants 1 & 2 are assumed to be equal				
TOTAL MERCURY EMISSION FROM 81-10 FOR THE YEAR 1959 (lb/yr)			**120.00**	
S81-101	1300	NA	120.00000	0.00173
TOTAL MERCURY EMISSIONS FROM STEAM PLANT 3 FOR THE YEAR 1959 (lb/yr)			**77**	
S9401-31	270000	0.40983	31.55705	0.00045
S9401-32	388806.87	0.59017	45.44295	0.00065
TOTAL FLOW RATE (cfm)	**658806.87**			
TOTAL MERCURY EMISSION FROM 9204-4 FOR THE YEAR 1959 (lb/yr)			**916.00**	
S9204-41	60000	0.10823	99.13420	0.00143
S9204-42	60000	0.10823	99.13420	0.00143
V9204-41	20000	0.03608	33.04473	0.00048
V9204-42	20000	0.03608	33.04473	0.00048
V9204-43	24800	0.04473	40.97547	0.00059
V9204-44	20000	0.03608	33.04473	0.00048
V9204-45	24800	0.04473	40.97547	0.00059
V9204-46	20000	0.03608	33.04473	0.00048
V9204-47	24800	0.04473	40.97547	0.00059
V9204-48	20000	0.03608	33.04473	0.00048
V9204-49	20000	0.03608	33.04473	0.00048
F9204-41	40000	0.07215	66.08947	0.00095
F9204-42	40000	0.07215	66.08947	0.00095

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1959)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	MERCURY EMISSION g/s
F9204-43	40000	0.07215	66.08947	0.00095
F9204-44	40000	0.07215	66.08947	0.00095
F9204-45	40000	0.07215	66.08947	0.00095
F9204-46	40000	0.07215	66.08947	0.00095
TOTAL FLOW RATE (cfm)	**554400**			
TOTAL MERCURY EMISSION FROM 9720 FOR THE YEAR 1959 (lb/yr)			**2500.00**	
A9720-26	NA	NA	2500.0	0.03596

Notes:

(1) Volume Flow Rates are based on information provided by Ernie Choat and on engineering judgement based on similarity of operations and fan sizes.
(2) Fraction of Mercury Emitted = Volume flow rate / Total volume flow rate
(3) Mercury Emission = Fraction of mercury emitted * Total mercury emissions

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1960)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	MERCURY EMISSION g/s
TOTAL MERCURY EMISSIONS FROM 9201-2 FOR THE YEAR 1960 (lb/yr)			**0.00**	
S9201-21	15000	0.22388	0.00000	0.00000
S9201-22	2000	0.02985	0.00000	0.00000
S9201-23	2000	0.02985	0.00000	0.00000
S9201-24	16000	0.23881	0.00000	0.00000
S9201-25	32000	0.47761	0.00000	0.00000
TOTAL FLOW RATE (cfm)	**67000**			
TOTAL MERCURY EMISSIONS FROM 9201-4 FOR THE YEAR 1960 (lb/yr)			**2919.00**	
S9201-41	35000	0.00949	27.70268	0.00040
S9201-42	35000	0.00949	27.70268	0.00040
S9201-43	35000	0.00949	27.70268	0.00040
S9201-44	35000	0.00949	27.70268	0.00040
S9201-45	35000	0.00949	27.70268	0.00040
S9201-46	35000	0.00949	27.70268	0.00040
S9201-47	35000	0.00949	27.70268	0.00040
S9201-48	35000	0.00949	27.70268	0.00040
S9201-49	107200	0.02907	84.84936	0.00122
S9201-410	107200	0.02907	84.84936	0.00122
S9201-411	107200	0.02907	84.84936	0.00122
S9201-412	107200	0.02907	84.84936	0.00122
S9201-413	26000	0.00705	20.57914	0.00030
S9201-414	26000	0.00705	20.57914	0.00030
S9201-415	26000	0.00705	20.57914	0.00030
S9201-416	26000	0.00705	20.57914	0.00030
S9201-417	73851.25	0.02003	58.45365	0.00084
S9201-418	73851.25	0.02003	58.45365	0.00084
S9201-419	73851.25	0.02003	58.45365	0.00084
S9201-420	73851.25	0.02003	58.45365	0.00084
S9201-421	73851.25	0.02003	58.45365	0.00084
S9201-422	73851.25	0.02003	58.45365	0.00084
S9201-423	73851.25	0.02003	58.45365	0.00084
S9201-424	73851.25	0.02003	58.45365	0.00084
F9201-44	143000	0.03878	113.18525	0.00163
F9201-46	143000	0.03878	113.18525	0.00163
F9201-47	70200	0.01904	55.56367	0.00080
F9201-48	70200	0.01904	55.56367	0.00080
F9201-49	70200	0.01904	55.56367	0.00080
F9201-410	70200	0.01904	55.56367	0.00080
F9201-411	70200	0.01904	55.56367	0.00080
F9201-412	70200	0.01904	55.56367	0.00080
F9201-413	143000	0.03878	113.18525	0.00163
F9201-415	143000	0.03878	113.18525	0.00163
F9201-416	22500	0.00610	17.80887	0.00026

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1960)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	MERCURY EMISSION g/s
F9201-417	22500	0.00610	17.80887	0.00026
F9201-418	22500	0.00610	17.80887	0.00026
F9201-420	45000	0.01220	35.61773	0.00051
F9201-421	45000	0.01220	35.61773	0.00051
F9201-423	70200	0.01904	55.56367	0.00080
F9201-424	70200	0.01904	55.56367	0.00080
F9201-425	143000	0.03878	113.18525	0.00163
F9201-427	143000	0.03878	113.18525	0.00163
F9201-428	143000	0.03878	113.18525	0.00163
F9201-430	143000	0.03878	113.18525	0.00163
F9201-431	70200	0.01904	55.56367	0.00080
F9201-432	70200	0.01904	55.56367	0.00080
F9201-434	70200	0.01904	55.56367	0.00080
F9201-436	70200	0.01904	55.56367	0.00080
F9201-437	70200	0.01904	55.56367	0.00080
F9201-438	70200	0.01904	55.56367	0.00080
TOTAL FLOW RATE (cfm)	**3687910**			
TOTAL MERCURY EMISSIONS FROM 9201-5 FOR THE YEAR 1960 (lb/yr)			**492.00**	
S9201-51	76000	0.03436	16.90582	0.00024
S9201-52	76000	0.03436	16.90582	0.00024
S9201-53	76000	0.03436	16.90582	0.00024
S9201-54	76000	0.03436	16.90582	0.00024
S9201-55	46550	0.02105	10.35482	0.00015
S9201-56	46550	0.02105	10.35482	0.00015
S9201-57	46550	0.02105	10.35482	0.00015
S9201-58	46550	0.02105	10.35482	0.00015
S9201-59	75355	0.03407	16.76234	0.00024
S9201-510	75355	0.03407	16.76234	0.00024
S9201-511	75355	0.03407	16.76234	0.00024
S9201-512	75355	0.03407	16.76234	0.00024
S9201-513	114223.13	0.05164	25.40837	0.00037
S9201-514	114223.13	0.05164	25.40837	0.00037
S9201-515	114223.13	0.05164	25.40837	0.00037
S9201-516	114223.13	0.05164	25.40837	0.00037
S9201-517	64267.5	0.02906	14.29599	0.00021
S9201-518	64267.5	0.02906	14.29599	0.00021
S9201-519	64267.5	0.02906	14.29599	0.00021
S9201-520	64267.5	0.02906	14.29599	0.00021
S9201-521	31750	0.01435	7.06263	0.00010
S9201-522	31750	0.01435	7.06263	0.00010
S9201-523	31750	0.01435	7.06263	0.00010
S9201-524	31750	0.01435	7.06263	0.00010
F9201-54	89500	0.04047	19.90883	0.00029
F9201-56	89500	0.04047	19.90883	0.00029

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1960)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	g/s
F9201-513	45300	0.02048	10.07676	0.00014
F9201-515	45300	0.02048	10.07676	0.00014
F9201-525	45300	0.02048	10.07676	0.00014
F9201-527	45300	0.02048	10.07676	0.00014
F9201-528	89500	0.04047	19.90883	0.00029
F9201-529	40000	0.01808	8.89780	0.00013
F9201-530	89500	0.04047	19.90883	0.00029
TOTAL FLOW RATE (cfm)	**2211782.52**			
TOTAL MERCURY EMISSIONS FROM STEAM PLANT 1 FOR THE YEAR 1960 (lb/yr)			**0**	
S9401-11 (Steam Plant 1)*	62209	0.36000	0.00000	0.00000
S9401-12 (Steam Plant 1)*	110593.95	0.64000	0.00000	0.00000
TOTAL FLOW RATE (cfm)	**172802.95**			
TOTAL MERCURY EMISSIONS FROM STEAM PLANT 2 FOR THE YEAR 1960 (lb/yr)			**0**	
S9401-21 (Steam Plant 2)*	270000	NA	0.00000	0.00000
* The emissions for steam plants 1 & 2 are assumed to be equal				
TOTAL MERCURY EMISSION FROM 81-10 FOR THE YEAR 1960 (lb/yr)			**68.00**	
S81-101	1300	NA	68.00000	0.00098
TOTAL MERCURY EMISSIONS FROM STEAM PLANT 3 FOR THE YEAR 1960 (lb/yr)			**77**	
S9401-31	270000	0.40983	31.55705	0.00045
S9401-32	388806.87	0.59017	45.44295	0.00065
TOTAL FLOW RATE (cfm)	**658806.87**			
TOTAL MERCURY EMISSION FROM 9204-4 FOR THE YEAR 1960 (lb/yr)			**0.00**	
S9204-41	60000	0.10823	0.00000	0.00000
S9204-42	60000	0.10823	0.00000	0.00000
V9204-41	20000	0.03608	0.00000	0.00000
V9204-42	20000	0.03608	0.00000	0.00000
V9204-43	24800	0.04473	0.00000	0.00000
V9204-44	20000	0.03608	0.00000	0.00000
V9204-45	24800	0.04473	0.00000	0.00000
V9204-46	20000	0.03608	0.00000	0.00000
V9204-47	24800	0.04473	0.00000	0.00000
V9204-48	20000	0.03608	0.00000	0.00000
V9204-49	20000	0.03608	0.00000	0.00000
F9204-41	40000	0.07215	0.00000	0.00000
F9204-42	40000	0.07215	0.00000	0.00000

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1960)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	MERCURY EMISSION g/s
F9204-43	40000	0.07215	0.00000	0.00000
F9204-44	40000	0.07215	0.00000	0.00000
F9204-45	40000	0.07215	0.00000	0.00000
F9204-46	40000	0.07215	0.00000	0.00000
TOTAL FLOW RATE (cfm)	**554400**			

Notes:

(1) Volume Flow Rates are based on information provided by Ernie Choat and on engineering judgement based on similarity of operations and fan sizes.

(2) Fraction of Mercury Emitted = Volume flow rate / Total volume flow rate

(3) Mercury Emission = Fraction of mercury emitted * Total mercury emissions

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1961)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	MERCURY EMISSION g/s
TOTAL MERCURY EMISSIONS FROM 9201-2 FOR THE YEAR 1961 (lb/yr)			**0.00**	
S9201-21	15000	0.22388	0.00000	0.00000
S9201-22	2000	0.02985	0.00000	0.00000
S9201-23	2000	0.02985	0.00000	0.00000
S9201-24	16000	0.23881	0.00000	0.00000
S9201-25	32000	0.47761	0.00000	0.00000
TOTAL FLOW RATE (cfm)	**67000**			
TOTAL MERCURY EMISSIONS FROM 9201-4 FOR THE YEAR 1961 (lb/yr)			**2324.00**	
S9201-41	35000	0.00949	22.05585	0.00032
S9201-42	35000	0.00949	22.05585	0.00032
S9201-43	35000	0.00949	22.05585	0.00032
S9201-44	35000	0.00949	22.05585	0.00032
S9201-45	35000	0.00949	22.05585	0.00032
S9201-46	35000	0.00949	22.05585	0.00032
S9201-47	35000	0.00949	22.05585	0.00032
S9201-48	35000	0.00949	22.05585	0.00032
S9201-49	107200	0.02907	67.55393	0.00097
S9201-410	107200	0.02907	67.55393	0.00097
S9201-411	107200	0.02907	67.55393	0.00097
S9201-412	107200	0.02907	67.55393	0.00097
S9201-413	26000	0.00705	16.38435	0.00024
S9201-414	26000	0.00705	16.38435	0.00024
S9201-415	26000	0.00705	16.38435	0.00024
S9201-416	26000	0.00705	16.38435	0.00024
S9201-417	73851.25	0.02003	46.53864	0.00067
S9201-418	73851.25	0.02003	46.53864	0.00067
S9201-419	73851.25	0.02003	46.53864	0.00067
S9201-420	73851.25	0.02003	46.53864	0.00067
S9201-421	73851.25	0.02003	46.53864	0.00067
S9201-422	73851.25	0.02003	46.53864	0.00067
S9201-423	73851.25	0.02003	46.53864	0.00067
S9201-424	73851.25	0.02003	46.53864	0.00067
F9201-44	143000	0.03878	90.11391	0.00130
F9201-46	143000	0.03878	90.11391	0.00130
F9201-47	70200	0.01904	44.23774	0.00064
F9201-48	70200	0.01904	44.23774	0.00064
F9201-49	70200	0.01904	44.23774	0.00064
F9201-410	70200	0.01904	44.23774	0.00064
F9201-411	70200	0.01904	44.23774	0.00064
F9201-412	70200	0.01904	44.23774	0.00064
F9201-413	143000	0.03878	90.11391	0.00130
F9201-415	143000	0.03878	90.11391	0.00130
F9201-416	22500	0.00610	14.17876	0.00020

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1961)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	MERCURY EMISSION g/s
F9201-417	22500	0.00610	14.17876	0.00020
F9201-418	22500	0.00610	14.17876	0.00020
F9201-420	45000	0.01220	28.35752	0.00041
F9201-421	45000	0.01220	28.35752	0.00041
F9201-423	70200	0.01904	44.23774	0.00064
F9201-424	70200	0.01904	44.23774	0.00064
F9201-425	143000	0.03878	90.11391	0.00130
F9201-427	143000	0.03878	90.11391	0.00130
F9201-428	143000	0.03878	90.11391	0.00130
F9201-430	143000	0.03878	90.11391	0.00130
F9201-431	70200	0.01904	44.23774	0.00064
F9201-432	70200	0.01904	44.23774	0.00064
F9201-434	70200	0.01904	44.23774	0.00064
F9201-436	70200	0.01904	44.23774	0.00064
F9201-437	70200	0.01904	44.23774	0.00064
F9201-438	70200	0.01904	44.23774	0.00064
TOTAL FLOW RATE (cfm)	**3687910**			

TOTAL MERCURY EMISSIONS FROM 9201-5 FOR THE YEAR 1961 (lb/yr)			**0.00**	
S9201-51	76000	0.03436	0.00000	0.00000
S9201-52	76000	0.03436	0.00000	0.00000
S9201-53	76000	0.03436	0.00000	0.00000
S9201-54	76000	0.03436	0.00000	0.00000
S9201-55	46550	0.02105	0.00000	0.00000
S9201-56	46550	0.02105	0.00000	0.00000
S9201-57	46550	0.02105	0.00000	0.00000
S9201-58	46550	0.02105	0.00000	0.00000
S9201-59	75355	0.03407	0.00000	0.00000
S9201-510	75355	0.03407	0.00000	0.00000
S9201-511	75355	0.03407	0.00000	0.00000
S9201-512	75355	0.03407	0.00000	0.00000
S9201-513	114223.13	0.05164	0.00000	0.00000
S9201-514	114223.13	0.05164	0.00000	0.00000
S9201-515	114223.13	0.05164	0.00000	0.00000
S9201-516	114223.13	0.05164	0.00000	0.00000
S9201-517	64267.5	0.02906	0.00000	0.00000
S9201-518	64267.5	0.02906	0.00000	0.00000
S9201-519	64267.5	0.02906	0.00000	0.00000
S9201-520	64267.5	0.02906	0.00000	0.00000
S9201-521	31750	0.01435	0.00000	0.00000
S9201-522	31750	0.01435	0.00000	0.00000
S9201-523	31750	0.01435	0.00000	0.00000
S9201-524	31750	0.01435	0.00000	0.00000
F9201-54	89500	0.04047	0.00000	0.00000
F9201-56	89500	0.04047	0.00000	0.00000

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1961)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	g/s
F9201-513	45300	0.02048	0.00000	0.00000
F9201-515	45300	0.02048	0.00000	0.00000
F9201-525	45300	0.02048	0.00000	0.00000
F9201-527	45300	0.02048	0.00000	0.00000
F9201-528	89500	0.04047	0.00000	0.00000
F9201-529	40000	0.01808	0.00000	0.00000
F9201-530	89500	0.04047	0.00000	0.00000
TOTAL FLOW RATE (cfm)	**2211782.52**			
TOTAL MERCURY EMISSIONS FROM STEAM PLANT 1 FOR THE YEAR 1961 (lb/yr)			**0**	
S9401-11 (Steam Plant 1)*	62209	0.36000	0.00000	0.00000
S9401-12 (Steam Plant 1)*	110593.95	0.64000	0.00000	0.00000
TOTAL FLOW RATE (cfm)	**172802.95**			
TOTAL MERCURY EMISSIONS FROM STEAM PLANT 2 FOR THE YEAR 1961 (lb/yr)			**0**	
S9401-21 (Steam Plant 2)*	270000	NA	0.00000	0.00000
* The emissions for steam plants 1 & 2 are assumed to be equal				
TOTAL MERCURY EMISSION FROM 81-10 FOR THE YEAR 1961 (lb/yr)			**82.00**	
S81-101	1300	NA	82.00000	0.00118
TOTAL MERCURY EMISSIONS FROM STEAM PLANT 3 FOR THE YEAR 1961 (lb/yr)			**77**	
S9401-31	270000	0.40983	31.55705	0.00045
S9401-32	388806.87	0.59017	45.44295	0.00065
TOTAL FLOW RATE (cfm)	**658806.87**			
TOTAL MERCURY EMISSION FROM 9204-4 FOR THE YEAR 1961 (lb/yr)			**0.00**	
S9204-41	60000	0.10823	0.00000	0.00000
S9204-42	60000	0.10823	0.00000	0.00000
V9204-41	20000	0.03608	0.00000	0.00000
V9204-42	20000	0.03608	0.00000	0.00000
V9204-43	24800	0.04473	0.00000	0.00000
V9204-44	20000	0.03608	0.00000	0.00000
V9204-45	24800	0.04473	0.00000	0.00000
V9204-46	20000	0.03608	0.00000	0.00000
V9204-47	24800	0.04473	0.00000	0.00000
V9204-48	20000	0.03608	0.00000	0.00000
V9204-49	20000	0.03608	0.00000	0.00000
F9204-41	40000	0.07215	0.00000	0.00000
F9204-42	40000	0.07215	0.00000	0.00000

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1961)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	MERCURY EMISSION g/s
F9204-43	40000	0.07215	0.00000	0.00000
F9204-44	40000	0.07215	0.00000	0.00000
F9204-45	40000	0.07215	0.00000	0.00000
F9204-46	40000	0.07215	0.00000	0.00000
TOTAL FLOW RATE (cfm)	**554400**			

Notes:

(1) Volume Flow Rates are based on information provided by Ernie Choat and on engineering judgement based on similarity of operations and fan sizes.

(2) Fraction of Mercury Emitted = Volume flow rate / Total volume flow rate

(3) Mercury Emission = Fraction of mercury emitted * Total mercury emissions

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1962)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	MERCURY EMISSION g/s
TOTAL MERCURY EMISSIONS FROM 9201-2 FOR THE YEAR 1962 (lb/yr)			**0.00**	
S9201-21	15000	0.22388	0.00000	0.00000
S9201-22	2000	0.02985	0.00000	0.00000
S9201-23	2000	0.02985	0.00000	0.00000
S9201-24	16000	0.23881	0.00000	0.00000
S9201-25	32000	0.47761	0.00000	0.00000
TOTAL FLOW RATE (cfm)	**67000**			
TOTAL MERCURY EMISSIONS FROM 9201-4 FOR THE YEAR 1962 (lb/yr)			**2324.00**	
S9201-41	35000	0.00949	22.05585	0.00032
S9201-42	35000	0.00949	22.05585	0.00032
S9201-43	35000	0.00949	22.05585	0.00032
S9201-44	35000	0.00949	22.05585	0.00032
S9201-45	35000	0.00949	22.05585	0.00032
S9201-46	35000	0.00949	22.05585	0.00032
S9201-47	35000	0.00949	22.05585	0.00032
S9201-48	35000	0.00949	22.05585	0.00032
S9201-49	107200	0.02907	67.55393	0.00097
S9201-410	107200	0.02907	67.55393	0.00097
S9201-411	107200	0.02907	67.55393	0.00097
S9201-412	107200	0.02907	67.55393	0.00097
S9201-413	26000	0.00705	16.38435	0.00024
S9201-414	26000	0.00705	16.38435	0.00024
S9201-415	26000	0.00705	16.38435	0.00024
S9201-416	26000	0.00705	16.38435	0.00024
S9201-417	73851.25	0.02003	46.53864	0.00067
S9201-418	73851.25	0.02003	46.53864	0.00067
S9201-419	73851.25	0.02003	46.53864	0.00067
S9201-420	73851.25	0.02003	46.53864	0.00067
S9201-421	73851.25	0.02003	46.53864	0.00067
S9201-422	73851.25	0.02003	46.53864	0.00067
S9201-423	73851.25	0.02003	46.53864	0.00067
S9201-424	73851.25	0.02003	46.53864	0.00067
F9201-44	143000	0.03878	90.11391	0.00130
F9201-46	143000	0.03878	90.11391	0.00130
F9201-47	70200	0.01904	44.23774	0.00064
F9201-48	70200	0.01904	44.23774	0.00064
F9201-49	70200	0.01904	44.23774	0.00064
F9201-410	70200	0.01904	44.23774	0.00064
F9201-411	70200	0.01904	44.23774	0.00064
F9201-412	70200	0.01904	44.23774	0.00064
F9201-413	143000	0.03878	90.11391	0.00130
F9201-415	143000	0.03878	90.11391	0.00130
F9201-416	22500	0.00610	14.17876	0.00020

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1962)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	MERCURY EMISSION g/s
F9201-417	22500	0.00610	14.17876	0.00020
F9201-418	22500	0.00610	14.17876	0.00020
F9201-420	45000	0.01220	28.35752	0.00041
F9201-421	45000	0.01220	28.35752	0.00041
F9201-423	70200	0.01904	44.23774	0.00064
F9201-424	70200	0.01904	44.23774	0.00064
F9201-425	143000	0.03878	90.11391	0.00130
F9201-427	143000	0.03878	90.11391	0.00130
F9201-428	143000	0.03878	90.11391	0.00130
F9201-430	143000	0.03878	90.11391	0.00130
F9201-431	70200	0.01904	44.23774	0.00064
F9201-432	70200	0.01904	44.23774	0.00064
F9201-434	70200	0.01904	44.23774	0.00064
F9201-436	70200	0.01904	44.23774	0.00064
F9201-437	70200	0.01904	44.23774	0.00064
F9201-438	70200	0.01904	44.23774	0.00064
TOTAL FLOW RATE (cfm)	**3687910**			
TOTAL MERCURY EMISSIONS FROM 9201-5 FOR THE YEAR 1962 (lb/yr)			**0.00**	
S9201-51	76000	0.03436	0.00000	0.00000
S9201-52	76000	0.03436	0.00000	0.00000
S9201-53	76000	0.03436	0.00000	0.00000
S9201-54	76000	0.03436	0.00000	0.00000
S9201-55	46550	0.02105	0.00000	0.00000
S9201-56	46550	0.02105	0.00000	0.00000
S9201-57	46550	0.02105	0.00000	0.00000
S9201-58	46550	0.02105	0.00000	0.00000
S9201-59	75355	0.03407	0.00000	0.00000
S9201-510	75355	0.03407	0.00000	0.00000
S9201-511	75355	0.03407	0.00000	0.00000
S9201-512	75355	0.03407	0.00000	0.00000
S9201-513	114223.13	0.05164	0.00000	0.00000
S9201-514	114223.13	0.05164	0.00000	0.00000
S9201-515	114223.13	0.05164	0.00000	0.00000
S9201-516	114223.13	0.05164	0.00000	0.00000
S9201-517	64267.5	0.02906	0.00000	0.00000
S9201-518	64267.5	0.02906	0.00000	0.00000
S9201-519	64267.5	0.02906	0.00000	0.00000
S9201-520	64267.5	0.02906	0.00000	0.00000
S9201-521	31750	0.01435	0.00000	0.00000
S9201-522	31750	0.01435	0.00000	0.00000
S9201-523	31750	0.01435	0.00000	0.00000
S9201-524	31750	0.01435	0.00000	0.00000
F9201-54	89500	0.04047	0.00000	0.00000
F9201-56	89500	0.04047	0.00000	0.00000

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1962)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	MERCURY EMISSION g/s
F9201-513	45300	0.02048	0.00000	0.00000
F9201-515	45300	0.02048	0.00000	0.00000
F9201-525	45300	0.02048	0.00000	0.00000
F9201-527	45300	0.02048	0.00000	0.00000
F9201-528	89500	0.04047	0.00000	0.00000
F9201-529	40000	0.01808	0.00000	0.00000
F9201-530	89500	0.04047	0.00000	0.00000
TOTAL FLOW RATE (cfm)	**2211782.52**			
TOTAL MERCURY EMISSIONS FROM STEAM PLANT 1 FOR THE YEAR 1962 (lb/yr)			**0**	
S9401-11 (Steam Plant 1)*	62209	0.36000	0.00000	0.00000
S9401-12 (Steam Plant 1)*	110593.95	0.64000	0.00000	0.00000
TOTAL FLOW RATE (cfm)	**172802.95**			
TOTAL MERCURY EMISSIONS FROM STEAM PLANT 2 FOR THE YEAR 1962 (lb/yr)			**0**	
S9401-21 (Steam Plant 2)*	270000	NA	0.00000	0.00000
* The emissions for steam plants 1 & 2 are assumed to be equal				
TOTAL MERCURY EMISSION FROM 81-10 FOR THE YEAR 1962 (lb/yr)			**63.00**	
S81-101	1300	NA	63.00000	0.00091
TOTAL MERCURY EMISSIONS FROM STEAM PLANT 3 FOR THE YEAR 1962 (lb/yr)			**77**	
S9401-31	270000	0.40983	31.55705	0.00045
S9401-32	388806.87	0.59017	45.44295	0.00065
TOTAL FLOW RATE (cfm)	**658806.87**			
TOTAL MERCURY EMISSION FROM 9204-4 FOR THE YEAR 1962 (lb/yr)			**0.00**	
S9204-41	60000	0.10823	0.00000	0.00000
S9204-42	60000	0.10823	0.00000	0.00000
V9204-41	20000	0.03608	0.00000	0.00000
V9204-42	20000	0.03608	0.00000	0.00000
V9204-43	24800	0.04473	0.00000	0.00000
V9204-44	20000	0.03608	0.00000	0.00000
V9204-45	24800	0.04473	0.00000	0.00000
V9204-46	20000	0.03608	0.00000	0.00000
V9204-47	24800	0.04473	0.00000	0.00000
V9204-48	20000	0.03608	0.00000	0.00000
V9204-49	20000	0.03608	0.00000	0.00000
F9204-41	40000	0.07215	0.00000	0.00000
F9204-42	40000	0.07215	0.00000	0.00000

TABLE N-3: ALLOCATION OF MERCURY EMISSION RATE BY SOURCE (1962)

STACK I.D.	VOLUME FLOW RATE (cfm)	FRACTION OF MERCURY EMITTED FROM EACH SOURCE (unitless)	MERCURY EMISSION lb/yr	MERCURY EMISSION g/s
F9204-43	40000	0.07215	0.00000	0.00000
F9204-44	40000	0.07215	0.00000	0.00000
F9204-45	40000	0.07215	0.00000	0.00000
F9204-46	40000	0.07215	0.00000	0.00000
TOTAL FLOW RATE (cfm)	**554400**			

Notes:

(1) Volume Flow Rates are based on information provided by Ernie Choat and on engineering judgement based on similarity of operations and fan sizes.
(2) Fraction of Mercury Emitted = Volume flow rate / Total volume flow rate
(3) Mercury Emission = Fraction of mercury emitted * Total mercury emissions

Table N-4: UTM Coordinates for Receptors Modeled for Mercury Emissions from Y-12

Receptor Name	X-UTM (m)	Y-UTM (m)
EFPC Tree #2	747818.13	3987511.29
EFPC Tree #3	747295.56	3987619.01
EFPC Tree #4	747297.05	3987671.43
EFPC Tree #5	747325.83	3987670.29
EFPC Tree #6	747302.89	3987570.78
Wolf Valley Resident	754702.63	3990855.03
Tree SW of 9201-5	745853.67	3984897.19
Tree NE of 9201-5	748778.52	3986668.83
Ambient Station No. 8	746099.77	3984676.32
Ambient Station No. 2	748405.08	3986473.40

Figure 1-2 in Section 1 and Figure O-1 in Appendix O show the locations of the receptors identified above.

Table N-5: Summary of Air Concentrations Modeled at Each Receptor (μg m^{-3})

	Year									
	1953	**1954**	**1955**	**1956**	**1957**	**1958**	**1959**	**1960**	**1961**	**1962**
EFPC Tree#2	0.0031	0.0075	0.047	0.029	0.012	0.019	0.016	0.0076	0.0054	0.0054
EFPC Tree#3	0.0022	0.0054	0.034	0.021	0.0094	0.014	0.012	0.0059	0.0042	0.0042
EFPC Tree#4	0.0021	0.0052	0.033	0.020	0.0091	0.014	0.012	0.0057	0.0041	0.0041
EFPC Tree#5	0.0022	0.0053	0.034	0.021	0.0091	0.014	0.012	0.0057	0.0041	0.0041
EFPC Tree #6	0.0023	0.0057	0.036	0.022	0.0097	0.015	0.0123	0.0061	0.0044	0.0043
Wolf Valley Resident	0.00083	0.0020	0.014	0.0084	0.0037	0.0057	0.0048	0.0022	0.0016	0.0016
Tree SW of 9201-5	0.069	0.18	0.81	0.48	0.19	0.29	0.23	0.12	0.087	0.086
Tree NE of 9201-5	0.0062	0.014	0.099	0.061	0.028	0.039	0.032	0.017	0.012	0.012
Ambient Station No. 8	0.058	0.15	0.71	0.42	0.19	0.27	0.21	0.12	0.090	0.089
Ambient Station No. 2	0.0080	0.018	0.124	0.077	0.035	0.048	0.040	0.022	0.016	0.016

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APPENDIX O

COMPARISON OF MEASUREMENTS OF MERCURY IN TREE RINGS AND ANNUAL AVERAGE AIRBORNE MERCURY CONCENTRATIONS

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APPENDIX O

COMPARISON OF MEASUREMENTS OF MERCURY IN TREE RINGS AND ANNUAL AVERAGE AIRBORNE MERCURY CONCENTRATIONS

O.1 Introduction

In 1993, Dr. Ralph Turner of ORNL collected samples of tree rings from red cedars growing on the Y-12 facility and along EFPC (Figure O-1). These samples showed that mercury concentrations in the tree rings were elevated compared to background levels (Turner 1995). Several investigators have measured elevated mercury concentrations in tree rings from areas with elevated airborne mercury concentrations. The tree ring mercury was assumed to come from foliar uptake of airborne mercury, because plants take up (and release) mercury through their foliage while uptake through tree roots is minimal (Beauford et al. 1977; de Temmerman et al. 1986; Mosbaek et al. 1988; Lindberg 1995). Trees add a new ring for each year of growth. Consequently, it is theorized that analysis of mercury concentrations in tree ring samples can provide an indication of historical trends in airborne mercury concentrations (Lodenius 1994; Turner and Bloom, n.d.; Turner 1995).

The following discussion evaluates the plausibility of using the tree ring data collected near the ORR to estimate historical air concentrations of mercury. This discussion is based on tree ring concentrations measured in two trees on Y-12– the East Tree (measured twice) and the West Tree– and five trees in the East Fork Poplar Creek floodplain (EFPC2, EFPC3, EFPC4, EFPC5, and EFPC6). The locations of these trees are shown in Figure O-1. Table O-1 summarizes mercury concentrations measured in the rings of the trees growing on the Y-12 Plant, and Table O-2 summarizes mercury concentrations measured in the EFPC floodplain trees.

O.2 Evaluation of the Plausibility of Using Tree Ring Data to Estimate Historic Air Concentrations of Mercury

Evaluation of tree ring data from EFPC floodplain trees shows that concentrations of mercury in tree rings corresponding to the ten years (1953-1963) surrounding the period of peak mercury releases from Y-12 (1955-1959) were considerably higher than tree ring concentrations for earlier or later periods. However, as outlined in the following analysis, a direct correspondence between mercury concentrations measured in the rings of trees at Y-12 and in the EFPC floodplain and annual average airborne mercury concentrations at the tree locations cannot be established using current data. At this time, there is not enough information about mercury uptake by red cedars, transport of mercury within the trees, and variation from tree to tree and from year to year within a single tree to allow detailed mathematical modeling of mercury deposition in tree rings as a function of ambient airborne mercury concentrations. Therefore, tree ring data cannot be used at present to reliably estimate annual average airborne mercury concentrations at the tree locations.

FIGURE O-1

OAK RIDGE
TENNESSEE

Y-12
DISCRETE RECEPTORS

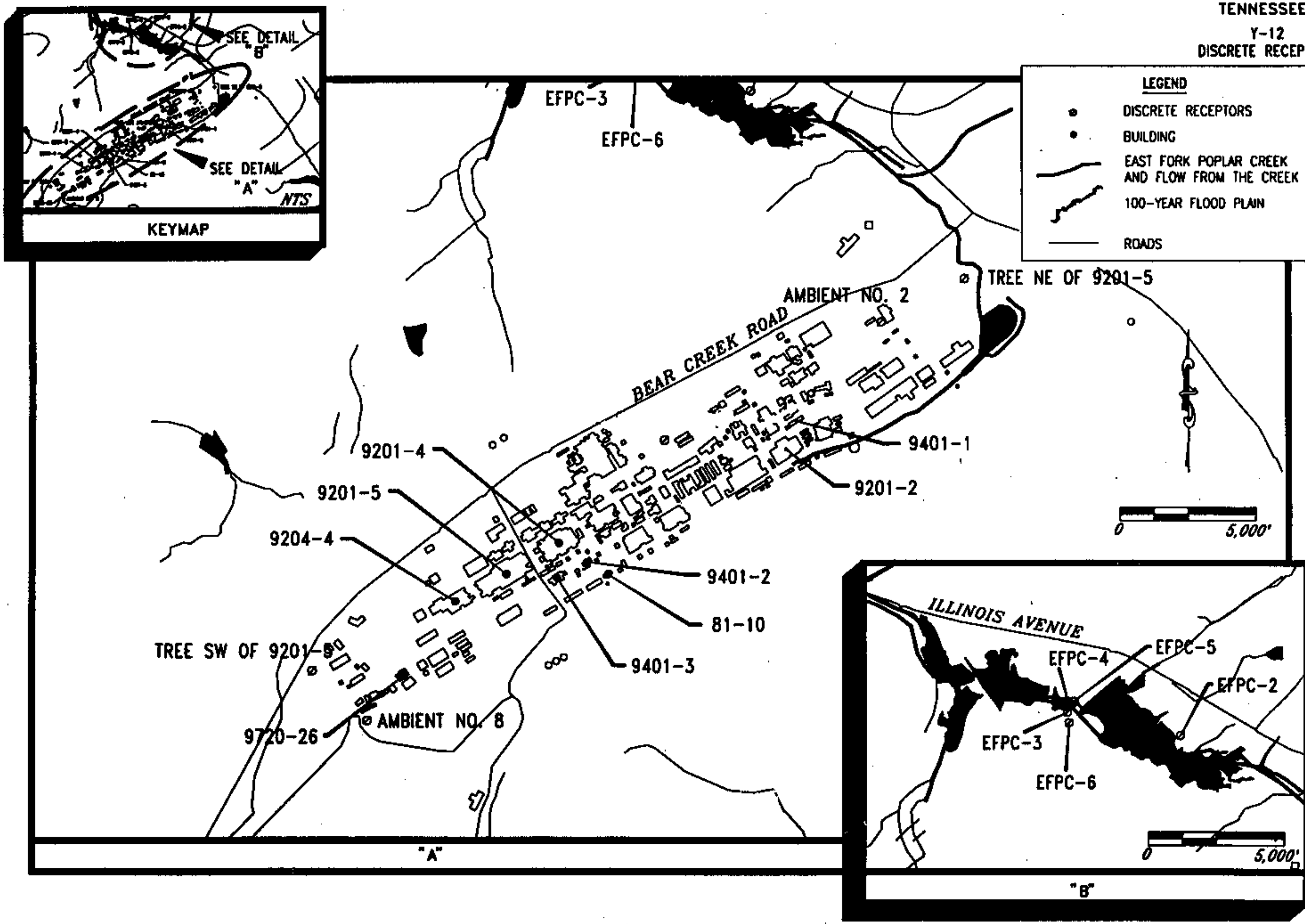


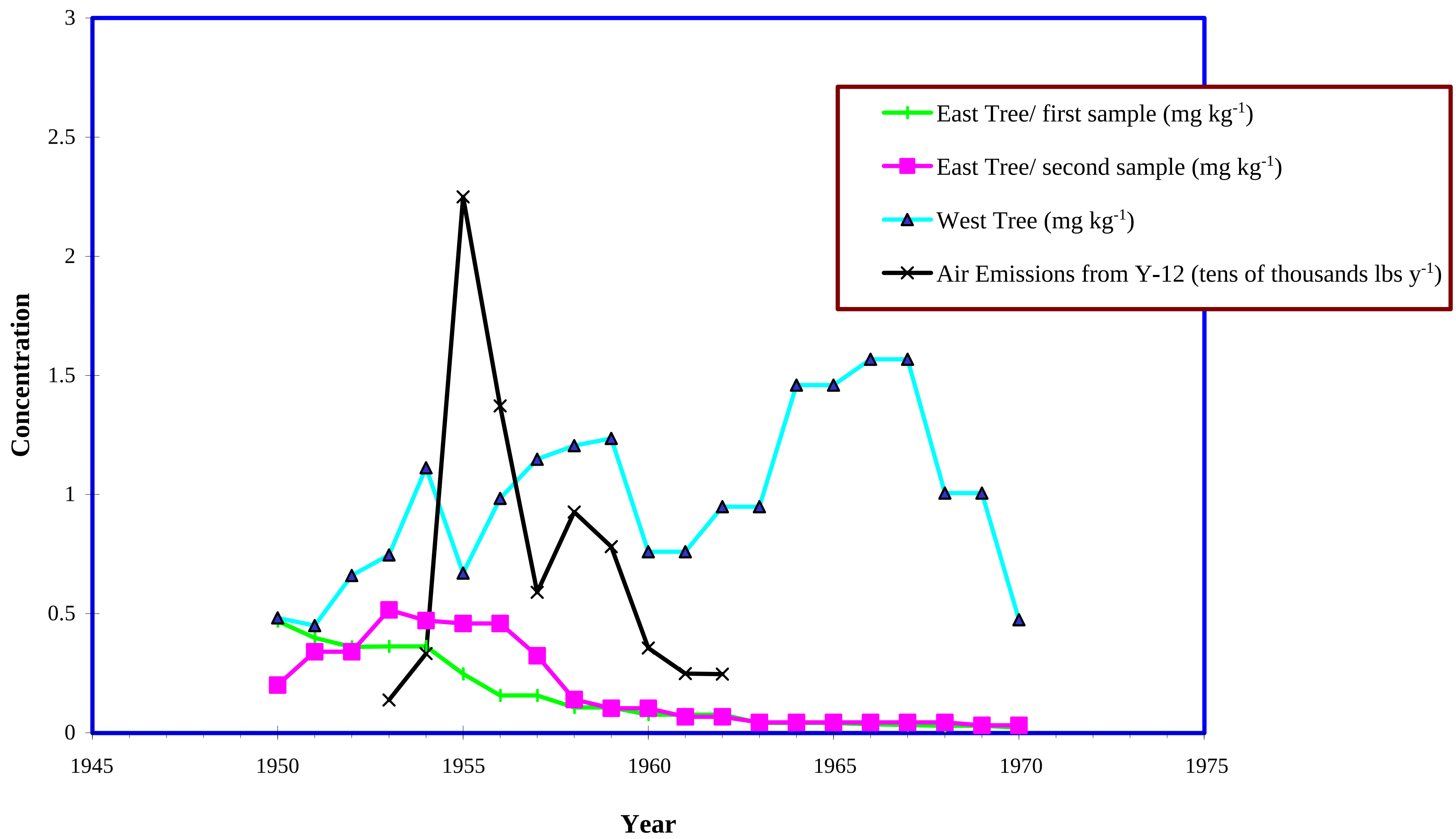
Table O-1: Summary of Mercury Concentrations in Tree Rings of Y-12 Trees and Y-12 Air Emissions History

Year	East Tree/ first sample (mg kg^{-1})	East Tree/ second sample (mg kg^{-1})	West Tree (mg kg^{-1})	Air Emissions from Y-12 (lbs/yr)
1950	0.47	0.2001	0.48	---
1951	0.40	0.34	0.45	---
1952	0.36	0.34	0.66	---
1953	0.36	0.52	0.75	1381
1954	0.36	0.47	1.1	3323
1955	0.25	0.46	0.67	22491
1956	0.16	0.46	0.98	13717
1957	0.16	0.32	1.1	5897
1958	0.11	0.14	1.2	9265
1959	0.11	0.10	1.2	7811
1960	0.077	0.10	0.76	3556
1961	0.077	0.068	0.76	2483
1962	0.077	0.068	0.95	2464
1963	0.042	0.043	0.95	---
1964	0.042	0.043	1.5	---
1965	0.042	0.043	1.5	---
1966	0.035	0.043	1.6	---
1967	0.033	0.043	1.6	---
1968	0.029	0.043	1.0	---
1969	0.030	0.032	1.0	---
1970	0.021	0.032	0.47	---
1971	0.019	0.032	0.47	---
1972	0.016	0.018	0.23	---
1973	0.016	0.018	0.23	---
1974	0.016	0.018	0.13	---
1975	0.016	0.018	0.13	---
1976	0.016	0.018	0.085	---
1977	0.016	0.0097	0.085	---
1978	0.014	0.0097	0.058	---
1979	0.014	0.0097	0.058	---
1980	0.014	0.0097	0.048	---
1981	0.014	0.0097	0.048	---
1982	0.014	0.0012	0.058	---
1983	0.015	0.0012	0.058	---
1984	0.016	0.0012	0.060	---
1985	0.016	0.0012	0.031	---
1986	0.0078	0.0012	0.019	---
1987	0.0067	0.0012	0.023	---
1988	0.0039	0.0082	0.030	---
1989	0.0035	0.0049	0.050	---
1990	0.0044	0.0043	0.018	---
1991	0.0022	0.0043	0.016	---
1992	0.0020	0.0027	0.010	---
1993	0.0020	0.0027	0.012	---

Table O-2: Summary of Mercury Concentrations in Tree Rings of EFPC Floodplain Trees

Year	Tree #EFPC 2 Tree Ring Concentration (mg kg^{-1})	Tree #EFPC 3 Tree Ring Concentration (mg kg^{-1})	Tree #EFPC4 Tree Ring Concentration (mg kg^{-1})	Tree #EFPC 5 Tree Ring Concentration (mg kg^{-1})	Tree #EFPC 6 Tree Ring Concentration (mg kg^{-1})
1950	5.3	1.8	ND	ND	1.2
1951	5.3	1.8	ND	ND	0.61
1952	5.3	1.8	ND	ND	0.37
1953	7.2	1.8	ND	ND	0.31
1954	7.2	2.7	ND	4.6	0.29
1955	7.2	2.7	ND	4.6	0.33
1956	7.2	2.7	ND	4.6	0.25
1957	7.2	2.7	ND	5.1	0.29
1958	1.5	2.7	ND	5.1	0.26
1959	1.5	3.0	0.22	0.63	0.17
1960	1.5	3.0	0.22	0.63	0.17
1961	1.5	3.0	0.22	0.63	0.17
1962	1.5	3.0	0.22	0.63	0.17
1963	1.5	3.0	0.22	0.63	0.17
1964	1.5	0.49	0.050	0.29	0.098
1965	0.14	0.49	0.050	0.29	0.098
1966	0.14	0.49	0.050	0.29	0.098
1967	0.14	0.49	0.050	0.29	0.098
1968	0.14	0.49	0.050	0.29	0.098
1969	0.14	1.7	0.016	0.32	0.036
1970	0.14	1.7	0.016	0.32	0.036
1971	0.14	1.7	0.016	0.32	0.036
1972	0.050	1.7	0.016	0.32	0.036
1973	0.050	1.7	0.016	0.32	0.036
1974	0.050	0.632	0.058	0.16	0.014
1975	0.050	0.63	0.058	0.16	0.014
1976	0.050	0.63	0.058	0.16	0.014
1977	0.050	0.63	0.058	0.16	0.014
1978	0.050	0.63	0.058	0.16	0.014
1979	0.343	0.093	0.0040	0.092	0.011
1980	0.343	0.093	0.0040	0.092	0.011
1981	0.343	0.093	0.0040	0.092	0.011
1982	0.343	0.093	0.0040	0.092	0.011
1983	0.343	0.093	0.0040	0.092	0.011
1984	0.343	0.059	0.0057	0.13	0.0055
1985	0.343	0.059	0.0057	0.13	0.0055
1986	0.070	0.059	0.0057	0.13	0.0055
1987	0.070	0.059	0.0057	0.13	0.0055
1988	0.070	0.059	0.0057	0.13	0.0055
1989	0.070	0.12	0.0074	0.074	0.0014
1990	0.070	0.12	0.0074	0.074	0.0014
1991	0.070	0.12	0.0074	0.074	0.0014
1992	0.070	0.12	0.0074	0.074	0.0014
1993	0.070	0.12	0.0074	0.074	0.0014

FIGURE O-2
Comparison of Mercury Concentrations in Y-12 Tree Rings (mg kg^{-1})
vs. Air Emissions from Y-12 (in tens of thousands of pounds per year)



Point One *Years of peak tree ring concentrations do not directly correspond with peak releases*

Figure O-2 shows the mercury concentrations measured in the rings of trees on the Y-12 facility vs. the history of air emissions from Y-12. As shown in Figure O-2, concentrations measured in the trees do not closely correspond with air emissions. Specifically, discrepancies between tree ring concentrations and the airborne mercury emission history at Y-12 include:

- In the first measurement of the East tree, tree ring concentrations were lower in the peak release years (1955 and 1956) than in 1948-1954. Tree ring concentrations in 1945-1949, before significant releases of mercury from Y-12 began in 1950, were higher than for all years after 1957.

- In the second measurement of the East tree, peak tree ring concentrations were lower in the peak release years (1955 and 1956) than in 1953 and 1954. Tree ring concentrations in 1948 and 1949, before significant releases of mercury from Y-12, were higher than for all years after 1958.

- In the West tree, tree ring concentrations in the peak release years (1955 and 1956) were lower than in 1954, 1957-1959 and 1964-1969. Tree ring concentrations in 1948 and 1949, before significant releases of mercury from Y-12, were higher than for all years after 1975.

- The highest tree ring concentrations in the West tree occur in 1964-1967. Decontamination and decommissioning of Building 9201-5 took place in 1965 and 1966. However, an assumption that high concentrations in the West tree in 1964-1967 resulted from Building 9201-5 decontamination and decommissioning is difficult to support because:

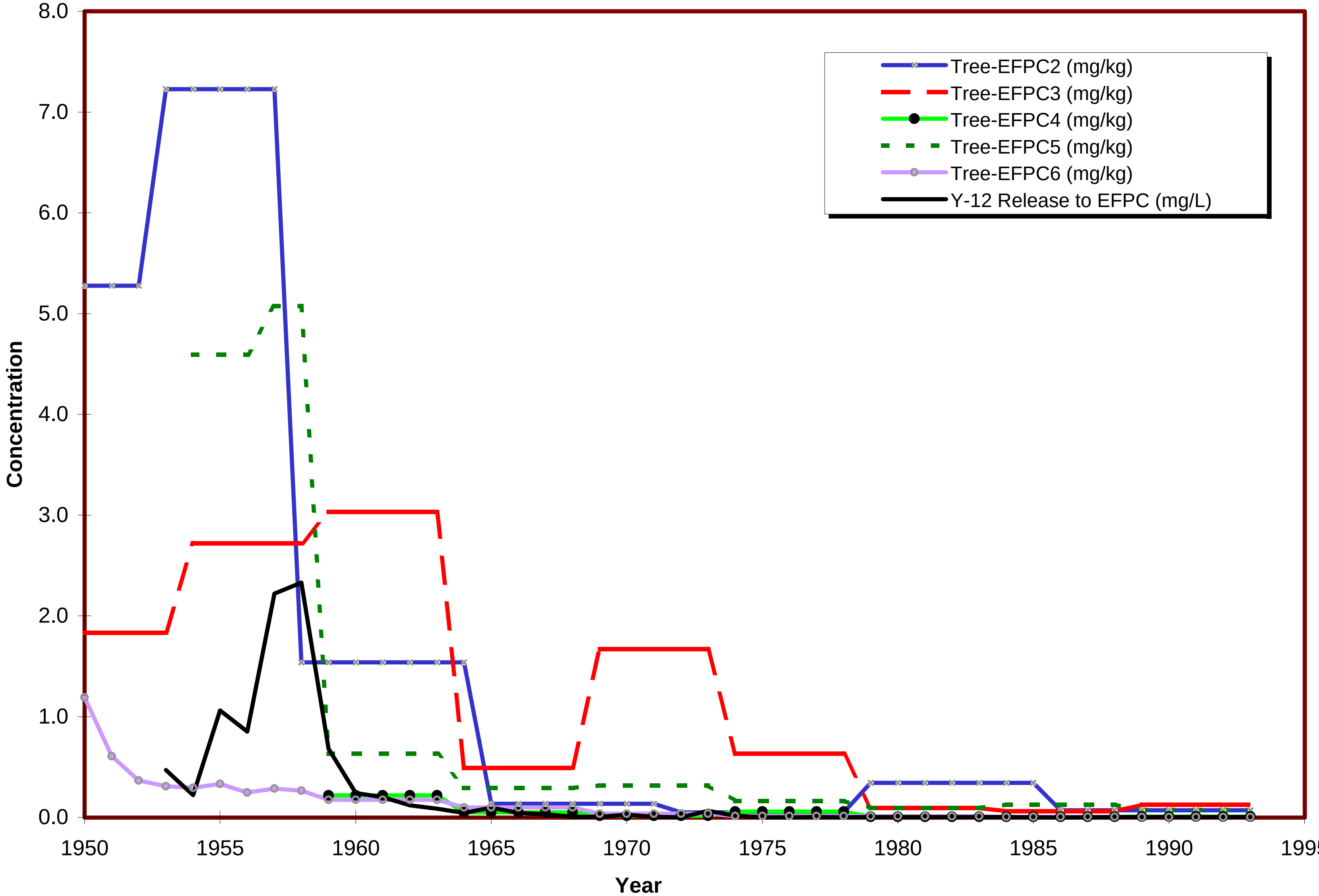
  (1) There is no corresponding peak in the East tree data.

  (2) The higher tree ring concentrations in 1964-1967, as compared to the tree ring concentrations in 1954-1959, require the unlikely additional assumption that mercury emissions from decontamination and decommissioning of Building 9201-5 substantially exceeded peak operational air emissions from Buildings 9201-4 and 9201-5 in 1954-1959.

- Tree ring concentrations in the West tree in 1938, before initiation of the Manhattan Project at Oak Ridge, were higher than in 1986 and all years after 1990, when mercury emissions from the previously contaminated Y-12 site were continuing.

Figure O-3 shows mercury concentrations measured in the rings of trees from the EFPC floodplain vs. concentrations measured in discharges from Y-12 to EFPC. As discussed in Section 6.3 of

Figure O-3: Relationship of Mercury Concentrations Measured in Rings of Trees Along EFPC (mg kg^{-1}) toY-12 Releases to EFPC (mg L^{-1})



the main text, it is assumed that airborne mercury in the floodplain largely arose from volatilization of mercury from EFPC. As shown, concentrations in the trees do not closely correspond with the history of mercury releases to EFPC. Specifically, discrepancies between tree ring concentrations and the releases to EFPC include:

- C Mercury levels in the EFPC-6 tree were higher for 1934-1948 (before significant mercury releases from Oak Ridge) than after 1963. Tree ring data before 1948 are not available for trees EFPC-2 through EFPC-5.

- C Data for trees EFPC-2 and -3 provide averages from 1948-1952 and 1949-1953, respectively. Although only pilot plants were operating before 1953,

  (1) 1948-1952 tree ring concentrations in tree EFPC-2 were higher than for all but one of the six subsequent averaging periods; and

  (2) 1949-1953 tree ring concentrations in tree EFPC-3 were higher than for all but two of the eight subsequent averaging periods.

Point Two *There is no consistent way to shift tree ring peaks to agree with emission peaks.*

Analysis of tree ring records for the EFPC trees does not reveal a consistent way to shift tree ring peaks to secure agreement with the release history. For example, data from tree EFPC-2 would suggest that the tree ring peak must be shifted forward in time to make it coincide with the emission peak, while data from tree EFPC-3 would suggest that the tree ring peak must be shifted backward in time to make it coincide with the emission peak.

The peak emission years 1955 and 1956 correspond in the Y-12 West tree to low tree ring concentrations between higher tree ring concentrations in 1954 and 1957-58. So, the West tree ring record can't be shifted forward or backward to make it coincide with the emission peak. If high tree ring concentrations in the West tree in 1964-1967 are related to decontamination and decommissioning of 9201-5 in 1965 and 1966, any time shift of the tree ring record would destroy that correspondence.

The two samples from the Y-12 East tree conflict. The first sample has a tree ring peak five years before the emission peak and the second sample has a tree ring peak three years before the emission peak.

Point Three *There is no indication of a consistent relation between tree ring mercury concentrations and mercury concentrations in air.*

Trees EFPC-3 through EFPC-6 grew close together in the EFPC floodplain and experienced similar temporal patterns of airborne mercury concentrations. Uptake of mercury from soil through tree roots is negligible, so variations in soil mercury content are not expected to strongly influence mercury in the tree rings. As indicated by the discussion below, the trees appear to have responded quite differently to airborne mercury.

C *Ratios of tree ring concentrations between different trees change from year to year*

If a reliable relation between air concentrations and tree ring concentrations exists for each individual tree, the ratios of tree ring concentrations in trees EFPC-3 through EFPC-6 should remain approximately the same over the years. The ratio of tree ring concentrations in EFPC-3 (the tree with the highest average mercury concentration) to concentrations in the other three trees is as follows:

Years	Fraction of EFPC-3 Concentration		
	EFPC-4	**EFPC-5**	**EFPC-6**
1989-1993	0.06	0.6	0.01
1984-1988	0.1	2.14	0.09
1979-1983	0.04	1	0.12
1974-1978	0.09	0.26	0.02
1969-1973	0.01	0.5	0.06
1964-1968	0.1	0.46	0.16
1959-1963	0.07	0.21	0.06
1954-1958	---	1.77	0.1
1949-1953	---	---	0.4

In addition, trees EFPC-3 and EFPC-5 grew less than 100 feet apart. If there is a consistent relation between airborne mercury concentrations and tree ring concentrations for each tree, tree ring concentrations in EFPC-5 should be consistently higher (or lower) than concentrations in EFPC-3. However, tree ring concentration in EFPC-5 is about twice as high as EFPC-3 for peak release years 1954-1958 and for 1984-1988, the same as EFPC-3 for 1979-1983, but only 20 to 60% of EFPC-3 for all other years.

C *Tree ring concentrations for a given year vary widely in trees growing near each other.*

Average, range, median, quartiles and interquartile ranges (IQ) of tree ring concentrations for trees EFPC-3 through EFPC-6 are as follows:

Year	Average ($mg\ kg^{-1}$)	Range	Median ($mg\ kg^{-1}$)	25%ile ($mg\ kg^{-1}$)	75%ile ($mg\ kg^{-1}$)	IQ range
1989-93	51.4	122.1	40.5	4.4	98.5	94.1
1984-88	40.6	120.9	32.4	5.6	92.5	86.9
1979-83	49.9	88.6	51.5	7.4	92.4	85
1974-78	216.6	618.5	110.2	35.7	397.6	361.9
1969-73	509.3	1654.5	175.4	25.7	992.8	967.1
1964-68	232.4	440.1	194.8	74.1	390.7	316.6
1959-63	1014	2856.8	425.4	196.9	1830.5	1634
1954-58	2605	4537	2721	1499.7	3768	2268

Median and interquartile ranges are given because they are statistically robust measures of central tendency and spread, more resistant to bias by outlying values than the arithmetic average and the range. These data show that tree ring concentrations in trees EFPC-3 through EFPC-6 (growing close together in the floodplain) are not tightly clustered around a central value. In fact:

- In 1959-63, EFPC-3 concentration was 17.5 times EFPC-6 concentration;
- In 1964-68, EFPC-3 concentration was 9.8 times EFPC-4 concentration;
- In 1969-73, EFPC-3 concentration was 104 times EFPC-4 concentration;
- In 1974-78, EFPC-3 concentration was 45.2 times EFPC-6 concentration;
- In 1979-83, EFPC-3 concentration was 23 times EFPC-4 concentration;
- In 1984-88, EFPC-5 concentration was 23 times EFPC-6 concentration; and
- In 1989-93, EFPC-3 concentration was 88 times EFPC-6 concentration.

Data from trees EFPC-3 and EFPC-5 alone are also widely spread:

Year	Average ($mg\ kg^{-1}$)	Range ($mg\ kg^{-1}$)
1989-93	98.5	50
1984-88	92.5	67
1979-83	92.4	0.4
1974-78	397.6	469.5
1969-73	992.8	1355.2
1964-68	390.7	198.8
1959-63	1830.5	2399.1
1954-58	3768	2094

APPENDIX P

CHARACTERIZATION OF MERCURY VOLATILIZATION FROM EAST FORK POPLAR CREEK AND MODELING OF AIR CONCENTRATIONS TO NEAR-FLOODPLAIN RECEPTORS

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APPENDIX P

CHARACTERIZATION OF MERCURY VOLATILIZATION FROM EAST FORK POPLAR CREEK AND MODELING OF AIR CONCENTRATIONS TO NEAR-FLOODPLAIN RECEPTORS

P.1 Introduction

This appendix describes the methodology and results of the air dispersion modeling for volatilization of mercury from EFPC. Specifically, this appendix describes:

- Discussion of the approach used to model air dispersion of mercury volatilized from EFPC;
- Derivation of the differential equation used to characterize volatilization of mercury from EFPC surface water;
- Results of the air dispersion modeling to receptors near the ORR

Emission rate estimates from EFPC were based on the assumption that mercury emissions from EFPC are in the form of vapor.

P.2 Modeling Approach for Estimation Airborne Mercury Concentrations near EFPC

Air dispersion modeling was conducted to estimate ground-level concentrations of airborne mercury at receptors near EFPC. The most recent version of the USEPA-approved Industrial Source Complex Short Term (ISCST3) computer model was used (USEPA 1995, Version 96113). ISCST3 is a Gaussian air dispersion model that calculates ground-level concentrations downwind from an area source from the following double integral in the upwind (x) and crosswind (y) directions:

$$\chi = \frac{Q_A\, K}{2\,\pi\, u_s} \int_x \frac{V\, D}{\sigma_y\, \sigma_z} \left\{ \int_y \exp\left[-0.5\left(\frac{y}{\sigma_y}\right)^2\right] dy \right\} dx \qquad \text{(Equation P-1)}$$

Where:

Q_A	=	Area source emission rate (mass per unit area per unit time)(g s^{-1})
K	=	Units scaling coefficient
V	=	Vertical term
D	=	Decay term as a function of x
σ_y, σ_z	=	Standard deviations of lateral and vertical concentration distributions (m)
u_s	=	Mean wind speed (m s^{-1}) at release height

The dispersion modeling used unit emissions (1 g s^{-1}) from each creek segment. This determines the contribution to annual average airborne concentration at each receptor from a unit release by each segment. The contribution to the annual average air concentration at each receptor from a given segment is then obtained by multiplying the contribution from a unit release at the segment by the estimated emission rate (Q) from that segment for each year of emission. Next, the total annual average airborne concentration at each receptor is calculated by summing the contributions from all segments source to the concentration at the receptor location for each year.

The following assumptions are made in using the Gaussian equation:

- Wind velocity and direction are constant over height and over the averaging period.
- The emission rate is constant.
- The plume reflects completely at the ground (i.e., no deposition).
- No diffusion occurs in, or opposite to, the direction of the plume travel.

Required inputs to the air dispersion model include:

- Location, length, width, and orientation of area sources used to represent EFPC
- Emission rates for each source
- Meteorological data representative of conditions in the EFPC floodplain
- Receptor locations

Each of these inputs is described below.

Location and Characteristics of Area Sources

Volatilization of mercury from EFPC was modeled assuming that the creek is a series of elongated area sources along the creek. A total of 403 area sources (segments) with a maximum length of 100 meters and a width of 15 meters were used. The length of each segment was chosen to approximate the shape of the creek Source parameters necessary to characterize emissions for air dispersion modeling, including length, width, and orientation for each segment are presented in Table P-1.

TABLE P-1: SUMMARY OF EFPC AREA SOURCES

SEGMENT NUMBER	X-UTM	Y-UTM	SEGMENT ORIENTATION						LENGTH OF SEGMENT SIDES	
	(m)	(m)		DEG	MIN	SEC		DECIMAL	Xinit (m)	Yinit (m)
S1	748923.30	3987389.00	S	58	57	25	W	58.96	15.00	100.00
S2	748837.60	3987338.00	S	58	57	25	W	58.96	15.00	100.00
S3	748791.70	3987310.10	S	58	57	25	W	58.96	15.00	53.62
S4	748770.10	3987287.70	S	42	51	15	W	42.85	15.00	31.16
S5	748668.40	3987287.00	S	89	25	14	W	89.42	15.00	101.73
S6	748568.40	3987286.00	S	89	25	14	W	89.42	15.00	100.00
S7	748468.40	3987285.00	S	89	25	14	W	89.42	15.00	100.00
S8	748368.40	3987283.60	S	89	25	14	W	89.42	15.00	100.00
S9	748337.00	3987280.50	S	22	47	47	W	22.80	27.70	15.00
S10	748270.60	3987344.30	S	44	30	44	W	44.51	86.59	15.00
S11	748226.20	3987364.50	S	25	22	30	W	25.38	53.63	15.00
S12	748153.70	3987376.50	S	88	55	20	W	88.92	15.00	78.99
S13	748085.60	3987420.20	S	43	20	50	W	43.35	79.51	15.00
S14	748024.70	3987411.90	S	74	51	15	W	74.85	15.00	73.71
S15	747954.10	3987438.30	S	32	0	34	W	32.01	73.89	15.00
S16	747879.40	3987434.20	S	11	29	46	E	-11.50	84.37	15.00
S17	747828.50	3987432.80	S	1	34	45	E	-1.58	50.90	15.00
S18	747775.10	3987439.90	S	23	45	43	W	23.76	51.72	15.00
S19	747705.60	3987432.50	S	15	40	17	E	-15.67	78.45	15.00
S20	747637.80	3987464.10	S	24	58	57	W	24.98	74.82	15.00
S21	747598.10	3987490.70	S	52	10	11	W	52.17	45.44	15.00
S22	747550.50	3987491.30	S	8	17	2	E	-8.28	60.04	15.00
S23	747450.40	3987493.10	S	9	38	28	W	9.64	99.04	15.00
S24	747376.10	3987567.00	S	46	32	24	W	46.54	100.00	15.00
S25	747307.30	3987639.70	S	36	31	22	W	36.52	95.80	15.00
S26	747256.10	3987664.20	S	26	30	20	W	26.51	61.92	15.00
S27	747230.40	3987685.20	S	40	3	9	W	40.05	29.66	15.00
S28	747167.70	3987696.60	S	0	4	47	E	-0.08	72.39	15.00
S29	747135.30	3987691.00	S	16	30	5	W	16.50	29.30	15.00
S30	747043.70	3987733.40	S	16	30	5	W	16.50	100.00	15.00
S31	746937.90	3987762.40	N	16	35	27	E	16.59	108.66	15.00
S32	746878.30	3987780.00	S	16	35	27	W	16.59	63.92	15.00
S33	746782.50	3987808.60	S	16	35	27	W	16.59	100.00	15.00
S34	746676.70	3987791.00	S	16	12	54	E	-16.22	114.58	15.00
S35	746646.90	3987807.00	N	54	43	46	E	54.73	30.48	15.00
S36	746589.10	3987888.80	S	54	43	46	W	54.73	100.00	15.00
S37	746580.50	3987921.00	S	77	6	23	W	77.11	28.03	15.00
S38	746558.20	3988018.90	S	77	6	23	W	77.11	100.00	15.00
S39	746500.90	3988061.50	S	39	10	47	W	39.18	80.25	15.00
S40	746401.70	3988113.80	S	27	54	19	W	27.91	115.06	15.00
S41	746337.30	3988136.00	S	19	26	11	W	19.44	70.44	15.00
S42	746243.00	3988170.00	S	19	26	11	W	19.44	100.00	15.00
S43	746148.70	3988202.90	S	19	26	11	W	19.44	100.00	15.00
S44	746120.00	3988222.20	N	34	54	47	E	34.91	30.63	15.00
S45	746084.50	3988218.00	S	69	13	44	W	69.23	15.00	47.08
S46	745991.00	3988182.40	S	69	13	44	W	69.23	15.00	100.00
S47	745897.50	3988146.90	S	69	13	44	W	69.23	15.00	100.00
S48	745860.00	3988145.90	S	88	25	14	W	88.42	15.00	37.59

TABLE P-1: SUMMARY OF EFPC AREA SOURCES

SEGMENT NUMBER	X-UTM	Y-UTM	SEGMENT ORIENTATION						LENGTH OF SEGMENT SIDES	
	(m)	(m)		DEG	MIN	SEC		DECIMAL	Xinit (m)	Yinit (m)
S49	745815.50	3988150.10	S	24	58	49	W	24.98	42.12	15.00
S50	745770.50	3988198.70	S	48	19	19	W	48.32	60.33	15.00
S51	745752.10	3988239.30	N	66	36	32	E	66.61	39.82	15.00
S52	745732.80	3988256.80	S	44	31	44	W	44.53	31.70	15.00
S53	745701.00	3988258.80	S	8	39	56	W	8.67	40.45	15.00
S54	745653.00	3988262.00	S	76	45	15	W	76.75	15.00	51.62
S55	745555.70	3988239.00	S	76	45	15	W	76.75	15.00	100.00
S56	745461.80	3988201.30	S	76	45	15	W	76.75	15.00	100.00
S57	745354.50	3988179.00	S	70	12	57	W	70.22	15.00	110.41
S58	745260.40	3988144.70	S	70	12	57	W	70.22	15.00	100.00
S59	745158.70	3988139.50	S	5	32	35	W	5.54	100.70	15.00
S60	745113.40	3988132.20	S	64	30	26	W	64.51	15.00	51.74
S61	745079.40	3988099.50	S	46	8	2	W	46.13	15.00	47.20
S62	745049.00	3988048.90	S	30	56	50	W	30.95	15.00	59.02
S63	745039.00	3988013.70	S	15	55	25	W	15.92	15.00	36.51
S64	745036.30	3987917.80	S	1	38	56	W	1.65	15.00	95.94
S65	745036.30	3987918.80	S	75	27	26	W	75.46	100.00	15.00
S66	745061.40	3987821.00	N	75	27	26	E	75.46	81.14	15.00
S67	745083.70	3987672.70	S	1	34	45	E	-1.58	15.00	69.86
S68	745034.30	3987655.40	S	70	46	27	W	70.77	15.00	52.33
S69	744951.10	3987645.80	S	83	22	33	W	83.38	15.00	83.75
S70	744873.60	3987604.50	S	61	57	24	W	61.96	15.00	87.74
S71	744831.20	3987555.10	S	40	40	36	W	40.68	15.00	65.18
S72	744805.70	3987548.00	S	73	33	39	W	73.56	15.00	26.52
S73	744709.80	3987519.30	S	73	33	39	W	73.56	15.00	100.00
S74	744602.00	3987465.60	S	63	31	42	W	63.53	15.00	120.45
S75	744514.60	3987455.70	S	83	31	10	W	83.52	15.00	87.89
S76	744462.50	3987436.10	S	69	22	32	W	69.38	15.00	55.68
S77	744407.20	3987383.80	S	46	35	47	W	46.60	15.00	76.13
S78	744353.70	3987374.90	S	80	33	51	W	80.56	15.00	54.26
S79	744290.90	3987328.80	S	53	43	45	W	53.73	15.00	77.88
S80	744287.00	3987267.10	S	3	39	15	W	3.65	15.00	61.81
S81	744265.60	3987242.20	S	40	41	36	W	40.69	15.00	32.80
S82	744179.50	3987217.50	S	73	59	44	W	74.00	15.00	89.55
S83	744126.10	3987147.50	S	37	18	55	W	37.32	15.00	88.13
S84	744084.40	3987143.30	S	84	22	12	W	84.37	15.00	41.91
S85	743991.50	3987086.60	S	58	34	34	W	58.58	15.00	108.78
S86	743959.10	3987071.00	S	64	14	40	W	64.24	15.00	36.02
S87	743869.00	3987027.50	S	64	14	40	W	64.24	15.00	100.00
S88	743805.10	3986960.70	S	43	43	28	W	43.72	15.00	92.48
S89	743745.50	3986885.60	S	38	25	53	W	38.43	15.00	95.86
S90	743722.20	3986874.20	S	63	58	9	W	63.97	15.00	25.93
S91	743674.70	3986872.90	S	88	25	55	W	88.43	15.00	47.55
S92	743642.10	3986870.40	S	22	51	19	W	22.86	29.07	15.00
S93	743623.50	3986951.90	S	82	11	6	W	82.19	70.43	15.00
S94	743623.50	3986956.30	N	8	59	22	E	8.99	15.00	73.38
S95	743583.50	3987023.30	S	10	18	51	W	10.31	64.61	15.00
S96	743465.30	3987034.90	S	88	29	50	W	88.50	15.00	120.93

TABLE P-1: SUMMARY OF EFPC AREA SOURCES

SEGMENT NUMBER	X-UTM	Y-UTM	SEGMENT ORIENTATION						LENGTH OF SEGMENT SIDES	
	(m)	(m)		DEG	MIN	SEC		DECIMAL	Xinit (m)	Yinit (m)
S97	743400.10	3987002.10	S	63	22	1	W	63.37	15.00	72.96
S98	743295.80	3986971.70	S	73	44	57	W	73.75	15.00	108.66
S99	743242.10	3986969.30	S	87	24	5	W	87.40	15.00	53.74
S100	743142.20	3986964.80	S	87	24	5	W	87.40	15.00	100.00
S101	743106.80	3986901.90	S	29	23	10	W	29.39	15.00	72.12
S102	743085.20	3986831.20	S	17	0	6	W	17.00	15.00	73.91
S103	743085.20	3986831.00	S	87	32	36	W	87.54	37.23	15.00
S104	743086.80	3986794.00	S	87	32	36	W	87.54	100.00	15.00
S105	743064.80	3986654.60	S	33	38	31	W	33.64	15.00	47.50
S106	743024.00	3986644.30	S	75	53	12	W	75.89	15.00	42.09
S107	742959.20	3986659.90	N	76	30	22	W	-76.51	15.00	66.56
S108	742920.90	3986637.60	S	59	51	53	W	59.86	15.00	44.29
S109	742889.40	3986578.10	S	27	52	28	W	27.87	15.00	67.39
S110	742884.80	3986488.20	S	2	55	36	W	2.93	15.00	89.93
S111	742827.40	3986457.50	S	61	51	21	W	61.86	15.00	65.17
S112	742788.70	3986422.40	S	47	46	20	W	47.77	15.00	52.27
S113	742771.00	3986392.60	S	30	35	51	W	30.60	15.00	34.62
S114	742709.00	3986399.70	S	21	2	51	W	21.05	59.64	15.00
S115	742643.40	3986402.80	S	81	7	30	W	81.13	15.00	72.82
S116	742599.10	3986412.90	S	32	6	51	W	32.11	42.92	15.00
S117	742574.80	3986410.90	S	0	40	6	W	0.67	32.13	15.00
S118	742550.60	3986408.50	S	54	26	18	W	54.44	15.00	29.94
S119	742548.70	3986369.40	S	2	49	11	W	2.82	15.00	39.14
S120	742548.70	3986369.40	S	50	28	21	W	50.47	72.54	15.00
S121	742573.40	3986255.20	S	20	13	15	W	20.22	15.00	62.09
S122	742513.50	3986202.00	S	48	23	51	W	48.40	15.00	80.16
S123	742477.20	3986183.00	S	61	51	34	W	61.86	15.00	41.11
S124	742389.00	3986135.40	S	61	51	34	W	61.86	15.00	100.00
S125	742366.30	3986102.30	S	34	25	43	W	34.43	15.00	40.24
S126	742281.30	3986092.80	S	83	39	43	W	83.66	15.00	85.47
S127	742242.20	3986101.10	S	33	57	46	W	33.96	37.08	15.00
S128	742234.80	3986141.10	S	88	25	15	W	88.42	27.95	15.00
S129	742235.50	3986145.80	N	16	51	41	E	16.86	15.00	30.91
S130	742243.80	3986171.50	S	88	14	10	E	-88.24	93.55	15.00
S131	742159.60	3986295.60	S	25	0	50	W	25.01	105.59	15.00
S132	742132.70	3986322.50	S	46	26	47	W	46.45	32.58	15.00
S133	742112.90	3986324.90	S	13	49	21	W	13.82	27.82	15.00
S134	742037.20	3986258.00	S	44	14	54	W	44.25	15.00	113.70
S135	742029.80	3986229.00	S	14	10	51	W	14.18	15.00	29.94
S136	742029.80	3986229.00	S	52	5	54	W	52.10	42.49	15.00
S137	742033.40	3986162.90	S	34	41	20	W	34.69	15.00	39.62
S138	741968.70	3986126.00	S	60	26	37	W	60.44	15.00	74.40
S139	741881.70	3986077.00	S	60	26	37	W	60.44	15.00	100.00
S140	741794.70	3986027.50	S	60	26	37	W	60.44	15.00	100.00
S141	741759.90	3985998.80	S	50	24	56	W	50.42	15.00	45.13
S142	741710.90	3985982.60	S	71	43	32	W	71.73	15.00	51.61
S143	741661.10	3985936.40	S	47	12	22	W	47.21	15.00	67.95
S144	741657.50	3985886.60	S	4	3	52	W	4.06	15.00	49.97

TABLE P-1: SUMMARY OF EFPC AREA SOURCES

SEGMENT NUMBER	X-UTM	Y-UTM	SEGMENT ORIENTATION						LENGTH OF SEGMENT SIDES	
	(m)	(m)		DEG	MIN	SEC		DECIMAL	Xinit (m)	Yinit (m)
S145	741657.50	3985886.60	N	50	6	29	E	50.11	73.54	15.00
S146	741704.70	3985830.20	S	88	58	28	W	88.97	25.80	15.00
S147	741687.70	3985776.60	S	32	6	23	W	32.11	15.00	32.80
S148	741619.10	3985717.00	S	49	1	36	W	49.03	15.00	90.92
S149	741577.00	3985673.00	S	44	4	39	W	44.08	15.00	60.52
S150	741507.40	3985601.70	S	44	4	39	W	44.08	15.00	100.00
S151	741501.10	3985569.50	S	11	7	57	W	11.13	15.00	32.76
S152	741501.10	3985569.50	S	70	31	13	W	70.52	100.00	15.00
S153	741534.40	3985475.20	S	47	49	52	W	47.83	56.90	15.00
S154	741571.40	3985448.00	N	85	31	20	E	85.52	15.00	100.36
S155	741672.70	3985440.90	S	29	54	13	W	29.90	57.59	15.00
S156	741707.20	3985332.30	S	10	56	56	W	10.95	15.00	81.34
S157	741607.60	3985329.60	S	88	25	16	W	88.42	15.00	99.63
S158	741583.90	3985301.00	S	39	26	21	W	39.44	15.00	37.15
S159	741578.50	3985249.80	S	5	57	34	W	5.96	15.00	51.39
S160	741562.30	3985217.70	S	26	44	9	W	26.74	15.00	36.02
S161	741562.30	3985217.70	S	80	47	54	W	80.80	87.11	15.00
S162	741569.70	3985115.70	S	22	22	17	W	22.37	15.00	17.33
S163	741459.30	3985109.80	N	4	45	48	E	4.76	109.52	15.00
S164	741455.60	3985093.50	S	8	52	2	W	8.87	15.00	31.67
S165	741455.60	3985093.50	S	66	23	24	W	66.39	48.77	15.00
S166	741459.30	3984986.40	S	14	15	3	W	14.25	15.00	64.35
S167	741398.90	3984973.10	S	77	32	19	W	77.54	15.00	61.86
S168	741336.00	3984925.20	S	52	47	9	W	52.79	15.00	79.08
S169	741261.00	3984966.30	S	38	50	58	W	38.85	84.17	15.00
S170	741228.30	3984978.90	S	22	6	54	W	22.12	39.35	15.00
S171	741182.60	3985023.20	S	45	9	50	W	45.16	57.74	15.00
S172	741110.00	3985046.80	S	19	6	23	W	19.11	82.95	15.00
S173	741038.20	3985110.40	S	42	18	5	W	42.30	90.04	15.00
S174	740990.20	3985120.00	S	13	28	40	W	13.48	56.10	15.00
S175	740962.20	3985109.20	S	51	7	6	W	51.12	15.00	40.53
S176	740962.20	3985109.20	N	83	47	20	E	83.79	60.17	15.00
S177	740915.90	3984948.90	S	27	42	47	W	27.71	15.00	113.44
S178	740882.70	3984941.30	S	77	7	21	W	77.12	15.00	34.08
S179	740815.80	3984934.60	S	7	10	11	W	7.17	65.50	15.00
S180	740787.40	3984929.60	S	56	43	28	W	56.72	15.00	36.25
S181	740779.10	3984851.30	S	6	1	59	W	6.03	15.00	78.70
S182	740747.20	3984829.60	S	55	42	3	W	55.70	15.00	38.65
S183	740732.70	3984803.60	S	29	10	42	W	29.18	15.00	29.72
S184	740732.70	3984803.60	N	75	47	49	E	75.80	31.97	15.00
S185	740740.60	3984772.60	N	52	14	41	E	52.24	38.19	15.00
S186	740763.90	3984742.40	N	88	25	14	E	88.42	17.82	15.00
S187	740728.30	3984713.00	S	5	55	11	W	5.92	34.76	15.00
S188	740628.90	3984723.60	S	5	55	11	W	5.92	100.00	15.00
S189	740589.60	3984702.40	S	48	31	40	W	48.53	15.00	54.48
S190	740578.30	3984668.50	S	18	20	10	W	18.34	15.00	35.74
S191	740578.30	3984668.50	S	83	32	19	W	83.54	77.90	15.00
S192	740570.10	3984587.20	S	77	7	41	W	77.13	15.00	17.46

TABLE P-1: SUMMARY OF EFPC AREA SOURCES

SEGMENT NUMBER	X-UTM	Y-UTM	SEGMENT ORIENTATION						LENGTH OF SEGMENT SIDES	
	(m)	(m)		DEG	MIN	SEC		DECIMAL	Xinit (m)	Yinit (m)
S193	740476.50	3984592.50	S	12	27	20	W	12.46	92.57	15.00
S194	740413.20	3984559.80	S	54	31	58	W	54.53	15.00	81.59
S195	740339.50	3984557.80	S	88	25	43	W	88.43	15.00	73.79
S196	740315.60	3984543.30	S	58	45	36	W	58.76	15.00	27.96
S197	740284.70	3984454.70	S	2	30	27	W	2.51	15.00	85.07
S198	740311.90	3984458.30	N	74	4	25	E	74.07	31.84	15.00
S199	740271.90	3984426.40	S	22	25	15	W	22.42	15.00	48.66
S200	740234.70	3984392.90	S	47	59	51	W	48.00	15.00	50.06
S201	740229.40	3984316.60	S	4	1	55	W	4.03	15.00	76.47
S202	740192.20	3984307.30	S	75	58	19	W	75.97	15.00	38.37
S203	740173.60	3984317.80	N	74	22	40	E	74.38	15.09	15.00
S204	740140.70	3984314.00	S	8	47	42	W	8.80	45.61	15.00
S205	740112.80	3984320.10	S	73	54	46	W	73.91	15.00	31.42
S206	740087.90	3984300.30	S	51	35	51	W	51.60	15.00	31.85
S207	740083.40	3984267.00	S	7	40	34	W	7.68	15.00	33.62
S208	740083.40	3984267.00	S	42	46	59	W	42.78	59.82	15.00
S209	740125.90	3984209.40	S	4	45	49	W	4.76	15.00	16.98
S210	740092.80	3984164.50	S	36	18	0	W	36.30	15.00	55.80
S211	740092.10	3984138.20	S	1	31	57	W	1.53	15.00	26.30
S212	740092.10	3984138.20	N	60	43	18	E	60.72	37.91	15.00
S213	740110.70	3984105.10	N	88	26	29	E	88.44	26.05	15.00
S214	740111.40	3984079.10	N	57	59	52	E	58.00	69.17	15.00
S215	740139.70	3983982.50	S	12	27	38	W	12.46	15.00	38.76
S216	740139.20	3983904.20	S	0	20	35	W	0.34	15.00	78.39
S217	740100.50	3983884.00	S	62	17	30	W	62.29	15.00	43.69
S218	740012.00	3983837.30	S	62	17	30	W	62.29	15.00	100.00
S219	739943.90	3983835.50	S	88	25	15	W	88.42	15.00	68.16
S220	739865.10	3983843.70	S	16	51	45	W	16.86	77.71	15.00
S221	739817.20	3983879.70	S	37	53	54	W	37.90	54.54	15.00
S222	739768.00	3983889.10	S	87	35	57	W	87.60	15.00	58.47
S223	739763.30	3983789.00	S	2	42	5	W	2.70	15.00	100.00
S224	739758.70	3983691.80	S	2	42	5	W	2.70	15.00	97.45
S225	739736.20	3983592.90	S	12	48	28	W	12.81	15.00	101.47
S226	739705.50	3983597.71	S	37	12	15	W	37.20	27.75	15.00
S227	739625.40	3983658.20	N	37	12	15	E	37.20	100.00	15.00
S228	739603.33	3983668.83	S	89	37	7	W	89.62	15.00	31.16
S229	739503.40	3983665.00	S	87	37	7	W	87.62	15.00	100.00
S230	739403.50	3983660.50	S	87	37	7	W	87.62	15.00	100.00
S231	739374.90	3983643.40	S	59	8	20	W	59.14	15.00	33.35
S232	739338.60	3983597.60	S	38	19	20	W	38.32	15.00	58.45
S233	739335.70	3983561.90	S	4	43	50	W	4.73	15.00	35.74
S234	739320.50	3983553.80	S	61	50	49	W	61.85	15.00	17.18
S235	739296.80	3983563.20	S	57	27	49	W	57.46	20.66	15.00
S236	739291.90	3983627.70	S	87	30	53	W	87.51	57.17	15.00
S237	739287.60	3983727.60	S	87	30	53	W	87.51	100.00	15.00
S238	739272.30	3983752.90	N	61	48	48	E	61.81	36.10	15.00
S239	739243.78	3983748.39	N	4	35	38	E	4.59	40.70	15.00
S240	739144.10	3983756.00	N	4	35	38	E	4.59	100.00	15.00

TABLE P-1: SUMMARY OF EFPC AREA SOURCES

SEGMENT NUMBER	X-UTM	Y-UTM	SEGMENT ORIENTATION						LENGTH OF SEGMENT SIDES	
	(m)	(m)		DEG	MIN	SEC		DECIMAL	Xinit (m)	Yinit (m)
S241	739044.40	3983764.00	N	4	35	38	E	4.59	100.00	15.00
S242	738944.70	3983772.40	S	4	35	38	W	4.59	100.00	15.00
S243	738941.80	3983737.70	S	4	45	49	W	4.76	15.00	49.84
S244	738941.80	3983737.70	N	75	0	31	E	75.01	43.76	15.00
S245	738953.10	3983695.40	S	85	49	2	W	85.82	52.66	15.00
S246	738938.00	3983613.90	S	33	7	56	W	33.13	15.00	34.70
S247	738859.10	3983594.00	S	75	43	21	W	75.72	15.00	81.38
S248	738762.20	3983569.10	N	75	43	21	E	75.72	15.00	100.00
S249	738738.77	3983566.76	S	84	14	23	W	84.24	15.00	23.57
S250	738639.30	3983556.70	S	84	14	23	W	84.24	15.00	100.00
S251	738639.30	3983556.70	N	88	25	15	E	88.42	97.36	15.00
S252	738641.50	3983474.00	S	88	25	15	W	88.42	15.00	100.00
S253	738741.50	3983477.00	N	88	25	15	E	88.42	15.00	29.42
S254	738769.40	3983477.80	N	82	44	5	E	82.73	15.00	99.85
S255	738870.40	3983475.60	N	36	18	0	E	36.30	50.98	15.00
S256	738910.20	3983406.10	S	1	47	18	W	1.79	15.00	39.32
S257	738910.20	3983406.10	N	81	32	19	E	81.54	102.29	15.00
S258	738890.30	3983272.60	S	47	14	12	W	47.24	15.00	47.63
S259	738872.80	3983270.40	S	82	42	39	W	82.71	15.00	17.64
S260	738845.30	3983294.20	N	65	13	48	E	65.23	33.19	15.00
S261	738827.50	3983300.60	N	28	40	49	E	28.68	27.62	15.00
S262	738795.30	3983303.40	S	75	14	44	W	75.25	15.00	40.76
S263	738696.70	3983293.20	S	2	49	37	W	2.83	98.00	15.00
S264	738655.50	3983283.10	S	59	5	12	W	59.09	15.00	48.80
S265	738601.90	3983220.00	S	40	9	53	W	40.16	15.00	83.15
S266	738537.40	3983143.20	S	40	9	53	W	40.16	15.00	100.00
S267	738502.30	3983136.00	S	78	24	29	W	78.41	15.00	35.85
S268	738477.00	3983149.60	S	59	48	7	W	59.80	24.53	15.00
S269	738473.30	3983218.30	N	88	25	48	E	88.43	61.59	15.00
S270	738440.10	3983231.90	N	32	42	50	E	32.71	47.62	15.00
S271	738391.90	3983232.60	N	3	12	14	E	3.20	55.46	15.00
S272	738292.10	3983238.10	N	3	12	14	E	3.20	100.00	15.00
S273	738192.30	3983243.80	N	3	12	14	E	3.20	100.00	15.00
S274	738150.50	3983222.70	S	49	48	52	W	49.81	15.00	55.82
S275	738139.30	3983172.70	S	12	36	7	W	12.60	15.00	51.32
S276	738139.30	3983172.70	S	72	19	16	W	72.32	45.30	15.00
S277	738153.00	3983129.50	N	86	38	14	E	86.64	78.04	15.00
S278	738107.80	3982965.70	S	30	7	35	W	30.13	15.00	99.26
S279	738107.80	3982966.00	S	77	46	8	W	77.77	100.00	15.00
S280	738129.00	3982868.00	S	77	46	8	W	77.77	32.18	15.00
S281	738135.80	3982836.60	S	60	59	25	W	60.99	54.36	15.00
S282	738159.00	3982748.50	S	4	25	26	W	4.42	15.00	40.63
S283	738136.70	3982743.80	S	78	7	56	W	78.13	15.00	22.78
S284	738077.70	3982793.30	N	51	13	2	E	51.22	75.52	15.00
S285	738046.80	3982803.40	N	21	33	51	E	21.56	39.87	15.00
S286	738014.30	3982803.60	S	70	7	46	W	70.13	15.00	40.45
S287	737988.80	3982758.90	S	29	41	55	W	29.70	15.00	51.43
S288	737988.90	3982722.20	S	0	4	32	W	0.08	15.00	36.71

TABLE P-1: SUMMARY OF EFPC AREA SOURCES

SEGMENT NUMBER	X-UTM	Y-UTM	SEGMENT ORIENTATION						LENGTH OF SEGMENT SIDES	
	(m)	(m)		DEG	MIN	SEC		DECIMAL	Xinit (m)	Yinit (m)
S289	737988.90	3982722.20	S	44	6	15	W	44.10	32.75	15.00
S290	738012.40	3982699.40	S	5	34	26	W	5.57	54.66	15.00
S291	738045.00	3982645.50	S	24	9	5	W	24.15	15.00	53.32
S292	737992.70	3982643.50	S	14	28	10	W	14.47	50.15	15.00
S293	737930.40	3982649.50	S	5	39	19	W	5.66	64.88	15.00
S294	737835.60	3982701.40	S	29	23	1	W	29.38	102.08	15.00
S295	737785.70	3982714.00	S	89	30	4	W	89.50	15.00	57.20
S296	737728.60	3982656.90	S	44	59	6	W	44.99	15.00	80.78
S297	737708.10	3982616.40	S	26	54	16	W	26.90	15.00	45.36
S298	737700.80	3982517.00	S	4	9	50	W	4.16	15.00	100.00
S299	737698.30	3982482.10	S	4	9	50	W	4.16	15.00	34.65
S300	737685.20	3982441.40	S	17	51	12	W	17.85	15.00	42.73
S301	737663.70	3982423.20	S	49	45	49	W	49.76	15.00	28.25
S302	737621.00	3982416.80	S	81	32	55	W	81.55	15.00	43.17
S303	737566.10	3982452.80	N	46	27	17	E	46.45	63.90	15.00
S304	737524.70	3982455.50	N	8	10	43	E	8.18	50.63	15.00
S305	737491.60	3982442.70	S	51	55	17	W	51.92	15.00	44.75
S306	737472.50	3982357.60	S	12	38	48	W	12.65	15.00	87.28
S307	737421.90	3982314.10	S	49	18	24	W	49.31	15.00	66.70
S308	737421.90	3982314.10	S	89	0	56	W	89.02	44.80	15.00
S309	737422.70	3982269.30	S	42	30	48	W	42.51	42.02	15.00
S310	737387.10	3982166.00	S	41	41	12	W	41.69	15.00	100.00
S311	737350.40	3982125.00	S	41	14	12	W	41.24	15.00	55.26
S312	737269.80	3982119.00	S	85	47	54	W	85.80	15.00	80.79
S313	737236.50	3982096.80	S	56	14	32	W	56.24	15.00	40.04
S314	737236.50	3982096.80	N	89	33	25	E	89.56	69.21	15.00
S315	737237.10	3982027.60	S	57	55	5	W	57.92	107.58	15.00
S316	737294.20	3981936.40	S	73	34	40	W	73.58	16.29	15.00
S317	737259.30	3981880.70	S	44	32	24	W	44.54	15.00	56.31
S318	737202.90	3981899.90	N	33	23	30	E	33.39	57.73	15.00
S319	737130.00	3981840.60	S	48	27	52	W	48.46	15.00	108.36
S320	737130.00	3981840.60	S	81	34	25	W	81.57	100.00	15.00
S321	737144.60	3981742.00	S	81	34	25	W	81.57	33.92	15.00
S322	737139.20	3981662.60	S	12	52	28	W	12.87	15.00	46.72
S323	737096.50	3981602.10	S	35	13	30	W	35.23	15.00	74.07
S324	737061.70	3981586.80	S	89	33	41	W	89.56	15.00	34.93
S325	737018.70	3981566.70	S	50	37	31	W	50.63	15.00	55.40
S326	736977.20	3981552.80	S	71	33	54	W	71.57	15.00	43.77
S327	736948.20	3981536.40	S	60	35	19	W	60.59	15.00	33.37
S328	736940.90	3981475.50	S	6	49	16	W	6.82	15.00	61.38
S329	736898.90	3981366.20	S	21	0	31	W	21.01	15.00	117.03
S330	736898.90	3981366.20	N	89	22	46	E	89.38	34.21	15.00
S331	736884.70	3981293.60	S	20	47	15	W	20.79	15.00	41.10
S332	736861.20	3981286.30	S	72	40	25	W	72.67	15.00	24.62
S333	736792.60	3981281.60	N	8	43	17	E	8.72	67.07	15.00
S334	736763.40	3981284.70	S	69	29	34	W	69.49	15.00	33.64
S335	736684.70	3981319.80	S	34	4	24	W	34.07	84.86	15.00
S336	736657.30	3981370.20	S	63	25	12	W	63.42	50.04	15.00

TABLE P-1: SUMMARY OF EFPC AREA SOURCES

SEGMENT NUMBER	X-UTM	Y-UTM	SEGMENT ORIENTATION						LENGTH OF SEGMENT SIDES	
	(m)	(m)		DEG	MIN	SEC		DECIMAL	Xinit (m)	Yinit (m)
S337	736650.70	3981449.70	S	86	6	1	W	86.10	73.90	15.00
S338	736592.90	3981501.50	S	44	38	55	W	44.65	87.48	15.00
S339	736568.80	3981599.00	S	77	28	20	W	77.47	92.26	15.00
S340	736562.50	3981638.10	N	80	57	12	E	80.95	38.69	15.00
S341	736436.50	3981642.70	S	7	3	12	W	7.05	140.07	15.00
S342	736363.00	3981647.30	S	82	13	25	W	82.22	15.00	76.05
S343	736289.10	3981597.30	S	55	54	11	W	55.90	15.00	89.23
S344	736234.40	3981584.40	S	76	46	22	W	76.77	15.00	56.21
S345	736186.60	3981584.60	S	18	25	45	W	18.43	45.38	15.00
S346	736125.80	3981628.00	S	36	3	18	W	36.06	70.19	15.00
S347	736044.90	3981686.80	S	36	3	18	W	36.06	100.00	15.00
S348	736023.00	3981685.40	N	2	44	6	E	2.74	30.11	15.00
S349	735974.00	3981655.60	S	47	55	11	W	47.92	15.00	66.90
S350	735973.60	3981556.00	S	0	15	3	W	0.25	15.00	100.00
S351	735973.40	3981521.90	S	0	15	3	W	0.25	15.00	33.70
S352	735973.40	3981521.90	S	74	49	25	W	74.82	72.09	15.00
S353	735992.30	3981452.30	N	85	35	5	E	85.58	64.30	15.00
S354	735988.40	3981367.50	S	23	14	26	W	23.24	15.00	22.54
S355	735958.50	3981340.70	S	48	10	28	W	48.17	15.00	40.12
S356	735900.50	3981326.00	S	75	23	10	W	75.39	15.00	59.87
S357	735803.80	3981300.40	S	75	23	10	W	75.39	15.00	100.00
S358	735735.40	3981300.00	S	89	25	29	W	89.42	15.00	68.41
S359	735635.40	3981293.70	S	89	25	29	E	-89.42	15.00	100.00
S360	735635.40	3981298.70	S	86	43	31	W	86.73	100.00	15.00
S361	735641.10	3981199.00	S	86	43	31	W	86.73	40.22	15.00
S362	735643.40	3981158.70	N	72	35	8	E	72.59	61.23	15.00
S363	735661.70	3981100.30	S	63	20	40	W	63.34	109.77	15.00
S364	735711.00	3981002.20	S	59	22	48	W	59.38	100.00	15.00
S365	735761.90	3980916.00	S	59	22	48	W	59.38	70.48	15.00
S366	735797.80	3980855.50	N	52	47	9	E	52.79	103.06	15.00
S367	735860.10	3980773.40	S	70	5	6	W	70.09	25.46	15.00
S368	735868.80	3980749.40	S	82	1	50	W	82.03	87.68	15.00
S369	735853.10	3980605.50	S	25	58	3	W	25.97	15.00	63.56
S370	735810.80	3980590.00	S	69	48	38	W	69.81	15.00	45.11
S371	735716.90	3980555.00	S	69	48	38	W	69.81	15.00	100.00
S372	735623.10	3980521.00	S	69	48	38	W	69.81	15.00	100.00
S373	735529.20	3980486.40	S	69	48	38	W	69.81	15.00	100.00
S374	735433.10	3980483.00	S	87	53	17	W	87.89	15.00	96.17
S375	735333.20	3980479.00	S	87	53	17	W	87.89	15.00	100.00
S376	735233.20	3980475.40	S	87	53	17	W	87.89	15.00	100.00
S377	735151.59	3980453.47	S	74	56	44	W	74.95	15.00	84.55
S378	735055.00	3980427.50	S	74	56	44	W	74.95	15.00	100.00
S379	734974.80	3980391.10	S	65	36	9	W	65.60	15.00	88.09
S380	734882.90	3980362.50	S	72	41	38	W	72.69	15.00	96.27
S381	734819.00	3980358.20	S	86	13	0	W	86.22	15.00	64.07
S382	734773.00	3980358.50	S	19	5	22	W	19.09	42.43	15.00
S383	734751.50	3980375.00	S	39	1	59	W	39.03	23.01	15.00
S384	734711.10	3980460.30	S	65	36	13	W	65.60	87.71	15.00

TABLE P-1: SUMMARY OF EFPC AREA SOURCES

SEGMENT NUMBER	X-UTM	Y-UTM	SEGMENT ORIENTATION						LENGTH OF SEGMENT SIDES	
	(m)	(m)		DEG	MIN	SEC		DECIMAL	Xinit (m)	Yinit (m)
S385	734696.40	3980524.00	S	77	15	5	W	77.25	62.39	15.00
S386	734696.20	3980530.00	S	9	17	15	W	9.29	15.00	43.93
S387	734703.30	3980573.00	S	9	17	15	W	9.29	15.00	100.00
S388	734719.40	3980671.80	S	9	17	15	W	9.29	15.00	100.00
S389	734692.80	3980766.40	N	13	28	13	E	13.47	55.54	15.00
S390	734657.80	3980756.20	S	57	12	31	W	57.21	15.00	45.81
S391	734610.00	3980668.00	S	28	31	41	W	28.53	15.00	100.00
S392	734588.00	3980627.80	S	28	31	41	W	28.53	15.00	46.15
S393	734554.20	3980587.90	S	40	15	24	W	40.26	15.00	52.31
S394	734529.40	3980584.70	S	82	37	23	W	82.62	15.00	25.06
S395	734478.80	3980587.90	S	20	53	28	W	20.89	48.43	15.00
S396	734436.00	3980635.10	S	49	26	7	W	49.44	56.45	15.00
S397	734424.80	3980666.20	N	71	14	41	E	71.24	27.27	15.00
S398	734381.10	3980707.10	N	44	42	5	E	44.70	66.74	15.00
S399	734354.50	3980703.70	N	1	33	40	E	1.56	36.74	15.00
S400	734326.50	3980701.70	S	59	1	46	W	59.03	15.00	33.21
S401	734287.80	3980649.90	S	36	48	16	W	36.80	15.00	64.60
S402	734287.80	3980649.90	S	87	12	42	W	87.21	60.46	15.00
S403	734290.70	3980589.50	S	60	58	3	W	60.97	44.97	15.00

Estimation of Emission Rates

Emissions of mercury vapor from each segment of EFPC were estimated based on:

- Annual releases of mercury from Y-12 to EFPC, and
- An assumption about the fraction *f* of the total mercury released from Y-12 that volatilized as the water traveled from Y-12 to the junction between EFPC and Poplar Creek.

The change in mass *M* of mercury entering a segment of EPFC with respect to distance *l* along the direction of travel within the box can be approximated from the solution to the differential equation:

$$\frac{dM}{dl} = -k\ M \qquad \text{(Equation P-2)}$$

where *k* is the mercury loss coefficient due to volatilization from EFPC. Integrating Equation P-1:

$$M(i) = M_{0,i}\ e^{-k\ l} \qquad \text{(Equation P-3)}$$

where $M_{0,i}$ is the intial mass of mercury entering segment *i* and M_i is the mass of mercury at distance *l* within the segment.

If a fraction *f* of the mercury in the original discharge M_0 is lost to air as the water flows from Y-12 to the junction with Poplar Creek, a total length *L* of 23,200 meters, the mass of mercury per meter of EFPC (*M(L)*) at the junction is:

$$M(L) = (1 - f)\ M_0 \qquad \text{(Equation P-4)}$$

Combining Equations P-3 and P-4 gives:

$$(1 - f)\ M_0 = M_0\ e^{-k\ L} \qquad \text{(Equation P-5)}$$

Solving for *k* gives:

$$k = -\frac{\ln\ (1-f)}{L} \qquad \text{(Equation P-6)}$$

and the mass of mercury M_i at distance l within the segment can be rewritten as:

$$M_i = M_{0,i} \; e^{\frac{\ln(1-f)}{L} l_i} \qquad \text{(Equation P-7)}$$

The total annual mass lost or emitted from each segment i, in g yr^{-1}, can then be calculated as follows:

$$M_{emitted,i} = M_{0,i} - M_i \qquad \text{(Equation P-8)}$$

The emission rate $M_{emission,i}$ is then converted to an annual average emission rate Q_i from each segment in g s^{-1}.

Three values of the mercury loss fraction f (0.01, 0.05, 0.3) were modeled. Emission rates are specified in Table P-2 for each of the 403 EFPC segments for calendar year 1957, the year of peak waterborne releases from the Y-12 Plant. Similar tables for other years (1950-1956 and 1958-1993) are available upon request.

Meteorological Data

EFPC is in a valley between two ridges– Blackoak Ridge to the northwest and East Fork Ridge to the southeast. Since the EFPC floodplain is generally flat, ISCST3 can be used to model air dispersion near the creek. The two ridges create a wind pattern that is mainly in the northeast-southwest direction. During the years of greatest air emissions of mercury (i.e., 1950s and early 1960s), hourly meteorological data for the EFPC floodplain are not available. Monthly average data from the Oak Ridge town center station (Station 886) were compared to hourly average data collected from 1987-1992 at the Y-12 MTE station. Based on this comparison, meteorological data from the Y-12 MTE station for the year 1987 were used to provide hourly wind speed, wind direction, temperature, stability class, and mixing height information to model releases from EFPC.

Receptor Locations

Receptor locations modeled near EFPC include the Scarboro Community, Robertsville School, the EFPC farm family, the community receptors, and the locations of trees in the EFPC floodplain analyzed for mercury content in their tree rings. Figure 1-2 and Figure O-1 in Appendix O show the location of each receptor.

Table P-3 presents a summary of the discrete receptors and their corresponding Universal Transverse Mercator (UTM) coordinates.

TABLE P-2: Data From Calculations of Mercury Evasion from EFPC Segments

EFPC Release Estimate Procedure

Assumptions

[1] Loss of mercury from stream is a function distance traveled along the creek
[2] Loss from narrow fast-moving sections of the creek is equal to loss from wide slow-moving sections
[3] Calculated mercury emissions from the stream are modeled as line source using the ISCST3 air dispersion model and the 1987 meteorological data

Mo	=	Initial mass of Hg released to stream starting at Y-12		
l	=	Distance from discharge point at Y-12		
lambda	=	volatilization constant		
dM/dl	=	-lambda * M		
M(l)	=	Mo * exp (-lambda * l)		
Mo	=	72,211	lb	(based on mercury loss estimates from the Y-12 plant for the year 1957)
	=	32754500.3	g	

		CASE 1			CASE 2			CASE 3		
Initial Mass (Mo) (g) =		32754500.3			32754500.3			32754500.3		
Total Length (m) =		26003.49			26003.49			26003.49		
Fraction Removed (f) =		0.01			0.05			0.3		
lamda (1/m) =		1.97E-06			4.05E-06			8.85E-05		
Sources	**Source Length (m)**	**Mass Left (g)**	**Mass Lost (g)**	**Emission (g/s)**	**Mass Left (g)**	**Mass Lost (g)**	**Emission (g/s)**	**Mass Left (g)**	**Mass Lost (g)**	**Emission (g/s)**
Release Point		32754500.3	0.0	0.0	32754500.3	0.0	0.0	32754500.3	0.0	0.0
S1	100.00	32753234.4	1265.9	4.01E-05	32748039.9	6460.4	2.05E-04	32709603.6	44896.7	1.42E-03
S2	100.00	32751968.5	1265.9	4.01E-05	32741580.8	6459.1	2.05E-04	32664768.5	44835.1	1.42E-03
S3	53.62	32751289.7	678.7	2.15E-05	32738118.0	3462.8	1.10E-04	32640753.2	24015.3	7.62E-04
S4	31.16	32750895.3	394.4	1.25E-05	32736105.8	2012.2	6.38E-05	32626805.4	13947.8	4.42E-04
S5	101.73	32749607.6	1287.7	4.08E-05	32729537.4	6568.4	2.08E-04	32581310.6	45494.8	1.44E-03
S6	100.00	32748341.9	1265.7	4.01E-05	32723082.0	6455.4	2.05E-04	32536651.4	44659.3	1.42E-03
S7	100.00	32747076.2	1265.7	4.01E-05	32716627.8	6454.2	2.05E-04	32492053.3	44598.1	1.41E-03
S8	100.00	32745810.5	1265.6	4.01E-05	32710174.9	6452.9	2.05E-04	32447516.4	44536.9	1.41E-03
S9	27.70	32745459.9	350.6	1.11E-05	32708387.7	1787.2	5.67E-05	32435190.4	12325.9	3.91E-04
S10	86.59	32744364.1	1095.9	3.47E-05	32702801.4	5586.2	1.77E-04	32396689.9	38500.6	1.22E-03
S11	53.63	32743685.3	678.7	2.15E-05	32699342.1	3459.4	1.10E-04	32372867.2	23822.6	7.55E-04
S12	78.99	32742685.7	999.6	3.17E-05	32694247.5	5094.6	1.62E-04	32337811.5	35055.7	1.11E-03
S13	79.51	32741679.5	1006.2	3.19E-05	32689120.2	5127.3	1.63E-04	32302563.3	35248.2	1.12E-03
S14	73.71	32740746.8	932.8	2.96E-05	32684367.7	4752.6	1.51E-04	32269920.7	32642.6	1.04E-03
S15	73.89	32739811.8	935.0	2.96E-05	32679604.2	4763.5	1.51E-04	32237231.5	32689.2	1.04E-03
S16	84.37	32738744.2	1067.6	3.39E-05	32674166.0	5438.2	1.72E-04	32199946.4	37285.1	1.18E-03
S17	50.90	32738100.1	644.1	2.04E-05	32670885.5	3280.4	1.04E-04	32177473.3	22473.1	7.13E-04
S18	51.72	32737445.7	654.4	2.08E-05	32667552.6	3332.9	1.06E-04	32154654.3	22819.0	7.24E-04
S19	78.45	32736453.1	992.6	3.15E-05	32662497.8	5054.8	1.60E-04	32120072.8	34581.5	1.10E-03
S20	74.82	32735506.4	946.7	3.00E-05	32657677.6	4820.2	1.53E-04	32087126.0	32946.7	1.04E-03
S21	45.44	32734931.5	574.9	1.82E-05	32654750.5	2927.1	9.28E-05	32067133.2	19992.9	6.34E-04
S22	60.04	32734171.9	759.6	2.41E-05	32650883.4	3867.1	1.23E-04	32040735.7	26397.5	8.37E-04
S23	99.04	32732918.9	1253.0	3.97E-05	32644505.3	6378.1	2.02E-04	31997238.7	43497.0	1.38E-03
S24	100.00	32731653.8	1265.1	4.01E-05	32638066.6	6438.7	2.04E-04	31953380.0	43858.7	1.39E-03
S25	95.80	32730441.9	1211.9	3.84E-05	32631899.6	6167.1	1.96E-04	31911419.8	41960.2	1.33E-03
S26	61.92	32729658.6	783.3	2.48E-05	32627914.1	3985.4	1.26E-04	31884328.2	27091.5	8.59E-04
S27	29.66	32729283.4	375.2	1.19E-05	32626005.2	1908.9	6.05E-05	31871359.4	12968.8	4.11E-04
S28	72.39	32728367.7	915.7	2.90E-05	32621346.8	4658.4	1.48E-04	31839729.0	31630.4	1.00E-03
S29	29.30	32727997.0	370.6	1.18E-05	32619461.5	1885.3	5.98E-05	31826935.5	12793.5	4.06E-04
S30	100.00	32726732.1	1264.9	4.01E-05	32613027.8	6433.7	2.04E-04	31783310.2	43625.3	1.38E-03
S31	108.66	32725357.7	1374.4	4.36E-05	32606038.3	6989.5	2.22E-04	31735974.8	47335.4	1.50E-03
S32	63.92	32724549.2	808.5	2.56E-05	32601927.4	4110.9	1.30E-04	31708162.3	27812.4	8.82E-04
S33	100.00	32723284.5	1264.8	4.01E-05	32595497.1	6430.3	2.04E-04	31664699.9	43462.5	1.38E-03
S34	114.58	32721835.3	1449.1	4.60E-05	32588130.9	7366.2	2.34E-04	31614973.8	49726.0	1.58E-03
S35	30.48	32721449.9	385.5	1.22E-05	32586171.6	1959.3	6.21E-05	31601759.1	13214.7	4.19E-04
S36	100.00	32720185.2	1264.7	4.01E-05	32579744.5	6427.2	2.04E-04	31558442.5	43316.6	1.37E-03
S37	28.03	32719830.7	354.5	1.12E-05	32577943.2	1801.3	5.71E-05	31546311.5	12131.0	3.85E-04
S38	100.00	32718566.1	1264.6	4.01E-05	32571517.6	6425.5	2.04E-04	31503070.9	43240.6	1.37E-03
S39	80.25	32717551.3	1014.8	3.22E-05	32566362.0	5155.6	1.63E-04	31468413.2	34657.7	1.10E-03
S40	115.06	32716096.4	1454.9	4.61E-05	32558971.5	7390.5	2.34E-04	31418788.6	49624.7	1.57E-03
S41	70.44	32715205.7	890.7	2.82E-05	32554447.9	4523.6	1.43E-04	31388446.9	30341.7	9.62E-04
S42	100.00	32713941.3	1264.4	4.01E-05	32548027.0	6420.9	2.04E-04	31345422.6	43024.2	1.36E-03

TABLE P-2: Data From Calculations of Mercury Evasion from EFPC Segments

		CASE 1			CASE 2			CASE 3		
S43 Initial Mass (Mo) (g) =	100.00	32712676.9	32754500.3 1264.4	4.01E-05	32541607.3	32754500.3 6419.6	2.04E-04	31302457.4	32754500.3 42905.2	1.36E-03
S44	30.63	32712289.7	387.3	1.23E-05	32539641.3	1966.1	6.23E-05	31289308.9	13148.5	4.17E-04
S45	47.08	32711694.4	595.2	1.89E-05	32536619.5	3021.7	9.58E-05	31269109.8	20199.2	6.41E-04
S46	100.00	32710430.1	1264.3	4.01E-05	32530202.1	6417.4	2.03E-04	31226249.1	42860.6	1.36E-03
S47	100.00	32709165.9	1264.2	4.01E-05	32523786.0	6416.1	2.03E-04	31183447.2	42801.9	1.36E-03
S48	37.59	32708690.7	475.2	1.51E-05	32521374.5	2411.5	7.65E-05	31167373.2	16074.1	5.10E-04
S49	42.12	32708158.2	532.5	1.69E-05	32518672.6	2701.9	8.57E-05	31149371.9	18001.3	5.71E-04
S50	60.33	32707395.6	762.7	2.42E-05	32514803.0	3869.6	1.23E-04	31123606.1	25765.8	8.17E-04
S51	39.82	32706892.2	503.4	1.60E-05	32512249.1	2553.8	8.10E-05	31106611.4	16994.7	5.39E-04
S52	31.70	32706491.5	400.7	1.27E-05	32510216.2	2032.9	6.45E-05	31093088.8	13522.5	4.29E-04
S53	40.45	32705980.1	511.3	1.62E-05	32507622.3	2593.9	8.23E-05	31075842.2	17246.6	5.47E-04
S54	51.62	32705327.6	652.5	2.07E-05	32504312.5	3309.9	1.05E-04	31053847.0	21995.2	6.97E-04
S55	100.00	32704063.6	1264.0	4.01E-05	32497901.5	6411.0	2.03E-04	31011281.5	42565.6	1.35E-03
S56	100.00	32702799.6	1264.0	4.01E-05	32491491.7	6409.8	2.03E-04	30968774.2	42507.2	1.35E-03
S57	110.41	32701404.1	1395.5	4.43E-05	32484416.2	7075.5	2.24E-04	30921909.7	46864.6	1.49E-03
S58	100.00	32700140.2	1263.9	4.01E-05	32478009.1	6407.1	2.03E-04	30879524.9	42384.7	1.34E-03
S59	100.70	32698867.5	1272.7	4.04E-05	32471558.4	6450.7	2.05E-04	30836902.2	42622.7	1.35E-03
S60	51.74	32698213.6	653.9	2.07E-05	32468244.5	3313.9	1.05E-04	30815025.4	21876.8	6.94E-04
S61	47.20	32697617.1	596.5	1.89E-05	32465221.7	3022.8	9.59E-05	30795081.7	19943.7	6.32E-04
S62	59.02	32696871.3	745.9	2.37E-05	32461442.3	3779.4	1.20E-04	30770161.9	24919.9	7.90E-04
S63	36.51	32696409.9	461.4	1.46E-05	32459104.6	2337.7	7.41E-05	30754756.4	15405.4	4.89E-04
S64	95.94	32695197.5	1212.4	3.84E-05	32452962.4	6142.2	1.95E-04	30714311.2	40445.2	1.28E-03
S65	100.00	32693933.9	1263.6	4.01E-05	32446561.5	6400.9	2.03E-04	30672211.0	42100.2	1.33E-03
S66	81.14	32692908.6	1025.3	3.25E-05	32441368.8	5192.8	1.65E-04	30638093.4	34117.7	1.08E-03
S67	69.86	32692025.8	882.7	2.80E-05	32436898.6	4470.2	1.42E-04	30608749.1	29344.3	9.31E-04
S68	52.33	32691364.6	661.2	2.10E-05	32433550.5	3348.1	1.06E-04	30586786.6	21962.5	6.96E-04
S69	83.75	32690306.5	1058.2	3.36E-05	32428192.8	5357.6	1.70E-04	30551670.2	35116.4	1.11E-03
S70	87.74	32689197.9	1108.6	3.52E-05	32422580.9	5611.9	1.78E-04	30514924.0	36746.2	1.17E-03
S71	65.18	32688374.4	823.5	2.61E-05	32418412.6	4168.3	1.32E-04	30487654.7	27269.3	8.65E-04
S72	26.52	32688039.4	335.1	1.06E-05	32416716.8	1695.8	5.38E-05	30476566.6	11088.2	3.52E-04
S73	100.00	32686776.0	1263.4	4.01E-05	32410323.0	6393.7	2.03E-04	30434792.3	41774.3	1.32E-03
S74	120.45	32685254.3	1521.7	4.83E-05	32402623.4	7699.6	2.44E-04	30384551.1	50241.1	1.59E-03
S75	87.89	32684144.0	1110.3	3.52E-05	32397006.3	5617.1	1.78E-04	30347943.5	36607.6	1.16E-03
S76	55.68	32683440.7	703.4	2.23E-05	32393448.3	3558.0	1.13E-04	30324774.7	23168.8	7.35E-04
S77	76.13	32682479.0	961.7	3.05E-05	32388584.1	4864.2	1.54E-04	30293125.2	31649.6	1.00E-03
S78	54.26	32681793.6	685.4	2.17E-05	32385117.7	3466.4	1.10E-04	30270587.8	22537.4	7.15E-04
S79	77.88	32680809.9	983.7	3.12E-05	32380143.0	4974.7	1.58E-04	30238269.0	32318.8	1.02E-03
S80	61.81	32680029.2	780.7	2.48E-05	32376195.4	3947.7	1.25E-04	30212643.4	25625.5	8.13E-04
S81	32.80	32679614.9	414.3	1.31E-05	32374100.7	2094.7	6.64E-05	30199053.9	13589.6	4.31E-04
S82	89.55	32678483.8	1131.1	3.59E-05	32368382.6	5718.1	1.81E-04	30161983.0	37070.9	1.18E-03
S83	88.13	32677370.7	1113.1	3.53E-05	32362756.1	5626.5	1.78E-04	30125544.3	36438.6	1.16E-03
S84	41.91	32676841.4	529.3	1.68E-05	32360080.8	2675.3	8.48E-05	30108231.5	17312.9	5.49E-04
S85	108.78	32675467.6	1373.8	4.36E-05	32353137.9	6942.9	2.20E-04	30063341.3	44890.2	1.42E-03
S86	36.02	32675012.7	454.9	1.44E-05	32350839.2	2298.7	7.29E-05	30048491.7	14849.6	4.71E-04
S87	100.00	32673749.9	1262.9	4.00E-05	32344458.5	6380.7	2.02E-04	30007304.2	41187.5	1.31E-03
S88	92.48	32672582.0	1167.9	3.70E-05	32338558.7	5899.8	1.87E-04	29969264.2	38040.0	1.21E-03
S89	95.86	32671371.5	1210.5	3.84E-05	32332444.4	6114.3	1.94E-04	29929884.8	39379.4	1.25E-03
S90	25.93	32671044.1	327.4	1.04E-05	32330790.7	1653.7	5.24E-05	29919241.6	10643.2	3.37E-04
S91	47.55	32670443.7	600.4	1.90E-05	32327758.4	3032.3	9.62E-05	29899734.2	19507.4	6.19E-04
S92	29.07	32670076.6	367.1	1.16E-05	32325904.7	1853.7	5.88E-05	29887814.4	11919.7	3.78E-04
S93	70.43	32669187.3	889.3	2.82E-05	32321414.1	4490.6	1.42E-04	29858955.3	28859.1	9.15E-04
S94	73.38	32668260.8	926.5	2.94E-05	32316736.0	4678.1	1.48E-04	29828917.0	30038.3	9.53E-04
S95	64.61	32667445.0	815.8	2.59E-05	32312617.6	4118.4	1.31E-04	29802493.8	26423.2	8.38E-04
S96	120.93	32665918.2	1526.8	4.84E-05	32304910.6	7707.0	2.44E-04	29753100.6	49393.2	1.57E-03
S97	72.96	32664997.0	921.1	2.92E-05	32300261.7	4648.9	1.47E-04	29723340.0	29760.5	9.44E-04
S98	108.66	32663625.2	1371.8	4.35E-05	32293339.3	6922.4	2.20E-04	29679072.6	44267.5	1.40E-03
S99	53.74	32662946.8	678.4	2.15E-05	32289916.2	3423.1	1.09E-04	29657203.6	21869.0	6.93E-04
S100	100.00	32661684.4	1262.4	4.00E-05	32283547.5	6368.7	2.02E-04	29616552.4	40651.2	1.29E-03
S101	72.12	32660774.0	910.4	2.89E-05	32278955.2	4592.4	1.46E-04	29587269.3	29283.1	9.29E-04
S102	73.91	32659841.0	933.0	2.96E-05	32274249.5	4705.7	1.49E-04	29557289.5	29979.8	9.51E-04
S103	37.23	32659371.1	470.0	1.49E-05	32271879.4	2370.1	7.52E-05	29542199.6	15089.9	4.78E-04
S104	100.00	32658108.8	1262.3	4.00E-05	32265514.2	6365.2	2.02E-04	29501706.0	40493.6	1.28E-03
S105	47.50	32657509.2	599.6	1.90E-05	32262491.2	3023.0	9.59E-05	29482491.0	19215.0	6.09E-04
S106	42.09	32656978.0	531.3	1.68E-05	32259812.8	2678.5	8.49E-05	29465475.0	17016.0	5.40E-04
S107	66.56	32656137.9	840.1	2.66E-05	32255577.5	4235.2	1.34E-04	29438586.3	26888.7	8.53E-04
S108	44.29	32655578.9	559.0	1.77E-05	32252759.7	2817.9	8.94E-05	29420707.8	17878.5	5.67E-04
S109	67.39	32654728.3	850.5	2.70E-05	32248472.6	4287.1	1.36E-04	29393525.3	27182.5	8.62E-04
S110	89.93	32653593.3	1135.0	3.60E-05	32242752.5	5720.1	1.81E-04	29357290.2	36235.1	1.15E-03
S111	65.17	32652770.9	822.5	2.61E-05	32238607.9	4144.6	1.31E-04	29331059.5	26230.7	8.32E-04

TABLE P-2: Data From Calculations of Mercury Evasion from EFPC Segments

		CASE 1			CASE 2			CASE 3		
Initial Mass (Mo) (g) =			32754500.3			32754500.3			32754500.3	
S112	52.27	32652111.2	[illegible]	2.09E-05	32235284.1	[illegible]	1.05E-04	29310037.9	[illegible]	6.67E-04
S113	34.62	32651674.3	436.9	1.39E-05	32233082.8	2201.3	6.98E-05	29296122.9	13914.9	4.41E-04
S114	59.64	32650921.7	752.6	2.39E-05	32229291.0	3791.8	1.20E-04	29272167.1	23955.8	7.60E-04
S115	72.82	32650002.7	918.9	2.91E-05	32224661.9	4629.1	1.47E-04	29242943.8	29223.3	9.27E-04
S116	42.92	32649461.1	541.6	1.72E-05	32221933.8	2728.1	8.65E-05	29225733.3	17210.5	5.46E-04
S117	32.13	32649055.7	405.4	1.29E-05	32219891.7	2042.1	6.48E-05	29212856.1	12877.2	4.08E-04
S118	29.94	32648677.9	377.8	1.20E-05	32217988.9	1902.8	6.03E-05	29200861.7	11994.4	3.80E-04
S119	39.14	32648184.0	493.9	1.57E-05	32215501.6	2487.3	7.89E-05	29185189.1	15672.6	4.97E-04
S120	72.54	32647268.6	915.3	2.90E-05	32210892.3	4609.4	1.46E-04	29156164.6	29024.5	9.20E-04
S121	62.09	32646485.2	783.5	2.48E-05	32206947.4	3944.8	1.25E-04	29131344.2	24820.4	7.87E-04
S122	80.16	32645473.8	1011.4	3.21E-05	32201855.3	5092.2	1.61E-04	29099331.7	32012.6	1.02E-03
S123	41.11	32644955.1	518.7	1.64E-05	32199244.1	2611.2	8.28E-05	29082927.7	16404.0	5.20E-04
S124	100.00	32643693.4	1261.7	4.00E-05	32192893.2	6350.8	2.01E-04	29043063.7	39864.0	1.26E-03
S125	40.24	32643185.7	507.7	1.61E-05	32190338.0	2555.2	8.10E-05	29027037.8	16025.9	5.08E-04
S126	85.47	32642107.3	1078.3	3.42E-05	32184911.4	5426.6	1.72E-04	28993028.1	34009.7	1.08E-03
S127	37.08	32641639.5	467.8	1.48E-05	32182557.4	2354.0	7.46E-05	28978285.8	14742.3	4.67E-04
S128	27.95	32641286.9	352.6	1.12E-05	32180783.1	1774.3	5.63E-05	28967178.4	11107.4	3.52E-04
S129	30.91	32640897.0	390.0	1.24E-05	32178821.0	1962.1	6.22E-05	28954899.7	12278.7	3.89E-04
S130	93.55	32639716.8	1180.2	3.74E-05	32172883.5	5937.5	1.88E-04	28917769.4	37130.3	1.18E-03
S131	105.59	32638384.8	1332.0	4.22E-05	32166183.2	6700.3	2.12E-04	28875917.6	41851.8	1.33E-03
S132	32.58	32637973.8	411.0	1.30E-05	32164116.1	2067.1	6.55E-05	28863016.4	12901.2	4.09E-04
S133	27.82	32637622.9	350.9	1.11E-05	32162351.1	1765.0	5.60E-05	28852004.6	11011.8	3.49E-04
S134	113.70	32636188.6	1434.2	4.55E-05	32155138.5	7212.5	2.29E-04	28807043.3	44961.3	1.43E-03
S135	29.94	32635811.0	377.7	1.20E-05	32153239.6	1899.0	6.02E-05	28795215.6	11827.8	3.75E-04
S136	42.49	32635275.0	536.0	1.70E-05	32150544.8	2694.8	8.55E-05	28778438.3	16777.3	5.32E-04
S137	39.62	32634775.3	499.7	1.58E-05	32148032.3	2512.6	7.97E-05	28762803.1	15635.2	4.96E-04
S138	74.40	32633836.9	938.4	2.98E-05	32143314.6	4717.6	1.50E-04	28733465.5	29337.5	9.30E-04
S139	100.00	32632575.6	1261.3	4.00E-05	32136974.8	6339.8	2.01E-04	28694080.5	39385.0	1.25E-03
S140	100.00	32631314.4	1261.2	4.00E-05	32130636.2	6338.6	2.01E-04	28654749.5	39331.0	1.25E-03
S141	45.13	32630745.2	569.2	1.80E-05	32127776.0	2860.2	9.07E-05	28637017.0	17732.4	5.62E-04
S142	51.61	32630094.3	650.9	2.06E-05	32124505.5	3270.6	1.04E-04	28616751.9	20265.1	6.43E-04
S143	67.95	32629237.4	856.9	2.72E-05	32120200.0	4305.5	1.37E-04	28590092.6	26659.3	8.45E-04
S144	49.97	32628607.2	630.2	2.00E-05	32117034.1	3165.9	1.00E-04	28570503.4	19589.2	6.21E-04
S145	73.54	32627679.8	927.4	2.94E-05	32112375.5	4658.6	1.48E-04	28541698.7	28804.7	9.13E-04
S146	25.80	32627354.4	325.4	1.03E-05	32110741.3	1634.2	5.18E-05	28531600.1	10098.7	3.20E-04
S147	32.80	32626940.8	413.6	1.31E-05	32108663.8	2077.5	6.59E-05	28518766.6	12833.4	4.07E-04
S148	90.92	32625794.3	1146.5	3.64E-05	32102905.8	5758.0	1.83E-04	28483223.1	35543.5	1.13E-03
S149	60.52	32625031.2	763.1	2.42E-05	32099073.6	3832.2	1.22E-04	28459588.5	23634.6	7.49E-04
S150	100.00	32623770.2	1260.9	4.00E-05	32092742.5	6331.1	2.01E-04	28420578.8	39009.6	1.24E-03
S151	32.76	32623357.2	413.1	1.31E-05	32090668.7	2073.8	6.58E-05	28407810.9	12767.9	4.05E-04
S152	100.00	32622096.3	1260.9	4.00E-05	32084339.3	6329.4	2.01E-04	28368872.3	38938.7	1.23E-03
S153	56.90	32621378.9	717.4	2.27E-05	32080738.4	3600.9	1.14E-04	28346740.0	22132.3	7.02E-04
S154	100.36	32620113.6	1265.3	4.01E-05	32074388.1	6350.3	2.01E-04	28307745.3	38994.7	1.24E-03
S155	57.59	32619387.5	726.1	2.30E-05	32070744.7	3643.4	1.16E-04	28285393.0	22352.3	7.09E-04
S156	81.34	32618362.0	1025.5	3.25E-05	32065599.4	5145.3	1.63E-04	28253852.8	31540.2	1.00E-03
S157	99.63	32617106.0	1256.0	3.98E-05	32059298.3	6301.1	2.00E-04	28215268.3	38584.4	1.22E-03
S158	37.15	32616637.7	468.3	1.49E-05	32056949.1	2349.2	7.45E-05	28200894.5	14373.9	4.56E-04
S159	51.39	32615989.9	647.8	2.05E-05	32053699.7	3249.4	1.03E-04	28181023.0	19871.4	6.30E-04
S160	36.02	32615535.8	454.1	1.44E-05	32051422.3	2277.4	7.22E-05	28167103.2	13919.8	4.41E-04
S161	87.11	32614437.7	1098.1	3.48E-05	32045915.4	5506.9	1.75E-04	28133468.2	33635.0	1.07E-03
S162	17.33	32614219.3	218.5	6.93E-06	32044819.9	1095.5	3.47E-05	28126781.5	6686.7	2.12E-04
S163	109.52	32612838.7	1380.5	4.38E-05	32037897.9	6922.0	2.19E-04	28084560.5	42221.0	1.34E-03
S164	31.67	32612439.6	399.2	1.27E-05	32035896.5	2001.4	6.35E-05	28072363.2	12197.3	3.87E-04
S165	48.77	32611824.8	614.7	1.95E-05	32032814.8	3081.8	9.77E-05	28053590.5	18772.7	5.95E-04
S166	64.35	32611013.7	811.1	2.57E-05	32028749.0	4065.8	1.29E-04	28028839.9	24750.6	7.85E-04
S167	61.86	32610234.1	779.7	2.47E-05	32024841.0	3908.0	1.24E-04	28005067.5	23772.3	7.54E-04
S168	79.08	32609237.4	996.7	3.16E-05	32019845.9	4995.2	1.58E-04	27974707.1	30360.5	9.63E-04
S169	84.17	32608176.5	1060.8	3.36E-05	32014530.1	5315.8	1.69E-04	27942428.6	32278.5	1.02E-03
S170	39.35	32607680.6	495.9	1.57E-05	32012045.2	2484.9	7.88E-05	27927351.0	15077.6	4.78E-04
S171	57.74	32606952.9	727.7	2.31E-05	32008399.4	3645.8	1.16E-04	27905241.6	22109.3	7.01E-04
S172	82.95	32605907.6	1045.4	3.31E-05	32003162.5	5236.9	1.66E-04	27873509.7	31731.9	1.01E-03
S173	90.04	32604772.9	1134.7	3.60E-05	31997478.9	5683.5	1.80E-04	27839106.4	34403.3	1.09E-03
S174	56.10	32604065.9	706.9	2.24E-05	31993938.3	3540.7	1.12E-04	27817692.7	21413.7	6.79E-04
S175	40.53	32603555.2	510.7	1.62E-05	31991380.6	2557.7	8.11E-05	27802232.4	15460.3	4.90E-04
S176	60.17	32602797.0	758.2	2.40E-05	31987583.8	3796.8	1.20E-04	27779296.2	22936.2	7.27E-04
S177	113.44	32601367.6	1429.4	4.53E-05	31980426.8	7157.0	2.27E-04	27736105.5	43190.7	1.37E-03
S178	34.08	32600938.2	429.4	1.36E-05	31978277.0	2149.8	6.82E-05	27723143.1	12962.4	4.11E-04
S179	65.50	32600112.9	825.3	2.62E-05	31974145.6	4131.4	1.31E-04	27698247.1	24896.0	7.89E-04
S180	36.25	32599656.1	456.7	1.45E-05	31971859.4	2286.2	7.25E-05	27684478.4	13768.7	4.37E-04

TABLE P-2: Data From Calculations of Mercury Evasion from EFPC Segments

		CASE 1			CASE 2			CASE 3		
S181 / Initial Mass (Mo) (g) =	78.70	32598664.5	[illegible]	3.14E-05	31966896.5	[illegible]	1.57E-04	27654609.6	[illegible]	9.47E-04
S182	38.65	32598177.6	487.0	1.54E-05	31964459.4	2437.0	7.73E-05	27639952.7	14656.9	4.65E-04
S183	29.72	32597803.1	374.4	1.19E-05	31962585.6	1873.8	5.94E-05	27628687.5	11265.2	3.57E-04
S184	31.97	32597400.3	402.8	1.28E-05	31960570.0	2015.6	6.39E-05	27616574.6	12112.9	3.84E-04
S185	38.19	32596919.2	481.1	1.53E-05	31958162.4	2407.6	7.63E-05	27602112.0	14462.6	4.59E-04
S186	17.82	32596694.7	224.5	7.12E-06	31957039.1	1123.3	3.56E-05	27595366.1	6745.9	2.14E-04
S187	34.76	32596256.8	437.9	1.39E-05	31954848.0	2191.1	6.95E-05	27582212.2	13153.9	4.17E-04
S188	100.00	32594996.9	1259.8	3.99E-05	31948545.4	6302.6	2.00E-04	27544405.2	37807.0	1.20E-03
S189	54.48	32594310.6	686.3	2.18E-05	31945112.2	3433.2	1.09E-04	27523829.8	20575.4	6.52E-04
S190	35.74	32593860.4	450.2	1.43E-05	31942860.2	2252.0	7.14E-05	27510340.2	13489.6	4.28E-04
S191	77.90	32592879.0	981.3	3.11E-05	31937952.2	4908.0	1.56E-04	27480960.9	29379.4	9.32E-04
S192	17.46	32592659.1	219.9	6.97E-06	31936852.2	1099.9	3.49E-05	27474380.3	6580.6	2.09E-04
S193	92.57	32591493.0	1166.1	3.70E-05	31931021.1	5831.1	1.85E-04	27439517.4	34862.9	1.11E-03
S194	81.59	32590465.3	1027.7	3.26E-05	31925882.5	5138.6	1.63E-04	27408826.4	30691.0	9.73E-04
S195	73.79	32589535.8	929.5	2.95E-05	31921235.9	4646.6	1.47E-04	27381099.0	27727.4	8.79E-04
S196	27.96	32589183.6	352.2	1.12E-05	31919475.4	1760.5	5.58E-05	27370600.0	10498.9	3.33E-04
S197	85.07	32588112.1	1071.5	3.40E-05	31914119.6	5355.8	1.70E-04	27338681.1	31918.9	1.01E-03
S198	31.84	32587711.1	401.0	1.27E-05	31912115.2	2004.3	6.36E-05	27326744.0	11937.0	3.79E-04
S199	48.66	32587098.2	612.9	1.94E-05	31909052.3	3062.9	9.71E-05	27308511.1	18232.9	5.78E-04
S200	50.06	32586467.7	630.5	2.00E-05	31905901.6	3150.7	9.99E-05	27289766.3	18744.8	5.94E-04
S201	76.47	32585504.6	963.1	3.05E-05	31901089.2	4812.4	1.53E-04	27261157.2	28609.1	9.07E-04
S202	38.37	32585021.4	483.2	1.53E-05	31898674.8	2414.4	7.66E-05	27246813.5	14343.8	4.55E-04
S203	15.09	32584831.3	190.0	6.03E-06	31897725.3	949.5	3.01E-05	27241174.5	5639.0	1.79E-04
S204	45.61	32584256.9	574.4	1.82E-05	31894855.7	2869.7	9.10E-05	27224137.6	17036.9	5.40E-04
S205	31.42	32583861.2	395.7	1.25E-05	31892879.0	1976.7	6.27E-05	27212407.3	11730.3	3.72E-04
S206	31.85	32583460.1	401.1	1.27E-05	31890875.4	2003.6	6.35E-05	27200521.7	11885.6	3.77E-04
S207	33.62	32583036.7	423.4	1.34E-05	31888760.5	2114.8	6.71E-05	27187981.1	12540.5	3.98E-04
S208	59.82	32582283.4	753.3	2.39E-05	31884997.9	3762.6	1.19E-04	27165682.1	22299.0	7.07E-04
S209	16.98	32582069.6	213.8	6.78E-06	31883930.0	1067.9	3.39E-05	27159355.8	6326.3	2.01E-04
S210	55.80	32581366.9	702.7	2.23E-05	31880420.8	3509.2	1.11E-04	27138576.6	20779.2	6.59E-04
S211	26.30	32581035.7	331.2	1.05E-05	31878766.9	1653.9	5.24E-05	27128788.4	9788.3	3.10E-04
S212	37.91	32580558.3	477.4	1.51E-05	31876383.1	2383.8	7.56E-05	27114685.4	14103.0	4.47E-04
S213	26.05	32580230.3	328.0	1.04E-05	31874745.2	1637.9	5.19E-05	27104998.7	9686.7	3.07E-04
S214	69.17	32579359.3	871.0	2.76E-05	31870396.4	4348.7	1.38E-04	27079294.6	25704.1	8.15E-04
S215	38.76	32578871.3	488.1	1.55E-05	31867959.8	2436.6	7.73E-05	27064901.7	14392.8	4.56E-04
S216	78.39	32577884.2	987.0	3.13E-05	31863032.5	4927.3	1.56E-04	27035816.4	29085.4	9.22E-04
S217	43.69	32577334.1	550.1	1.74E-05	31860286.7	2745.9	8.71E-05	27019619.4	16196.9	5.14E-04
S218	100.00	32576075.0	1259.1	3.99E-05	31854002.7	6284.0	1.99E-04	26982583.6	37035.9	1.17E-03
S219	68.16	32575216.8	858.2	2.72E-05	31849720.2	4282.5	1.36E-04	26957369.0	25214.5	8.00E-04
S220	77.71	32574238.5	978.4	3.10E-05	31844838.4	4881.8	1.55E-04	26928650.4	28718.6	9.11E-04
S221	54.54	32573551.8	686.6	2.18E-05	31841412.6	3425.8	1.09E-04	26908512.8	20137.6	6.39E-04
S222	58.47	32572815.7	736.1	2.33E-05	31837740.4	3672.2	1.16E-04	26886940.8	21572.0	6.84E-04
S223	100.00	32571556.8	1258.9	3.99E-05	31831460.9	6279.5	1.99E-04	26850086.8	36854.0	1.17E-03
S224	97.45	32570330.0	1226.8	3.89E-05	31825342.6	6118.2	1.94E-04	26814221.2	35865.6	1.14E-03
S225	101.47	32569052.7	1277.3	4.05E-05	31818973.3	6369.4	2.02E-04	26776927.0	37294.2	1.18E-03
S226	27.75	32568703.4	349.3	1.11E-05	31817231.6	1741.7	5.52E-05	26766736.8	10190.2	3.23E-04
S227	100.00	32567444.6	1258.8	3.99E-05	31810956.1	6275.5	1.99E-04	26730047.6	36689.2	1.16E-03
S228	31.16	32567052.4	392.2	1.24E-05	31809000.9	1955.2	6.20E-05	26718625.5	11422.1	3.62E-04
S229	100.00	32565793.7	1258.7	3.99E-05	31802727.0	6273.9	1.99E-04	26682002.2	36623.3	1.16E-03
S230	100.00	32564535.1	1258.6	3.99E-05	31796454.4	6272.6	1.99E-04	26645429.1	36573.1	1.16E-03
S231	33.35	32564115.3	419.7	1.33E-05	31794362.7	2091.7	6.63E-05	26633243.2	12186.0	3.86E-04
S232	58.45	32563379.7	735.6	2.33E-05	31790697.2	3665.5	1.16E-04	26611899.2	21344.0	6.77E-04
S233	35.74	32562929.9	449.8	1.43E-05	31788456.1	2241.1	7.11E-05	26598856.5	13042.6	4.14E-04
S234	17.18	32562713.7	216.2	6.86E-06	31787378.8	1077.2	3.42E-05	26592589.3	6267.2	1.99E-04
S235	20.66	32562453.7	260.0	8.25E-06	31786083.4	1295.4	4.11E-05	26585054.5	7534.8	2.39E-04
S236	57.17	32561734.2	719.5	2.28E-05	31782499.1	3584.3	1.14E-04	26564215.6	20839.0	6.61E-04
S237	100.00	32560475.7	1258.5	3.99E-05	31776230.4	6268.7	1.99E-04	26527803.9	36411.6	1.15E-03
S238	36.10	32560021.4	454.3	1.44E-05	31773967.7	2262.7	7.17E-05	26514671.6	13132.3	4.16E-04
S239	40.70	32559509.2	512.2	1.62E-05	31771416.9	2550.8	8.09E-05	26499873.7	14797.9	4.69E-04
S240	100.00	32558250.8	1258.4	3.99E-05	31765150.5	6266.5	1.99E-04	26463550.2	36323.4	1.15E-03
S241	100.00	32556992.4	1258.4	3.99E-05	31758885.2	6265.2	1.99E-04	26427276.6	36273.6	1.15E-03
S242	100.00	32555734.1	1258.3	3.99E-05	31752621.2	6264.0	1.99E-04	26391052.7	36223.9	1.15E-03
S243	49.84	32555107.0	627.1	1.99E-05	31749499.7	3121.5	9.90E-05	26373017.2	18035.5	5.72E-04
S244	43.76	32554556.4	550.6	1.75E-05	31746759.3	2740.5	8.69E-05	26357192.1	15825.1	5.02E-04
S245	52.66	32553893.8	662.6	2.10E-05	31743461.7	3297.5	1.05E-04	26338160.9	19031.1	6.03E-04
S246	34.70	32553457.2	436.6	1.38E-05	31741289.0	2172.7	6.89E-05	26325628.0	12532.9	3.97E-04
S247	81.38	32552433.3	1023.9	3.25E-05	31736194.1	5094.9	1.62E-04	26296258.6	29369.4	9.31E-04
S248	100.00	32551175.2	1258.1	3.99E-05	31729934.6	6259.5	1.98E-04	26260214.3	36044.3	1.14E-03
S249	23.57	32550878.7	296.5	9.40E-06	31728459.4	1475.2	4.68E-05	26251725.8	8488.5	2.69E-04

TABLE P-2: Data From Calculations of Mercury Evasion from EFPC Segments

		CASE 1			CASE 2			CASE 3		
S250 / Initial Mass (Mo) (g) =		100.00	32549620.6 / 32754500.3	1258.1	3.99E-05	31722201.4 / 32754500.3	6298.0	1.98E-04	26215742.5 / 32754500.3	35983.3	1.14E-03
S251	97.36	32548395.8	1224.8	3.88E-05	31716109.8	6091.6	1.93E-04	26180756.6	34986.0	1.11E-03
S252	100.00	32547137.8	1258.0	3.99E-05	31709854.3	6255.6	1.98E-04	26144870.5	35886.0	1.14E-03
S253	29.42	32546767.8	370.1	1.17E-05	31708014.1	1840.2	5.84E-05	26134322.2	10548.3	3.34E-04
S254	99.85	32545511.7	1256.0	3.98E-05	31701769.6	6244.6	1.98E-04	26098553.6	35768.7	1.13E-03
S255	50.98	32544870.5	641.3	2.03E-05	31698581.8	3187.8	1.01E-04	26080310.2	18243.4	5.78E-04
S256	39.32	32544375.9	494.6	1.57E-05	31696123.3	2458.5	7.80E-05	26066248.1	14062.1	4.46E-04
S257	102.29	32543089.3	1286.6	4.08E-05	31689728.5	6394.8	2.03E-04	26029701.4	36546.7	1.16E-03
S258	47.63	32542490.2	599.1	1.90E-05	31686751.3	2977.2	9.44E-05	26012701.4	17000.0	5.39E-04
S259	17.64	32542268.3	221.9	7.04E-06	31685648.8	1102.5	3.50E-05	26006408.2	6293.2	2.00E-04
S260	33.19	32541850.9	417.4	1.32E-05	31683574.4	2074.4	6.58E-05	25994571.5	11836.7	3.75E-04
S261	27.62	32541503.5	347.4	1.10E-05	31681848.3	1726.1	5.47E-05	25984725.4	9846.1	3.12E-04
S262	40.76	32540990.8	512.6	1.63E-05	31679301.1	2547.2	8.08E-05	25970201.9	14523.5	4.61E-04
S263	98.00	32539758.3	1232.5	3.91E-05	31673177.8	6123.3	1.94E-04	25935315.9	34885.9	1.11E-03
S264	48.80	32539144.6	613.7	1.95E-05	31670129.0	3048.7	9.67E-05	25917961.6	17354.3	5.50E-04
S265	83.15	32538098.9	1045.7	3.32E-05	31664935.0	5194.0	1.65E-04	25888418.5	29543.1	9.37E-04
S266	100.00	32536841.3	1257.6	3.99E-05	31658689.5	6245.5	1.98E-04	25852933.2	35485.3	1.13E-03
S267	35.85	32536390.5	450.8	1.43E-05	31656450.8	2238.7	7.10E-05	25840223.5	12709.6	4.03E-04
S268	24.53	32536082.0	308.5	9.78E-06	31654919.1	1531.7	4.86E-05	25831530.7	8692.8	2.76E-04
S269	61.59	32535307.5	774.5	2.46E-05	31651073.6	3845.5	1.22E-04	25809717.6	21813.1	6.92E-04
S270	47.62	32534708.7	598.8	1.90E-05	31648100.7	2972.9	9.43E-05	25792864.8	16852.8	5.34E-04
S271	55.46	32534011.3	697.4	2.21E-05	31644638.6	3462.0	1.10E-04	25773251.3	19613.5	6.22E-04
S272	100.00	32532753.9	1257.4	3.99E-05	31638397.2	6241.5	1.98E-04	25737923.8	35327.5	1.12E-03
S273	100.00	32531496.5	1257.4	3.99E-05	31632156.9	6240.2	1.98E-04	25702644.8	35279.0	1.12E-03
S274	55.82	32530794.7	701.8	2.23E-05	31628674.2	3482.8	1.10E-04	25682973.1	19671.7	6.24E-04
S275	51.32	32530149.5	645.2	2.05E-05	31625472.5	3201.7	1.02E-04	25664900.5	18072.6	5.73E-04
S276	45.30	32529579.9	569.5	1.81E-05	31622646.7	2825.8	8.96E-05	25648958.5	15942.0	5.06E-04
S277	78.04	32528598.7	981.2	3.11E-05	31617779.1	4867.6	1.54E-04	25621517.7	27440.7	8.70E-04
S278	99.26	32527350.8	1247.9	3.96E-05	31611589.1	6190.0	1.96E-04	25586658.0	34859.8	1.11E-03
S279	100.00	32526093.7	1257.2	3.99E-05	31605354.2	6234.9	1.98E-04	25551586.3	35071.7	1.11E-03
S280	32.18	32525689.1	404.5	1.28E-05	31603348.0	2006.1	6.36E-05	25540310.4	11275.8	3.58E-04
S281	54.36	32525005.8	683.4	2.17E-05	31599959.4	3388.6	1.07E-04	25521274.0	19036.4	6.04E-04
S282	40.63	32524495.0	510.8	1.62E-05	31597427.0	2532.5	8.03E-05	25507055.0	14219.0	4.51E-04
S283	22.78	32524208.7	286.4	9.08E-06	31596007.2	1419.8	4.50E-05	25499086.4	7968.7	2.53E-04
S284	75.52	32523259.4	949.3	3.01E-05	31591300.8	4706.4	1.49E-04	25472686.4	26399.9	8.37E-04
S285	39.87	32522758.2	501.2	1.59E-05	31588816.3	2484.4	7.88E-05	25458759.9	13926.5	4.42E-04
S286	40.45	32522249.7	508.5	1.61E-05	31586296.0	2520.4	7.99E-05	25444638.5	14121.4	4.48E-04
S287	51.43	32521603.3	646.5	2.05E-05	31583091.8	3204.2	1.02E-04	25426695.3	17943.2	5.69E-04
S288	36.71	32521141.8	461.4	1.46E-05	31580804.8	2286.9	7.25E-05	25413895.4	12799.9	4.06E-04
S289	32.75	32520730.2	411.6	1.31E-05	31578764.7	2040.1	6.47E-05	25402481.7	11413.7	3.62E-04
S290	54.66	32520043.2	687.0	2.18E-05	31575360.1	3404.6	1.08E-04	25383443.6	19038.1	6.04E-04
S291	53.32	32519373.0	670.2	2.13E-05	31572039.3	3320.8	1.05E-04	25364886.0	18557.6	5.88E-04
S292	50.15	32518742.7	630.3	2.00E-05	31568916.2	3123.1	9.90E-05	25347444.0	17442.0	5.53E-04
S293	64.88	32517927.3	815.4	2.59E-05	31564876.3	4039.9	1.28E-04	25324896.8	22547.2	7.15E-04
S294	102.08	32516644.3	1282.9	4.07E-05	31558521.1	6355.2	2.02E-04	25289462.4	35434.4	1.12E-03
S295	57.20	32515925.5	718.9	2.28E-05	31554960.6	3560.6	1.13E-04	25269628.6	19833.8	6.29E-04
S296	80.78	32514910.3	1015.2	3.22E-05	31549932.9	5027.7	1.59E-04	25241645.0	27983.6	8.87E-04
S297	45.36	32514340.2	570.0	1.81E-05	31547110.1	2822.8	8.95E-05	25225945.1	15699.9	4.98E-04
S298	100.00	32513083.6	1256.7	3.98E-05	31540887.9	6222.2	1.97E-04	25191367.9	34577.3	1.10E-03
S299	34.65	32512648.2	435.4	1.38E-05	31538732.1	2155.7	6.84E-05	25179397.9	11970.0	3.80E-04
S300	42.73	32512111.2	536.9	1.70E-05	31536073.9	2658.2	8.43E-05	25164644.5	14753.4	4.68E-04
S301	28.25	32511756.2	355.0	1.13E-05	31534316.7	1757.3	5.57E-05	25154895.4	9749.1	3.09E-04
S302	43.17	32511213.8	542.5	1.72E-05	31531631.5	2685.2	8.51E-05	25140004.6	14890.8	4.72E-04
S303	63.90	32510410.9	802.9	2.55E-05	31527657.3	3974.2	1.26E-04	25117979.6	22025.0	6.98E-04
S304	50.63	32509774.7	636.2	2.02E-05	31524508.7	3148.5	9.98E-05	25100542.1	17437.4	5.53E-04
S305	44.75	32509212.4	562.3	1.78E-05	31521726.1	2782.6	8.82E-05	25085139.9	15402.2	4.88E-04
S306	87.28	32508115.8	1096.6	3.48E-05	31516299.7	5426.5	1.72E-04	25055126.7	30013.2	9.52E-04
S307	66.70	32507277.7	838.0	2.66E-05	31512153.4	4146.3	1.31E-04	25032214.6	22912.1	7.27E-04
S308	44.80	32506714.9	562.9	1.78E-05	31509368.8	2784.6	8.83E-05	25016837.1	15377.5	4.88E-04
S309	42.02	32506186.9	527.9	1.67E-05	31506757.2	2611.6	8.28E-05	25002422.5	14414.7	4.57E-04
S310	100.00	32504930.6	1256.3	3.98E-05	31500542.9	6214.3	1.97E-04	24968151.6	34270.9	1.09E-03
S311	55.26	32504236.4	694.2	2.20E-05	31497109.4	3433.5	1.09E-04	24949233.7	18917.9	6.00E-04
S312	80.79	32503221.4	1014.9	3.22E-05	31492090.4	5019.1	1.59E-04	24921601.5	27632.2	8.76E-04
S313	40.04	32502718.4	503.0	1.59E-05	31489603.2	2487.2	7.89E-05	24907918.1	13683.3	4.34E-04
S314	69.21	32501849.0	869.4	2.76E-05	31485304.5	4298.7	1.36E-04	24884283.9	23634.2	7.49E-04
S315	107.58	32500497.6	1351.4	4.29E-05	31478623.8	6680.7	2.12E-04	24847591.4	36692.5	1.16E-03
S316	16.29	32500293.0	204.6	6.49E-06	31477612.3	1011.5	3.21E-05	24842040.1	5551.3	1.76E-04
S317	56.31	32499585.7	707.3	2.24E-05	31474116.1	3496.2	1.11E-04	24822860.2	19179.9	6.08E-04
S318	57.73	32498860.5	725.1	2.30E-05	31470532.2	3583.9	1.14E-04	24803212.0	19648.2	6.23E-04

TABLE P-2: Data From Calculations of Mercury Evasion from EFPC Segments

		CASE 1			CASE 2			CASE 3		
Initial Mass (Mo) (g) = / S319	108.36	32497499.5	32754300.3 / [illegible]	4.32E-05	31463806.2	32754300.3 / [illegible]	2.13E-04	24766374.1	32754300.3 / [illegible]	1.17E-03
S320	100.00	32496243.5	1256.0	3.98E-05	31457600.4	6205.8	1.97E-04	24732426.8	33947.3	1.08E-03
S321	33.92	32495817.4	426.0	1.35E-05	31455495.7	2104.7	6.67E-05	24720922.4	11504.4	3.65E-04
S322	46.72	32495230.7	586.8	1.86E-05	31452597.0	2898.7	9.19E-05	24705085.5	15836.9	5.02E-04
S323	74.07	32494300.4	930.3	2.95E-05	31448001.9	4595.1	1.46E-04	24679998.5	25087.0	7.96E-04
S324	34.93	32493861.7	438.7	1.39E-05	31445835.1	2166.7	6.87E-05	24668176.8	11821.7	3.75E-04
S325	55.40	32493166.0	695.8	2.21E-05	31442398.9	3436.2	1.09E-04	24649438.8	18738.0	5.94E-04
S326	43.77	32492616.3	549.7	1.74E-05	31439684.4	2714.6	8.61E-05	24634644.5	14794.3	4.69E-04
S327	33.37	32492197.2	419.1	1.33E-05	31437614.9	2069.4	6.56E-05	24623371.4	11273.1	3.57E-04
S328	61.38	32491426.4	770.8	2.44E-05	31433808.8	3806.1	1.21E-04	24602649.4	20722.0	6.57E-04
S329	117.03	32489956.8	1469.6	4.66E-05	31426553.2	7255.6	2.30E-04	24563188.1	39461.3	1.25E-03
S330	34.21	32489527.2	429.6	1.36E-05	31424432.6	2120.6	6.72E-05	24551664.8	11523.3	3.65E-04
S331	41.10	32489011.1	516.1	1.64E-05	31421885.1	2547.5	8.08E-05	24537827.8	13837.0	4.39E-04
S332	24.62	32488702.0	309.2	9.80E-06	31420359.1	1525.9	4.84E-05	24529542.8	8285.0	2.63E-04
S333	67.07	32487859.8	842.2	2.67E-05	31416202.5	4156.6	1.32E-04	24506987.0	22555.8	7.15E-04
S334	33.64	32487437.4	422.4	1.34E-05	31414117.9	2084.6	6.61E-05	24495681.5	11305.4	3.58E-04
S335	84.86	32486371.9	1065.5	3.38E-05	31408859.9	5258.0	1.67E-04	24467185.7	28495.8	9.04E-04
S336	50.04	32485743.6	628.3	1.99E-05	31405759.8	3100.1	9.83E-05	24450398.0	16787.8	5.32E-04
S337	73.90	32484815.7	927.9	2.94E-05	31401182.1	4577.7	1.45E-04	24425626.5	24771.4	7.85E-04
S338	87.48	32483717.4	1098.3	3.48E-05	31395764.0	5418.1	1.72E-04	24396335.5	29291.0	9.29E-04
S339	92.26	32482559.1	1158.3	3.67E-05	31390050.8	5713.1	1.81E-04	24365482.0	30853.5	9.78E-04
S340	38.69	32482073.4	485.7	1.54E-05	31387655.3	2395.5	7.60E-05	24352554.9	12927.1	4.10E-04
S341	140.07	32480314.9	1758.4	5.58E-05	31378984.2	8671.1	2.75E-04	24305812.3	46742.7	1.48E-03
S342	76.05	32479360.2	954.7	3.03E-05	31374277.3	4706.9	1.49E-04	24280471.3	25341.0	8.04E-04
S343	89.23	32478240.1	1120.1	3.55E-05	31368755.6	5521.7	1.75E-04	24250772.2	29699.1	9.42E-04
S344	56.21	32477534.5	705.6	2.24E-05	31365277.7	3477.9	1.10E-04	24232082.0	18690.1	5.93E-04
S345	45.38	32476964.9	569.6	1.81E-05	31362470.2	2807.5	8.90E-05	24217003.4	15078.6	4.78E-04
S346	70.19	32476083.9	881.0	2.79E-05	31358128.3	4341.9	1.38E-04	24193699.6	23303.8	7.39E-04
S347	100.00	32474828.7	1255.2	3.98E-05	31351943.3	6185.0	1.96E-04	24160537.2	33162.4	1.05E-03
S348	30.11	32474450.8	377.9	1.20E-05	31350081.3	1862.0	5.90E-05	24150560.9	9976.3	3.16E-04
S349	66.90	32473611.1	839.7	2.66E-05	31345944.4	4136.8	1.31E-04	24128409.9	22151.1	7.02E-04
S350	100.00	32472356.0	1255.1	3.98E-05	31339761.9	6182.5	1.96E-04	24095337.0	33072.9	1.05E-03
S351	33.70	32471933.1	423.0	1.34E-05	31337678.7	2083.2	6.61E-05	24084201.6	11135.3	3.53E-04
S352	72.09	32471028.3	904.7	2.87E-05	31333222.7	4455.9	1.41E-04	24060398.5	23803.1	7.55E-04
S353	64.30	32470221.4	807.0	2.56E-05	31329248.8	3973.9	1.26E-04	24039187.4	21211.1	6.73E-04
S354	22.54	32469938.5	282.9	8.97E-06	31327855.9	1392.9	4.42E-05	24031756.4	7431.0	2.36E-04
S355	40.12	32469435.0	503.5	1.60E-05	31325376.7	2479.2	7.86E-05	24018535.3	13221.1	4.19E-04
S356	59.87	32468683.7	751.3	2.38E-05	31321677.5	3699.2	1.17E-04	23998819.3	19716.0	6.25E-04
S357	100.00	32467428.8	1254.9	3.98E-05	31315499.8	6177.8	1.96E-04	23965924.1	32895.2	1.04E-03
S358	68.41	32466570.4	858.4	2.72E-05	31311274.3	4225.5	1.34E-04	23943446.5	22477.7	7.13E-04
S359	100.00	32465315.5	1254.8	3.98E-05	31305098.6	6175.7	1.96E-04	23910627.1	32819.3	1.04E-03
S360	100.00	32464060.8	1254.8	3.98E-05	31298924.1	6174.5	1.96E-04	23877852.8	32774.4	1.04E-03
S361	40.22	32463556.1	504.7	1.60E-05	31296441.0	2483.0	7.87E-05	23864683.6	13169.2	4.18E-04
S362	61.23	32462787.9	768.3	2.44E-05	31292661.3	3779.7	1.20E-04	23844649.1	20034.5	6.35E-04
S363	109.77	32461410.6	1377.2	4.37E-05	31285886.3	6775.0	2.15E-04	23808774.4	35874.7	1.14E-03
S364	100.00	32460156.0	1254.6	3.98E-05	31279715.6	6170.7	1.96E-04	23776139.6	32634.7	1.03E-03
S365	70.48	32459271.8	884.2	2.80E-05	31275367.2	4348.4	1.38E-04	23753165.5	22974.1	7.29E-04
S366	103.06	32457978.9	1292.9	4.10E-05	31269009.9	6357.4	2.02E-04	23719611.4	33554.1	1.06E-03
S367	25.46	32457659.5	319.4	1.01E-05	31267439.5	1570.3	4.98E-05	23711329.5	8281.9	2.63E-04
S368	87.68	32456559.6	1099.9	3.49E-05	31262032.2	5407.3	1.71E-04	23682830.1	28499.4	9.04E-04
S369	63.56	32455762.3	797.3	2.53E-05	31258112.9	3919.2	1.24E-04	23662192.0	20638.1	6.54E-04
S370	45.11	32455196.4	565.9	1.79E-05	31255331.6	2781.3	8.82E-05	23647555.6	14636.4	4.64E-04
S371	100.00	32453942.1	1254.4	3.98E-05	31249167.0	6164.7	1.95E-04	23615141.8	32413.8	1.03E-03
S372	100.00	32452687.7	1254.3	3.98E-05	31243003.5	6163.5	1.95E-04	23582772.5	32369.3	1.03E-03
S373	100.00	32451433.5	1254.3	3.98E-05	31236841.3	6162.2	1.95E-04	23550447.5	32325.0	1.03E-03
S374	96.17	32450227.3	1206.2	3.82E-05	31230916.2	5925.1	1.88E-04	23519402.4	31045.1	9.84E-04
S375	100.00	32448973.1	1254.2	3.98E-05	31224756.3	6159.9	1.95E-04	23487164.3	32238.1	1.02E-03
S376	100.00	32447719.0	1254.1	3.98E-05	31218597.7	6158.6	1.95E-04	23454970.4	32193.9	1.02E-03
S377	84.55	32446658.7	1060.3	3.36E-05	31213391.5	5206.2	1.65E-04	23427784.9	27185.5	8.62E-04
S378	100.00	32445404.6	1254.0	3.98E-05	31207235.1	6156.4	1.95E-04	23395672.4	32112.5	1.02E-03
S379	88.09	32444300.0	1104.6	3.50E-05	31201812.9	5422.2	1.72E-04	23367420.9	28251.5	8.96E-04
S380	96.27	32443092.8	1207.2	3.83E-05	31195888.3	5924.6	1.88E-04	23336585.1	30835.9	9.78E-04
S381	64.07	32442289.4	803.4	2.55E-05	31191946.0	3942.3	1.25E-04	23316085.6	20499.4	6.50E-04
S382	42.43	32441757.4	532.0	1.69E-05	31189335.5	2610.5	8.28E-05	23302519.9	13565.7	4.30E-04
S383	23.01	32441468.9	288.5	9.15E-06	31187919.9	1415.6	4.49E-05	23295166.4	7353.5	2.33E-04
S384	87.71	32440369.1	1099.7	3.49E-05	31182524.4	5395.4	1.71E-04	23267157.6	28008.8	8.88E-04
S385	62.39	32439586.9	782.2	2.48E-05	31178687.1	3837.3	1.22E-04	23247254.8	19902.8	6.31E-04
S386	43.93	32439036.1	550.8	1.75E-05	31175985.5	2701.7	8.57E-05	23233251.1	14003.7	4.44E-04
S387	100.00	32437782.4	1253.7	3.98E-05	31169836.4	6149.0	1.95E-04	23201405.3	31845.9	1.01E-03

TABLE P-2: Data From Calculations of Mercury Evasion from EFPC Segments

		CASE 1			CASE 2			CASE 3		
S388 Initial Mass (Mo) (g) =	100.00	32436528.7	32754300.3 [illegible]	3.98E-05	31163688.6	32754300.3 [illegible]	1.95E-04	23169603.0	32754300.3 [illegible]	1.01E-03
S389	55.54	32435832.4	696.3	2.21E-05	31160274.6	3414.0	1.08E-04	23151958.9	17644.1	5.59E-04
S390	45.81	32435258.1	574.3	1.82E-05	31157459.0	2815.6	8.93E-05	23137416.0	14543.0	4.61E-04
S391	100.00	32434004.5	1253.6	3.98E-05	31151313.7	6145.4	1.95E-04	23105701.5	31714.5	1.01E-03
S392	46.15	32433426.0	578.5	1.83E-05	31148478.0	2835.7	8.99E-05	23091079.9	14621.6	4.64E-04
S393	52.31	32432770.3	655.7	2.08E-05	31145264.1	3213.9	1.02E-04	23074517.8	16562.1	5.25E-04
S394	25.06	32432456.1	314.1	9.96E-06	31143724.6	1539.5	4.88E-05	23066587.7	7930.1	2.51E-04
S395	48.43	32431849.1	607.1	1.93E-05	31140749.5	2975.0	9.43E-05	23051270.0	15317.7	4.86E-04
S396	56.45	32431141.5	707.6	2.24E-05	31137282.2	3467.4	1.10E-04	23033428.4	17841.5	5.66E-04
S397	27.27	32430799.6	341.8	1.08E-05	31135607.3	1674.9	5.31E-05	23024814.5	8614.0	2.73E-04
S398	66.74	32429963.1	836.5	2.65E-05	31131508.6	4098.7	1.30E-04	23003746.4	21068.1	6.68E-04
S399	36.74	32429502.6	460.5	1.46E-05	31129252.6	2256.1	7.15E-05	22992156.8	11589.6	3.68E-04
S400	33.21	32429086.4	416.3	1.32E-05	31127213.4	2039.2	6.47E-05	22981685.7	10471.1	3.32E-04
S401	64.60	32428276.7	809.7	2.57E-05	31123247.2	3966.2	1.26E-04	22961331.1	20354.6	6.45E-04
S402	60.46	32427518.9	757.8	2.40E-05	31119535.6	3711.6	1.18E-04	22942297.3	19033.8	6.04E-04
S403	44.97	32426955.3	563.6	1.79E-05	31116775.3	2760.4	8.75E-05	22928150.2	14147.1	4.49E-04

Table P-3: EFPC Receptor Locations and UTM Coordinates

Receptor Name	X-UTM (m)	Y-UTM (m)
Scarboro Community	746330.93	3986591.76
Robertsville School	745557.13	3988472.36
EFPC Farm Family	742421.45	3986358.80
Community Receptor # 1	744252.64	3987481.98
Community Receptor # 2	744581.68	3988459.81
EFPC Tree #2	747818.13	3987511.29
EFPC Tree #3	747295.56	3987619.01
EFPC Tree #4	747297.05	3987671.43
EFPC Tree #5	747325.83	3987670.29
EFPC Tree #6	747302.89	3987570.78

P.3 Results

The ISCST3 model was run to determine average ambient concentrations at each of the receptors on an annual basis, based on a unit emission rate (1 g s^{-1}) from each source. The contribution to the annual average air concentration at each receptor from a given source is obtained by multiplying the contribution from a unit release at the source by the emission rate (Q) for that source for each year of emission. The contribution at receptor j from source i in year n is

$$C_{ij} = Q_{i,n} \times C_{1,ij} \qquad \text{(Equation P-9)}$$

Where:

$Q_{i,n}$	=	Mercury emission rate from source i for the year n (g s^{-1})
C_{1ij}	=	Concentration at receptor j due to unit emission (1 g s^{-1}) from source i (µg m^{-3})/(1 g s^{-1})
i	=	Source number
j	=	Receptor number
n	=	Year of emission

The total annual average airborne concentration at each receptor is then calculated by summing the contributions from all sources. Then, the total concentration in (µg m^{-3}) at receptor j in year n is:

$$C_{j,n} = \sum_{i=1}^{m} C_{i,j} \qquad \text{(Equation P-10)}$$

where m is the total number of sources.

Tables P-4 through P-8 present the estimated air concentrations at each receptor for each year of mercury emissions.

P.4 Reference

USEPA 1995. United Stated Environmental Protection Agency. *User's Guide for the Industrial Source Complex (ISC) Dispersion Models.* Research Triangle Park, North Carolina, March. ISCST3 version 96113. USEPA-454/B-95-003.

Table P-4: Estimation of Air Concentrations at the Scarboro Receptor due to Emissions from EFPC

Receptor	Year	Case 1 (Fraction removed = 0.01) (µg/m3)	Case 2 (Fraction removed = 0.05) (µg/m3)	Case 3 (Fraction removed = 0.3) (µg/m3)
SCAR	1950	2.80E-05	1.42E-04	9.48E-04
SCAR	1951	5.60E-05	2.84E-04	1.90E-03
SCAR	1952	2.80E-04	1.42E-03	9.48E-03
SCAR	1953	1.27E-03	6.45E-03	4.30E-02
SCAR	1954	7.61E-04	3.86E-03	2.57E-02
SCAR	1955	3.86E-03	1.96E-02	1.31E-01
SCAR	1956	3.17E-03	1.61E-02	1.07E-01
SCAR	1957	7.78E-03	3.95E-02	2.63E-01
SCAR	1958	6.93E-03	3.51E-02	2.34E-01
SCAR	1959	2.06E-03	1.04E-02	6.96E-02
SCAR	1960	7.54E-04	3.83E-03	2.55E-02
SCAR	1961	7.12E-04	3.61E-03	2.41E-02
SCAR	1962	4.92E-04	2.50E-03	1.67E-02
SCAR	1963	3.30E-04	1.67E-03	1.12E-02
SCAR	1964	1.20E-04	6.08E-04	4.05E-03
SCAR	1965	2.65E-04	1.35E-03	8.98E-03
SCAR	1966	1.46E-04	7.39E-04	4.93E-03
SCAR	1967	8.99E-05	4.56E-04	3.04E-03
SCAR	1968	1.49E-05	7.55E-05	5.04E-04
SCAR	1969	1.90E-05	9.66E-05	6.44E-04
SCAR	1970	7.29E-05	3.70E-04	2.47E-03
SCAR	1971	1.82E-05	9.21E-05	6.14E-04
SCAR	1972	2.06E-06	1.05E-05	6.97E-05
SCAR	1973	1.81E-04	9.19E-04	6.13E-03
SCAR	1974	3.55E-05	1.80E-04	1.20E-03
SCAR	1975	2.23E-06	1.13E-05	7.55E-05
SCAR	1976	2.63E-06	1.34E-05	8.91E-05
SCAR	1977	5.15E-06	2.61E-05	1.74E-04
SCAR	1978	2.28E-06	1.16E-05	7.71E-05
SCAR	1979	4.47E-06	2.27E-05	1.51E-04
SCAR	1980	5.58E-06	2.83E-05	1.89E-04
SCAR	1981	3.58E-06	1.82E-05	1.21E-04
SCAR	1982	6.76E-06	3.43E-05	2.29E-04
SCAR	1983	5.89E-06	2.99E-05	1.99E-04
SCAR	1984	4.84E-06	2.46E-05	1.64E-04
SCAR	1985	5.71E-06	2.90E-05	1.93E-04
SCAR	1986	6.79E-06	3.44E-05	2.30E-04
SCAR	1987	7.54E-06	3.83E-05	2.55E-04
SCAR	1988	4.21E-06	2.13E-05	1.42E-04
SCAR	1989	4.11E-06	2.09E-05	1.39E-04
SCAR	1990	3.76E-06	1.91E-05	1.27E-04
SCAR	1991	2.54E-06	1.29E-05	8.58E-05
SCAR	1992	2.40E-06	1.22E-05	8.11E-05
SCAR	1993	2.61E-06	1.32E-05	8.83E-05

Table P-5: Estimation of Air Concentrations at the Robertsville School Receptor due to Emissions from EFPC

Receptor	Year	Case 1 (Fraction removed = 0.01) (µg/m3)	Case 2 (Fraction removed = 0.05) (µg/m3)	Case 3 (Fraction removed = 0.3) (µg/m3)
SCHOO	1950	1.85E-05	9.38E-05	6.14E-04
SCHOO	1951	3.71E-05	1.88E-04	1.23E-03
SCHOO	1952	1.85E-04	9.38E-04	6.14E-03
SCHOO	1953	8.41E-04	4.26E-03	2.79E-02
SCHOO	1954	5.03E-04	2.55E-03	1.67E-02
SCHOO	1955	2.56E-03	1.29E-02	8.47E-02
SCHOO	1956	2.10E-03	1.06E-02	6.95E-02
SCHOO	1957	5.15E-03	2.61E-02	1.71E-01
SCHOO	1958	4.58E-03	2.32E-02	1.52E-01
SCHOO	1959	1.36E-03	6.88E-03	4.51E-02
SCHOO	1960	4.99E-04	2.53E-03	1.65E-02
SCHOO	1961	4.71E-04	2.38E-03	1.56E-02
SCHOO	1962	3.26E-04	1.65E-03	1.08E-02
SCHOO	1963	2.18E-04	1.10E-03	7.23E-03
SCHOO	1964	7.92E-05	4.01E-04	2.63E-03
SCHOO	1965	1.76E-04	8.89E-04	5.82E-03
SCHOO	1966	9.63E-05	4.88E-04	3.19E-03
SCHOO	1967	5.95E-05	3.01E-04	1.97E-03
SCHOO	1968	9.84E-06	4.98E-05	3.26E-04
SCHOO	1969	1.26E-05	6.37E-05	4.17E-04
SCHOO	1970	4.82E-05	2.44E-04	1.60E-03
SCHOO	1971	1.20E-05	6.08E-05	3.98E-04
SCHOO	1972	1.36E-06	6.90E-06	4.52E-05
SCHOO	1973	1.20E-04	6.06E-04	3.97E-03
SCHOO	1974	2.35E-05	1.19E-04	7.78E-04
SCHOO	1975	1.48E-06	7.47E-06	4.89E-05
SCHOO	1976	1.74E-06	8.81E-06	5.77E-05
SCHOO	1977	3.41E-06	1.72E-05	1.13E-04
SCHOO	1978	1.51E-06	7.63E-06	5.00E-05
SCHOO	1979	2.96E-06	1.50E-05	9.80E-05
SCHOO	1980	3.69E-06	1.87E-05	1.22E-04
SCHOO	1981	2.37E-06	1.20E-05	7.86E-05
SCHOO	1982	4.47E-06	2.26E-05	1.48E-04
SCHOO	1983	3.89E-06	1.97E-05	1.29E-04
SCHOO	1984	3.20E-06	1.62E-05	1.06E-04
SCHOO	1985	3.78E-06	1.91E-05	1.25E-04
SCHOO	1986	4.49E-06	2.27E-05	1.49E-04
SCHOO	1987	4.99E-06	2.53E-05	1.65E-04
SCHOO	1988	2.78E-06	1.41E-05	9.22E-05
SCHOO	1989	2.72E-06	1.38E-05	9.02E-05
SCHOO	1990	2.49E-06	1.26E-05	8.25E-05
SCHOO	1991	1.68E-06	8.49E-06	5.56E-05
SCHOO	1992	1.59E-06	8.03E-06	5.26E-05
SCHOO	1993	1.73E-06	8.74E-06	5.72E-05

Table P-6: Estimation of Air Concentrations at the EFPC Floodplain Farm Family Receptor due to Emissions from EFPC

Receptor	Year	Case 1 (Fraction removed = 0.01) (µg/m3)	Case 2 (Fraction removed = 0.05) (µg/m3)	Case 3 (Fraction removed = 0.3) (µg/m3)
FF	1950	2.78E-04	1.40E-03	9.03E-03
FF	1951	5.56E-04	2.81E-03	1.81E-02
FF	1952	2.78E-03	1.40E-02	9.03E-02
FF	1953	1.26E-02	6.37E-02	4.10E-01
FF	1954	7.55E-03	3.81E-02	2.45E-01
FF	1955	3.83E-02	1.94E-01	1.24E+00
FF	1956	3.15E-02	1.59E-01	1.02E+00
FF	1957	7.72E-02	3.90E-01	2.51E+00
FF	1958	6.87E-02	3.47E-01	2.23E+00
FF	1959	2.04E-02	1.03E-01	6.62E-01
FF	1960	7.48E-03	3.78E-02	2.43E-01
FF	1961	7.07E-03	3.57E-02	2.29E-01
FF	1962	4.89E-03	2.47E-02	1.59E-01
FF	1963	3.27E-03	1.65E-02	1.06E-01
FF	1964	1.19E-03	6.00E-03	3.86E-02
FF	1965	2.63E-03	1.33E-02	8.55E-02
FF	1966	1.45E-03	7.30E-03	4.69E-02
FF	1967	8.92E-04	4.51E-03	2.90E-02
FF	1968	1.48E-04	7.46E-04	4.79E-03
FF	1969	1.89E-04	9.54E-04	6.13E-03
FF	1970	7.24E-04	3.66E-03	2.35E-02
FF	1971	1.80E-04	9.10E-04	5.85E-03
FF	1972	2.04E-05	1.03E-04	6.64E-04
FF	1973	1.80E-03	9.07E-03	5.83E-02
FF	1974	3.52E-04	1.78E-03	1.14E-02
FF	1975	2.21E-05	1.12E-04	7.18E-04
FF	1976	2.61E-05	1.32E-04	8.48E-04
FF	1977	5.11E-05	2.58E-04	1.66E-03
FF	1978	2.26E-05	1.14E-04	7.34E-04
FF	1979	4.43E-05	2.24E-04	1.44E-03
FF	1980	5.54E-05	2.80E-04	1.80E-03
FF	1981	3.56E-05	1.80E-04	1.15E-03
FF	1982	6.70E-05	3.39E-04	2.18E-03
FF	1983	5.84E-05	2.95E-04	1.90E-03
FF	1984	4.80E-05	2.43E-04	1.56E-03
FF	1985	5.67E-05	2.86E-04	1.84E-03
FF	1986	6.74E-05	3.40E-04	2.19E-03
FF	1987	7.49E-05	3.78E-04	2.43E-03
FF	1988	4.17E-05	2.11E-04	1.35E-03
FF	1989	4.08E-05	2.06E-04	1.32E-03
FF	1990	3.73E-05	1.89E-04	1.21E-03
FF	1991	2.52E-05	1.27E-04	8.17E-04
FF	1992	2.38E-05	1.20E-04	7.72E-04
FF	1993	2.59E-05	1.31E-04	8.41E-04

Table P-7: Estimation of Air Concentrations at the Community #1 Receptor due to Emissions from EFPC

Receptor	Year	Case 1 (Fraction removed = 0.01) (µg/m3)	Case 2 (Fraction removed = 0.05) (µg/m3)	Case 3 (Fraction removed = 0.3) (µg/m3)
COM-1	1950	9.45E-06	4.77E-05	3.08E-04
COM-1	1951	1.89E-05	9.55E-05	6.16E-04
COM-1	1952	9.45E-05	4.77E-04	3.08E-03
COM-1	1953	4.29E-04	2.17E-03	1.40E-02
COM-1	1954	2.56E-04	1.30E-03	8.36E-03
COM-1	1955	1.30E-03	6.58E-03	4.25E-02
COM-1	1956	1.07E-03	5.40E-03	3.48E-02
COM-1	1957	2.62E-03	1.33E-02	8.55E-02
COM-1	1958	2.34E-03	1.18E-02	7.61E-02
COM-1	1959	6.93E-04	3.50E-03	2.26E-02
COM-1	1960	2.54E-04	1.28E-03	8.29E-03
COM-1	1961	2.40E-04	1.21E-03	7.83E-03
COM-1	1962	1.66E-04	8.39E-04	5.41E-03
COM-1	1963	1.11E-04	5.62E-04	3.62E-03
COM-1	1964	4.04E-05	2.04E-04	1.32E-03
COM-1	1965	8.95E-05	4.52E-04	2.92E-03
COM-1	1966	4.91E-05	2.48E-04	1.60E-03
COM-1	1967	3.03E-05	1.53E-04	9.88E-04
COM-1	1968	5.02E-06	2.53E-05	1.64E-04
COM-1	1969	6.42E-06	3.24E-05	2.09E-04
COM-1	1970	2.46E-05	1.24E-04	8.02E-04
COM-1	1971	6.12E-06	3.09E-05	1.99E-04
COM-1	1972	6.95E-07	3.51E-06	2.26E-05
COM-1	1973	6.11E-05	3.08E-04	1.99E-03
COM-1	1974	1.20E-05	6.04E-05	3.90E-04
COM-1	1975	7.52E-07	3.80E-06	2.45E-05
COM-1	1976	8.88E-07	4.48E-06	2.89E-05
COM-1	1977	1.74E-06	8.77E-06	5.66E-05
COM-1	1978	7.69E-07	3.88E-06	2.50E-05
COM-1	1979	1.51E-06	7.61E-06	4.91E-05
COM-1	1980	1.88E-06	9.51E-06	6.14E-05
COM-1	1981	1.21E-06	6.10E-06	3.94E-05
COM-1	1982	2.28E-06	1.15E-05	7.42E-05
COM-1	1983	1.99E-06	1.00E-05	6.47E-05
COM-1	1984	1.63E-06	8.25E-06	5.32E-05
COM-1	1985	1.93E-06	9.73E-06	6.28E-05
COM-1	1986	2.29E-06	1.16E-05	7.46E-05
COM-1	1987	2.54E-06	1.29E-05	8.29E-05
COM-1	1988	1.42E-06	7.16E-06	4.62E-05
COM-1	1989	1.39E-06	7.00E-06	4.52E-05
COM-1	1990	1.27E-06	6.41E-06	4.14E-05
COM-1	1991	8.55E-07	4.32E-06	2.79E-05
COM-1	1992	8.08E-07	4.08E-06	2.63E-05
COM-1	1993	8.80E-07	4.45E-06	2.87E-05

Table P-8: Estimation of Air Concentrations at the Community #2 Receptor due to Emissions from EFPC

Receptor	Year	Case 1 (Fraction removed = 0.01) (µg/m3)	Case 2 (Fraction removed = 0.05) (µg/m3)	Case 3 (Fraction removed = 0.3) (µg/m3)
COM-2	1950	4.63E-06	2.34E-05	1.50E-04
COM-2	1951	9.27E-06	4.68E-05	3.00E-04
COM-2	1952	4.63E-05	2.34E-04	1.50E-03
COM-2	1953	2.10E-04	1.06E-03	6.81E-03
COM-2	1954	1.26E-04	6.34E-04	4.07E-03
COM-2	1955	6.38E-04	3.22E-03	2.07E-02
COM-2	1956	5.24E-04	2.64E-03	1.70E-02
COM-2	1957	1.29E-03	6.49E-03	4.17E-02
COM-2	1958	1.14E-03	5.78E-03	3.71E-02
COM-2	1959	3.40E-04	1.71E-03	1.10E-02
COM-2	1960	1.25E-04	6.29E-04	4.04E-03
COM-2	1961	1.18E-04	5.94E-04	3.81E-03
COM-2	1962	8.13E-05	4.11E-04	2.64E-03
COM-2	1963	5.45E-05	2.75E-04	1.77E-03
COM-2	1964	1.98E-05	9.99E-05	6.41E-04
COM-2	1965	4.38E-05	2.21E-04	1.42E-03
COM-2	1966	2.41E-05	1.21E-04	7.80E-04
COM-2	1967	1.49E-05	7.50E-05	4.81E-04
COM-2	1968	2.46E-06	1.24E-05	7.97E-05
COM-2	1969	3.15E-06	1.59E-05	1.02E-04
COM-2	1970	1.21E-05	6.08E-05	3.91E-04
COM-2	1971	3.00E-06	1.51E-05	9.72E-05
COM-2	1972	3.40E-07	1.72E-06	1.10E-05
COM-2	1973	2.99E-05	1.51E-04	9.70E-04
COM-2	1974	5.86E-06	2.96E-05	1.90E-04
COM-2	1975	3.68E-07	1.86E-06	1.19E-05
COM-2	1976	4.35E-07	2.19E-06	1.41E-05
COM-2	1977	8.51E-07	4.29E-06	2.76E-05
COM-2	1978	3.77E-07	1.90E-06	1.22E-05
COM-2	1979	7.38E-07	3.73E-06	2.39E-05
COM-2	1980	9.22E-07	4.66E-06	2.99E-05
COM-2	1981	5.92E-07	2.99E-06	1.92E-05
COM-2	1982	1.12E-06	5.63E-06	3.62E-05
COM-2	1983	9.73E-07	4.91E-06	3.15E-05
COM-2	1984	8.00E-07	4.04E-06	2.59E-05
COM-2	1985	9.44E-07	4.76E-06	3.06E-05
COM-2	1986	1.12E-06	5.66E-06	3.64E-05
COM-2	1987	1.25E-06	6.29E-06	4.04E-05
COM-2	1988	7.00E-07	3.53E-06	2.26E-05
COM-2	1989	6.79E-07	3.43E-06	2.20E-05
COM-2	1990	6.22E-07	3.14E-06	2.02E-05
COM-2	1991	4.19E-07	2.12E-06	1.36E-05
COM-2	1992	3.96E-07	2.00E-06	1.28E-05
COM-2	1993	4.31E-07	2.18E-06	1.40E-05

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APPENDIX Q

EAST FORK POPLAR CREEK FLOODPLAIN SOIL DATA

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APPENDIX Q
EAST FORK POPLAR CREEK FLOODPLAIN SOIL DATA

Q.1 Introduction

This appendix presents the soil data that were used to characterize exposures of the Scarboro Community, EFPC farm family, and Robertsville School children exposure populations to mercury in soil and sediment. Exposures of the EFPC floodplain farm family and Robertsville School children populations to mercury in soil and sediment were evaluated using soil data collected from July 1991 through May 1992 by SAIC during Phase Ib of the EFPC Floodplain Remedial Investigation (RI) (SAIC/DOE 1994). Exposures of the Scarboro community population to mercury in EFPC sediment were also evaluated using soil data collected during the EFPC Floodplain RI. However, exposures of the Scarboro community population to mercury in soil were evaluated using soil data collected in the Scarboro area by Oak Ridge Associated Universities (ORAU) in 1984, because no soil samples were collected in the Scarboro community during the 1991-92 EFPC Floodplain RI.

Q.2 Data Used to Evaluate Exposures to Mercury in Soil

As described in Section 7.4, data from different segments of the floodplain were used to characterize exposures of the Scarboro community, Robertsville School children, and EFPC farm family populations to mercury in soil.

Soil samples collected in the Scarboro area in 1984 by ORAU were used to characterize exposures to individuals in the Scarboro community population via soil ingestion, soil contact, and vegetable ingestion pathways. In 1984, a total of 16 surface soil samples were collected along Hampton Road in the Scarboro Community and 41 samples were collected near the intersection of Tulsa and Tuskegee Roads. Measured mercury concentrations were low (maximum concentration 3.8 mg kg^{-1}).

Robertsville School is located at approximately EFPC Mile 12. It was assumed that these children occasionally participated in recreational activities along the creek in this area, predominantly on the north side of the creek. Exposure point concentrations for soil for this population were characterized using samples collected between approximately EFPC Miles 11.5 and 12.5 (i.e., between creek transects X55000 and X59000) along the creek and in the 100-year floodplain to the north of the creek (e.g., between southing S00 and northing N14).

The EFPC floodplain farm family population was assumed to reside at approximately EFPC Mile 10. Therefore, data collected during the EFPC Floodplain RI between approximately EFPC Miles 9.5 and 10.5 (i.e., (i.e., between creek transects X47500 and X51500) across the entire width of the 100-year floodplain (e.g., between northing N20 and southing S14) were used to characterize their exposures.

Exposures through direct contact with soil by the EFPC farm family or Robertsville School children populations (e.g., ingestion or dermal contact with soil) or ingestion of soil by livestock (for the EFPC farm family population) were evaluated using all of the soil data collected within the areas described above. It was assumed that exposures were primarily to surface soils. Samples collected from the surface interval (0 – 16 in. bgs) were used to characterize exposure point concentrations.

Exposures through uptake of mercury by vegetables grown at the outer edge of the floodplain by the EFPC farm family population were evaluated using data from samples collected at a distance of at least 20 meters from the creek (i.e., excluding the samples collected along the edge of the creek at northing N00 or southing S00) since the frequency of inundation of lower elevations of the floodplain precluded growing vegetable gardens in these areas. It was assumed that root uptake was associated primarily with surface soils. As such, samples collected from the surface interval (0 – 16 in. bgs) were used to characterize exposure point concentrations. Average concentrations of mercury in this interval were higher than in deeper intervals (i.e., 16 – 32 in. bgs and 32 – 48 in. bgs).

Q.3 Data Used to Evaluate Exposures to Mercury in Sediment

Since limited sediment data collected in EFPC are available, exposures of the Scarboro community, Robertsville School children, and EFPC floodplain farm family populations to mercury in sediment in EFPC were evaluated using data from soil samples collected on the edge of the creek (i.e., at northing N00 and southing S00) from the surface interval (0 – 16 in. bgs). While EFPC does not flow through the Scarboro community itself, the creek is close enough that children who were residents of the Scarboro community likely visited the creek for fishing and other recreational activity. Exposure point concentrations for sediment were therefore characterized using soil samples collected during the EFPC RI between approximately EFPC Miles 13 and 15 (i.e., between EFPC RI creek transects N33400 and N36700) on the edge of the creek (i.e., at EFPC RI easting E00 and westing W00).

Soil data used in this assessment for evaluation of exposures to mercury in soil and sediment for the Robertsville School children, EFPC floodplain farm family, and Scarboro community populations are presented in Tables Q-1 through Q-4.

TABLE Q-1: SOIL SAMPLES COLLECTED IN THE VICINITY OF THE ROBERTSVILLE SCHOOL RECEPTOR DURING THE EFPC FLOODPLAIN RI

Station Name	Date Collected	Adj. Mercury Conc. 0-1.3 ft bgs (mg/kg) *	Adj. Mercury Conc. 1.3-2.7 ft bgs (mg/kg)*	Adj. Mercury Conc. 2.7-4 ft bgs (mg/kg)*
E551N12	10/2/91	**1.3**		
E551N10	10/2/91	1.1		
E551N08	10/2/91	1.1		
E551N06	10/2/91	**191**		
E551N04	10/2/91	**128**		
E551N02	10/2/91	**111**		
E551N00	10/2/91	**243**		
E551S00	10/2/91	**115**		
E554N10	10/2/91	1.15		
E554N08	10/2/91	1.25		
E554N06	10/2/91	3.05		
E554N04	10/2/91	2.45		
E554N02	10/2/91	3.5		
E554N00	10/2/91	**79**	**137**	
E554S00	10/2/91	**111**	**124**	2.4
E557N12	10/3/91	**7.4**		
E557N10	10/3/91	**5.5**		
E557N08	10/3/91	**53**		
E557N06	10/3/91	**10**		
E557N04	10/3/91	**22**		
E557N02	10/3/91	**7.8**		
E557N00	10/3/91	**44**		
E557S00	10/2/91	**67**		
E564S00	10/30/91	**137**		
E567N10	10/29/91	1.9	1.95	1.9
E567N08	10/29/91	2.2		
E567N06	10/29/91	1.85	2	2.05
E567N04	10/29/91	2.15		
E567S00	10/30/91	**56**	**73**	
E574N14	10/29/91	1.4		
E574N12	10/29/91	1.25		
E574N08	10/29/91	1.35		
E574N06	10/29/91	1.55		
E574N04	10/29/91	1.35		
E574N02	10/29/91	2.45		
E574N00	10/29/91	**121**	**321**	**73**
E574S00	10/30/91	**80**	**21**	1.3
E577N14	10/28/91	1.95		
E577N12	10/28/91	1.85		
E577N10	10/28/91	1.75		
E577N08	10/28/91	1.8		
E577N06	10/28/91	1.95		
E577N06	2/25/92	**0.67**		
E577N04	2/24/92	**31**		
E577N04	10/28/91	**9.9**		
E577N02	10/28/91	**21**		
E577N00	10/28/91	**19**		
E577N00	2/24/92	**55**		
E577S00	10/28/91	**25**		

TABLE Q-1: SOIL SAMPLES COLLECTED IN THE VICINITY OF THE ROBERTSVILLE SCHOOL RECEPTOR DURING THE EFPC FLOODPLAIN RI

Station Name	Date Collected	Adj. Mercury Conc. 0-1.3 ft bgs (mg/kg) *	Adj. Mercury Conc. 1.3-2.7 ft bgs (mg/kg)*	Adj. Mercury Conc. 2.7-4 ft bgs (mg/kg)*
E578N02	10/29/91	1.3		
E578N00	10/29/91	**80**		
E578S00	10/30/91	1.65		
E580N00	2/21/92	**41.9**		
E580S00	2/20/92	**4.5**		
E583N00	2/18/92	**150**		
E583S00	2/18/92	**20.5**		
E587S00	10/30/91	**49**	**22**	
E590S00	10/30/91	1.2		

Notes
Bold values (at right of column) = Detected values
Blanks = Not analyzed
Values at left of column = Nondetected samples. Value equals one-half the reported detection limit.

All Floodplain Soil Samples Between E551and E590 along creek and on north side of creek (used to evaluate exposures to mercury in soil)

Distribution	lognormal	lognormal	lognormal
count	58	8	5
min (mg/kg)	0.67	1.95	1.3
max (mg/kg)	243	321	73
Mean (mg/kg)	49	152	12
Stdev (mg/kg)	252	744	33

Floodplain Soil Samples Between E475 and E515 Collected along Creek (N00, S00) (used to evaluate exposures to mercury in sediment)

Distribution	normal		
count	21	6	3
min (mg/kg)	1.2	21	1.3
max (mg/kg)	243	321	73
Mean (mg/kg)	71		
Stdev (mg/kg)	59		

TABLE Q-2: SOIL SAMPLES COLLECTED IN THE VICINITY OF THE EFPC FARM FAMILY RECEPTOR DURING THE EFPC FLOODPLAIN RI

Station Name	Date Collected	Adj. Mercury Conc. 0-1.3 ft bgs (mg/kg)*	Adj. Mercury Conc. 1.3-2.7 ft bgs (mg/kg)*	Adj. Mercury Conc. 2.7-4 ft bgs (mg/kg)*
E475N14	11/7/91	2.2		
E475N12	11/7/91	2.35		
E475N10	11/7/91	1	**6.6**	
E475N08	11/7/91	**73**	**7.8**	0.95
E475N06	11/7/91	**4.7**	0.9	0.9
E475N04	11/7/91	**70**	1.1	1.7
E475N02	11/7/91	**241**	**4.8**	**5.7**
E475N00	11/7/91	**15**	1.05	0.9
E475S00	11/6/91	1.3	1.25	
E475S02	11/6/91	0.6		
E475S04	11/6/91	0.55		
E478N06	11/7/91	0.485		
E478N04	11/7/91	0.475		
E478N02	11/7/91	**16**		
E478N00	11/7/91	14		
E478S02	11/6/91	**10**		
E478S04	11/6/91	1.2		
E478S06	11/6/91	**6.3**		
E478S08	11/6/91	1.4		
E478S10	11/6/91	1.35		
E478S12	11/6/91	1.1		
E478S14	11/6/91	1.2		
E478S16	11/6/91	1.4		
E482N16	11/6/91	0.6		
E482N14	11/6/91	0.6		
E482N12	11/6/91	0.55		
E482N10	2/21/92	**1.5**		
E482N08	11/6/91	**53**	**15**	
E482N06	11/6/91	**11**	0.495	
E482N04	11/6/91	**17**	0.55	**5.3**
E482N02	2/20/92	**20**	0.6	
E482N00	2/20/92	**24.8**	1.75	
E482S00	11/6/91	2.35	2.35	2.55
E482S02	2/24/92	**0.39**	1.15	1.15
E482S04	11/6/91	1.4	1.15	1.1
E482S06	11/6/91	0.6	0.6	
E485N08	11/5/91	2.05		
E485N06	11/5/91	1.8		
E485N04	11/5/91	1.8		
E485N02	11/5/91	1.9		
E485N00	11/5/91	**27**		
E485S00	11/5/91	**7**		
E485S02	11/5/91	1.6		
E485S04	11/5/91	1.7		
E485S06	11/5/91	1.7		
E485S08	11/5/91	1.65		
E485S10	11/5/91	1.8		
E485S12	11/5/91	1.7		
E485S14	11/5/91	1.85		
E485S16	11/5/91	2.05		

TABLE Q-2: SOIL SAMPLES COLLECTED IN THE VICINITY OF THE EFPC FARM FAMILY RECEPTOR DURING THE EFPC FLOODPLAIN RI

Station Name	Date Collected	Adj. Mercury Conc. 0-1.3 ft bgs (mg/kg)*	Adj. Mercury Conc. 1.3-2.7 ft bgs (mg/kg)*	Adj. Mercury Conc. 2.7-4 ft bgs (mg/kg)*
E488N06	11/5/91	1.8		
E488N04	11/5/91	**12**		
E488N02	11/5/91	**6.7**		
E488N00	11/5/91	**12**	2.2	
E488S00	11/5/91	2.1		
E488S02	11/5/91	1.2		
E488S04	11/5/91	1.3	1.6	1.5
E488S06	11/5/91	1.4	1.7	2.3
E488S08	11/5/91	1.25	1.25	
E488S10	11/5/91	1.4	1.4	1.5
E488S12	11/5/91	1.65		
E488S14	11/5/91	1.65	1.65	
E492N06	11/5/91	1.95		
E492N04	11/5/91	**11**		
E492N02	11/5/91	**108**		
E492N00	11/5/91	**81**		
E492N00	2/24/92	**80.6**		
E492S00	11/4/91	**10**		
E492S02	11/4/91	2.95		
E492S04	11/4/91	0.41		
E492S06	11/4/91	0.41		
E492S08	11/4/91	0.405		
E492S10	11/4/91	0.44		
E492S12	11/4/91	**17**		
E492S14	11/4/91	**25**		
E492S16	11/4/91	1.45		
E495N10	11/4/91	1.65	1.65	1.6
E495N08	11/4/91	2.4		
E495N06	11/4/91	2.15		
E495N04	2/18/92	**0.21**		
E495N02	11/4/91	2.65		
E495N00	11/4/91	**57**		
E495S00	11/1/91	**117**	**23**	0.455
E495S02	11/1/91	1.45	0.46	0.405
E495S04	11/1/91	**3.4**	0.4	1.65
E495S06	11/1/91	0.65	0.45	0.435
E495S08	11/1/91	**6.9**	**12**	
E495S10	11/1/91	**13**	**11**	1.65
E495S12	11/1/91	3.2		
E495S14	11/1/91	1.85		
E498S00	11/1/91	**16**		
E498S02	11/1/91	0.415		
E498S04	11/1/91	0.49		
E498S06	11/1/91	0.5		
E498S08	11/1/91	0.6		
E498S10	11/1/91	0.6		
E498S12	11/1/91	0.5		
E498S14	11/1/91	0.5		

TABLE Q-2: SOIL SAMPLES COLLECTED IN THE VICINITY OF THE EFPC FARM FAMILY RECEPTOR DURING THE EFPC FLOODPLAIN RI

Station Name	Date Collected	Adj. Mercury Conc. 0-1.3 ft bgs (mg/kg)*	Adj. Mercury Conc. 1.3-2.7 ft bgs (mg/kg)*	Adj. Mercury Conc. 2.7-4 ft bgs (mg/kg)*
E501S00	10/31/91	**77**	0.6	**18**
E501S02	10/31/91	1.3	1.25	1.2
E501S04	10/31/91	1.65	0.445	
E501S06	10/31/91	0.55		
E501S08	10/31/91	0.5	0.495	0.65
E501S10	10/31/91	0.6		
E501S12	10/31/91	0.75		
E505N20	11/1/91	**61**		
E505N18	11/1/91	**207**		
E505N16	10/31/91	**91**		
E505N14	10/31/91	1.7		
E505N12	10/31/91	1.65		
E505N10	10/31/91	**25**		
E505N08	10/31/91	**30**		
E505N06	10/31/91	1.75		
E505N04	10/31/91	**26**		
E505N02	10/31/91	1.7		
E505N00	10/31/91	**13**		
E505S00	10/31/91	**28**		
E505S02	10/31/91	0.6		
E505S04	10/31/91	1.7		
E508N16	10/3/91	1.75		
E508N14	10/3/91	2		
E508N12	10/3/91	2.1	1.9	1.85
E508N10	10/3/91	1.9		
E508N08	10/3/91	1.85		
E508N06	10/3/91	1.65	2.15	1.9
E508N04	10/3/91	1.55	1.7	1.8
E508N02	10/3/91	**73**	1.6	**4.9**
E508N00	10/3/91	**71**	2	1.75
E508S00	10/4/91	**46**	**8.6**	1.9
E508S02	10/4/91	**8.6**	1.6	1.65
E508S04	10/4/91	1.6	1.6	1.8
E508S06	10/4/91	1.6	1.7	1.75
E508S08	10/4/91	1.95	1.65	1.65
E508S10	10/4/91	1.9	2.2	2.1
E511N10	10/3/91	2.15		
E511N08	10/3/91	1.85		
E511N06	10/3/91	1.6		
E511N04	10/3/91	1.5		
E511N02	10/3/91	1.75		
E511N00	10/3/91	1.7		
E511S00	10/4/91	**11**		
E511S02	10/4/91	**45**		
E511S04	10/4/91	1.5		
E511S06	10/4/91	1.5		
E511S08	10/4/91	1.3		

TABLE Q-2: SOIL SAMPLES COLLECTED IN THE VICINITY OF THE EFPC FARM FAMILY RECEPTOR DURING THE EFPC FLOODPLAIN RI

Station Name	Date Collected	Adj. Mercury Conc. 0-1.3 ft bgs (mg/kg)*	Adj. Mercury Conc. 1.3-2.7 ft bgs (mg/kg)*	Adj. Mercury Conc. 2.7-4 ft bgs (mg/kg)*
E515N04	10/4/91	1.7	1.8	1.85
E515N02	10/4/91	**30**	**93**	**22**
E515N00	10/4/91	**298**	**11**	**54**
E515S00	10/4/91	**87**	2.15	**5.9**
E515S02	10/4/91	1.9	1.9	2.25
E515S04	10/4/91	2.3	2.2	

Notes
Bold values (at right of column) = Detected values
Blanks = Not analyzed
Values at left of column = Nondetected samples. Value equals one-half the reported detection limit.

All Floodplain Soil Samples Between E475 and E515
(used to evaluate exposures to mercury in soil through direct contact)

Distribution	lognormal	lognormal	lognormal
count	151	50	37
min (mg/kg)	0.21	0.4	0.405
max (mg/kg)	298	93	54
Mean (mg/kg)	13.4	3.6	3.3
Stdev (mg/kg)	50.1	5.6	4.4

Floodplain Soil Samples Between E475 and E515 Collected along Creek (N00, S00)
(used to evaluate exposures to mercury in sediment)

Distribution	lognormal		
count	24	11	8
min (mg/kg)	1.3	0.6	0.455
max (mg/kg)	298	23	54
Mean (mg/kg)	55	1.0	
Stdev (mg/kg)	138		

All Floodplain Soil Samples Between E475 and E515 Excluding N00 and S00
(used to evaluate exposures to mercury in vegetables from soil uptake)

Distribution	lognormal		
count	127	39	29
min (mg/kg)	0.21	0.4	0.405
max (mg/kg)	241	93	22
Mean (mg/kg)	7.2		
Stdev (mg/kg)	20		

TABLE Q-3: SOIL SAMPLES COLLECTED IN THE SCARBORO COMMUNITY BY ORAU

Location	Decription	Sample No.	Date Collected	Mercury Conc., Surface (mg/kg)
Tuskegee & Tulsa Rd.	at the intersection of Tuskegee and Tulsa Rd	84-0881	5/7/84	0.26
		84-0882	5/7/84	0.2
		84-0883	5/7/84	0.26
		84-0884	5/7/84	0.39
		84-0885	5/7/84	0.26
		84-0886	5/7/84	0.23
		84-0887	5/7/84	0.2
		84-0888	5/7/84	1.1
		84-0889	5/7/84	0.14
		84-0890	5/7/84	0.38
		84-0891	5/7/84	0.25
		84-0892	5/7/84	0.28
		84-0893	5/7/84	0.12
		84-0894	5/7/84	0.41
		84-0895	5/9/84	1
		84-0896	5/9/84	0.26
		84-0897	5/9/84	0.18
		84-0898	5/9/84	0.17
		84-0899	5/9/84	0.15
		84-0900	5/9/84	1.6
		84-0901	5/9/84	2.3
		84-0902	5/9/84	3.8
		84-0903	5/9/84	0.72
		84-0904	5/9/84	0.2
		84-0905	5/9/84	0.14
		84-0906	5/9/84	0.005
		84-0907	5/9/84	0.005
		84-0908	5/9/84	0.1
		84-0909	5/9/84	0.15
		84-0910	5/9/84	1.4
		84-0911	5/9/84	0.13
		84-0912	5/9/84	0.14
		84-0913	5/9/84	0.02
		84-0914	5/9/84	0.02
		84-0915	5/9/84	0.09
		84-1147	6/5/84	0.09
		84-1148	6/5/84	0.41
		84-1149	6/5/84	0.47
		84-1150	6/5/84	0.09
		84-1151	6/5/84	0.08
		84-1152	6/5/84	0.09
Hampton Road	North of pkg. lot	84-2425	11/20/84	0.11
		84-2426	11/20/84	0.1
		84-2427	11/20/84	0.03
		84-2438	11/27/84	0.05

TABLE Q-3: SOIL SAMPLES COLLECTED IN THE SCARBORO COMMUNITY BY ORAU

Location	Decription	Sample No.	Date Collected	Mercury Conc., Surface (mg/kg)
Hampton Road	Future Bldg. Site	84-2439	11/27/84	0.12
		84-2440	11/27/84	0.07
		84-2441	11/27/84	0.4
		84-2442	11/27/84	0.05
		84-2443	11/27/84	0.03
		84-2444	11/27/84	0.07
		84-2445	11/27/84	0.11
		84-2446	11/27/84	0.09
		84-2447	11/27/84	0.07
		84-2448	11/27/84	0.1
		84-2449	11/27/84	0.03
		84-2450	11/27/84	0.15

(used to evaluate exposures to mercury in soil)

Distribution	Lognormal
count	57
min (mg/kg)	0.005
max (mg/kg)	3.8
Mean (mg/kg)	0.34
Stdev (mg/kg)	0.69

TABLE Q-4: SOIL SAMPLES COLLECTED NEAR EFPC DURING THE EFPC FLOODPLAIN RI, SCARBORO COMMUNITY RECEPTOR

Station Name	Date Collected	Adj. Result 0-1.3 ft bgs (mg/kg)	Adj. Result 1.3-2.7 ft bgs (mg/kg)	Adj. Result 2.7-4 ft bgs (mg/kg)
N334E00	10/11/91	**107**		
N334E00	10/11/91		**180**	
N334E00	10/11/91			**5.6**
N334E00	2/27/92	**63.1**		
N334W00	10/11/91	**114**		
N334W00	10/11/91			**498**
N334W00	10/11/91		**547**	
N337E00	10/11/91	**69**		
N337W00	10/16/91	**88**		
N341E00	10/14/91	2.1		
N341E00	10/14/91		**8.7**	
N341E00	10/14/91			2.9
N344E00	10/14/91	1.8		
N344W00	10/17/91	**17**		
N347E00	10/14/91	**93**		
N347E00	10/14/91		**7.5**	
N347E00	10/14/91			**22**
N347W00	10/17/91	**97**		
N347W00	10/17/91		**18**	
N347W00	10/17/91			**9.9**
N351E00	10/17/91	**87**		
N351W00	10/17/91	**125**		
N354E00	10/17/91	1.2		
N354E00	10/17/91		1	
N354E00	10/17/91			1.3
N354W00	10/17/91	1.8		
N354W00	10/17/91		1.9	
N357E00	10/21/91	**6.8**		
N357W00	10/17/91	2.5		
N360E00	10/21/91	**38**		
N360E00	10/21/91		2.1	
N360E00	10/21/91			1.2
N360W00	10/18/91	1.8		
N360W00	10/18/91		**16**	
N364E00	10/21/91	**7.5**		
N364W00	10/18/91	2.4		
N367E00	10/21/91	**56**		
N367E00	10/21/91		2.4	
N367E00	10/21/91			2.3
N367E00	2/19/92	**63.2**		
N367W00	2/20/92	**147**		
N367W00	10/21/91		2.7	
N367W00	10/21/91			2.7

***Notes**

Bold values (at right of column) = Detected values
Blanks = Not analyzed
Values at left of column = Nondetected samples. Value equals one-half the reported detection limit.

Floodplain Soil Samples Between N334 and N367 Collected along Creek (W00, E00)
(used to evaluate exposures to mercury in sediment)

Distribution	normal	lognormal	lognormal
count	23	11	9
min (mg/kg)	1.2	1.0	1.2
max (mg/kg)	147	547	498
Mean (mg/kg)	52	56	31
Stdev (mg/kg)	48	326	147

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APPENDIX R

STUDIES OF MERCURY-CONTAMINATED LAKES AND RIVERS IN THE U.S. AND CANADA

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Review of Mercury Levels in Fish, Water and Sediments

Progress Report #2

For Oak Ridge Dose Reconstruction Project

Submitted in Partial Fulfilment of
Contract 04.0601430.020.002 to:

McLaren Hart Environmental Services Inc.
1135 Atlantic Avenue
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G96108
August, 1996

Approved by: C. Wren
Date: Aug. 1/96

EXECUTIVE SUMMARY

Published and unpublished data on mercury concentrations in water, sediments and biota from field studies were collected and analyzed to examine potential relationships between these variables.

There was a positive correlation ($r^2 = 0.57$) between mercury levels in water and biota at contaminated sites. However, data were only available from two studies.

There was a strong positive correlation ($r^2 = 0.81$) between mercury concentrations in biota and mercury in sediments from contaminated sites. The data from several studies spanning a number of species and geographical areas supported this relationship.

In areas with natural background mercury levels (no direct anthropogenic input) there is generally no relationship between mercury in sediment and biota.

The relationship of mercury in biota to sediments is considered more reliable for dose reconstruction purposes. This is due to the greater availability of data for sediments and biota and potential analytical difficulties associated with obtaining accurate measurements of mercury in water (particularly in older studies).

Studies in Ontario have measured mercury concentrations up to 3.2 μg/g in bluegill sunfish which is higher than the upper maximum level of 1.5 μg/g estimated for bluegill from the Watts Bar Reservoir.

Data from the mercury contaminated St. Clair River system are presented as a case study. The results show that fish mercury levels were better correlated to sediment levels collected 35-45 km upstream near the point source discharge, than to sediment levels at the downstream lake where fish were collected. In that situation the downstream lake sediment mercury levels would substantially underestimate fish mercury levels if used for dose reconstruction purposes.

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1. INTRODUCTION

Ecological Services for Planning Ltd. was retained by McLaren Hart Environmental Services Inc. to assemble information on mercury concentrations in fish, sediments and water from published and unpublished data sources. This is the second progress report and includes information from a larger database than the previous report.

Data from case studies were reviewed to investigate the relationships between mercury in water, sediments and fish. Using these relationships it may be possible to develop a model that will enable researchers to estimate or "reconstruct" mercury levels in fish that may have existed during conditions of active mercury loading into East Fork Poplar Creek and subsequently into Watts Bar Lake, the downstream reservoir. We did not encounter any studies that attempted to "back-calculate" mercury levels in fish based upon known or predicted mercury loading in water and sediments similar to what is being attempted for the Oak Ridge study.

The aspects of mercury accumulation in freshwater biota reviewed in this report include:

1. Critical body burdens of mercury (or maximum tissue levels)
2. Mercury accumulation in bluegill sunfish
3. Patterns of mercury accumulation in sediments and fish in the St. Clair river-lake ecosystem
4. Relation of fish to water mercury concentration (Concentration Factor CF)
5. Relation of fish to sediment mercury concentration (Concentration Ratio CR)
6. Overview of mercury levels in turtles

The terms Concentration Factor and Concentration Ratio follow the definitions used by Blaylock et. al. (n.d.). Before beginning this discussion, however, it is important to remember the following characteristics of mercury accumulation in freshwater fish:

- although mercury emitted to a surface water is often in the inorganic form, the primary form of mercury taken up by fish is the organic methylmercury form;

- the mercury (methylmercury) content of a fish increases with fish size and age. Therefore, it is important to establish a standard length <u>within</u> a species for making spatial or temporal comparisons;

- the concentration of mercury within fish tissues differs where generally kidney > liver > gill > spleen > brain > muscle. However, most monitoring studies generally measure mercury in muscle tissue only;

- the extent of mercury accumulation is species dependent, and largely governed by position in the food chain. The differences in mercury concentration can differ substantially between species within a location. The importance of comparing similar species and at standard sizes is illustrated by the following example:

In Lake St. Clair in 1971 the **mean** mercury concentration in muskellunge (7.1 ppm) was 44 times greater than the **mean** mercury concentration (0.16 ppm) in gizzard shad (Table 7, Appendix B). If the maximum muskellunge mercury concentration (23.0 ppm) is compared to the minimum shad (0.04 ppm) concentration, the values differ by a factor of 575x! Thus, concentration ratios (CR) and concentration factors (CF) must be considered species and size specific;

- the concentrations of mercury in different fish species are highly correlated over space and time. Therefore, it is possible to estimate the concentration of mercury in a species if data from another species are available. This assumes that the regression relationship between the two species has been established.

2. MAXIMUM FISH TISSUE MERCURY CONCENTRATIONS

There is evidence from laboratory and field surveys that there is an upper maximum limit for mercury concentrations in fish tissue. The maximum limit reported for freshwater fish from contaminated sites is in the order of 20 to 30 ug/g (ppm) on a fresh weight basis, however, concentrations are generally much lower.

The relevance of this information is to substantiate the potential upper historical levels of mercury predicted to occur in fish from the Poplar Creek - Watts Bar Reservoir system. The maximum predicted mercury levels in bluegill sunfish from that system was in the order of 1.5 ug/g (Blaylock et.al. no date). This upper predicted level is much lower than concentrations known to occur in freshwater fish collected from mercury contaminated areas.

Niimi *et al.* (1994) exposed subadult rainbow trout to various concentrations of both inorganic and organic mercury. Mercury concentrations differed substantially between tissues. The maximum individual muscle concentrations of mercury attained were 21 ug/g for exposure to inorganic mercury ($HgCl_2$) and 52 ug/g for exposure to methylmercury. Based on these and other laboratory data (Matida *et al.* 1971; McKim *et al.* 1976), the authors suggest that a body burden of 10-20 mg/kg Hg is lethal to fish. A body burden would equate to higher muscle tissue levels.

The Ontario Ministry of the Environment and Energy (MOEE) has undertaken long term monitoring programs of mercury in fish from contaminated waterways in Ontario including Lake St. Clair and Clay Lake on the Wabigoon-English River system. A review of those data revealed that the maximum mercury concentration reported was 24.0 ug/g in a walleye from Clay Lake during 1970. The population mean Hg in walleye from that sample (n = 274) was 12.1 (range 1.2-24.0 ug/g) (Parks et. al. 1984). A mercury concentration of 23.0 ug/g was reported in a muskellunge from Lake St. Clair during a 1971 survey (n = 8, range = 1.8 - 23.0; Table 7, Appendix A).

Fimreite and Reynolds (1973) also reported mercury levels in fish from the Wabigoon-English River system collected during 1970. The mean mercury levels reported by Fimreite and Reynolds (1973) are generally higher than those reported by the MOEE (Parks et. al. 1984). This can be explained by the generally larger fish sampled by Fimreite and Reynolds. The maximum species tissue mercury levels reported by Fimreite and Reynolds was 24.8 ug/g for Burbot from Clay Lake, 27.8 ug/g for northern pike from the Wabigoon River, and 19.6 μg/g for walleye from Clay Lake.

3. MERCURY CONCENTRATIONS IN BLUEGILL SUNFISH (*Lepomis macrochirus*)

The Oak Ridge Dose Reconstruction study utilizes bluegill sunfish for the fish exposure analysis. Blaylock et.al. (nd) estimated that the maximum mercury level that would have occurred in bluegill in the Watts Bar Reservoir was 1.5 ppm (ug/g) during the period 1956-1960. The value of 1.5 ug/g was estimated from predicted water and sediment mercury values for that time period.

Of possible relevance to the Oak Ridge reconstruction study are mercury levels recorded in bluegill sunfish from Lake St. Clair during the 1970's. The St. Clair River and Lake St. Clair were contaminated by mercury released from a chloralkali plant located in Sarnia, Ontario (Figure 1).

The discovery of mercury in the St. Clair River was made in approximately 1968, discharges to the environment ceased in 1970, which is the year that fish monitoring began by the Ontario Ministry of Environment and Energy (OMOEE). The maximum mercury level measured in a bluegill sunfish was 3.2 ug/g in 1970. The mean bluegill mercury concentration that year was 2.2 ug/g (Table 1).

Mercury levels in bluegill rapidly declined from a mean of 2.2 µg/g in 1970 to 0.49 µg/g in 1979, the last year that bluegill were collected. Mercury levels in pumpkinseed sunfish, a closely related species, declined to 0.22 by 1991 (Appendix A). The trend toward rapidly declining mercury levels in fish beginning shortly after discharges ceased was observed in all fish species examined (see Appendix A for data and figures).

Bluegill sunfish are not high in the food chain. Therefore, their tissue mercury levels would not generally be expected to be as high as larger predatory species such as walleye or northern pike. The food of bluegills generally consists of insects, crustaceans and plant material. Small fish and fish fry may also constitute a portion of their diet.

Table 1. Mercury Levels in Bluegill Sunfish from Lake St. Clair, Ontario

Year	Mercury (µg/g)		N
	Mean	Range	
1970	2.2	1.2-3.2	16
1971	1.2	0.69-1.5	9
1972	1.2	0.69-1.5	16
1973	0.62	0.17-1.5	194
1974	0.84	0.35-1.2	45
1975	0.74	0.71-0.80	4
1976	0.63	0.47-0.80	7
1979	0.49	--	--

unpublished data from the Ontario Ministry of the Environment

4. CASE STUDY: ST. CLAIR RIVER, ONTARIO

Large amounts of mercury were lost to the St. Clair River at Sarnia from a chloralkali plant then operated by Dow Chemicals. It was estimated that approximately 30 lbs (12kg) of elemental mercury was being discharged per day in 1969. A control order was placed on the plant in 1970 and releases were sharply curtailed, although releases did not completely stop after the control order was placed.

As a result of the discharges, mercury levels in sediments in the St. Clair River were elevated. Surveys beginning in 1968 revealed mercury concentrations in river sediments up to 1,700 ug/g (ppm) (Table 2). As a result of ceasing discharges, the average mercury level in river sediments declined, although concentrations above expected background levels persisted until 1990.

Lake St. Clair is approximately 50 km downstream of the point of mercury release into the receiving waters (Figure 1) and represents the major potential depositional area for sediments and associated substances. However, mercury levels in the downstream lake remained almost 100 times lower than in the river (Table 2) during the period immediately following substantive mercury loading (1970-1975).

Mercury levels in surface sediments of Lake St. Clair were elevated above background during the early 1970's, but appeared to level off to between 0.2 - 0.3 ug/g by about 1980.

The Ontario Ministry of Environment and Energy (OMOEE) began a fish monitoring program that measured mercury levels in several thousand fish in the area (Appendix A). Sampling concentrated on fish from Lake St. Clair with irregular sampling of fish in the St. Clair River. As a result of elevated mercury levels in the St. Clair river/lake system, commercial fishing was stopped, and severe restrictions were placed on consumption of sportfish.

We undertook extensive analysis of the fish and sediment mercury databases to examine trends and relationships. Sediment data prior to 1983 were not stored electronically and were retrieved from storage. Interestingly, mercury levels in fish from Lake St. Clair were better correlated ($r^2 = 0.78$, $n = 7$ for different years) to mercury in sediments from the river collected 35-45 km upstream, than to mercury in sediments ($r^2 = 0.42$) in Lake St. Clair itself (Figure 2).

This pattern, which was consistent for many species, is illustrated in Figure 2, showing the relationship between lake walleye to mercury in sediments from the lake (upper graph) and to mercury in sediments from the river (lower graph).

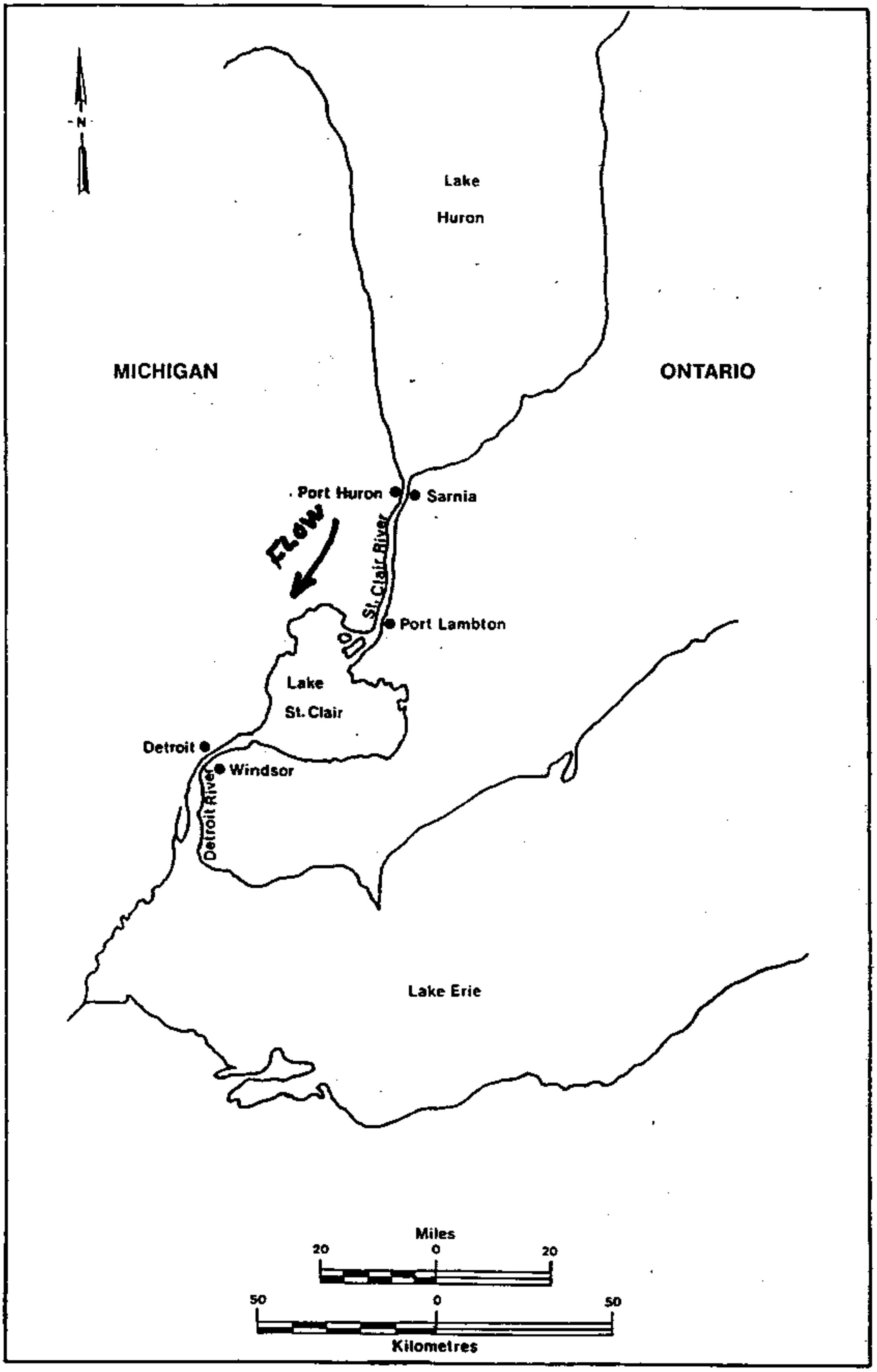


Figure 1. Location map of the St. Clair River.

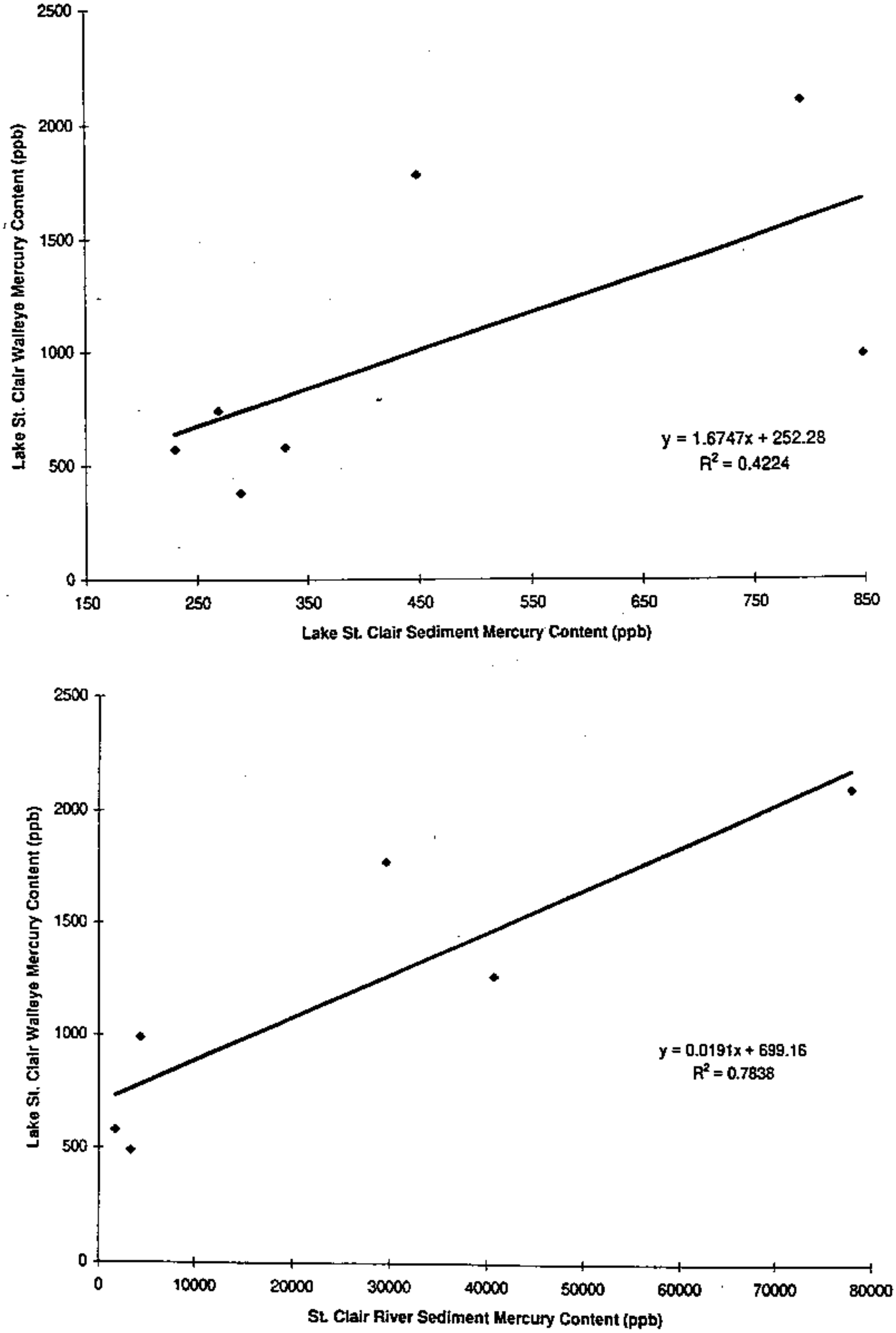


Figure 2. Relationship of Mercury Levels in Walleye from Lake St. Clair to Mercury in Sediments from **Lake** St. Clair (upper graph) and Sediments from St. Clair **River** (lower graph)

Table 2. Summary of Mercury Levels (µg/g) in Sediments from Lake St. Clair and St. Clair River, 1968-1993

Year	St. Clair River			Lake St. Clair		
	Mean	Range	N	Mean	Range	N
1968	240.8	0.8-1470	10			
1970	78.2	0.0-1700	151	0.79	0.01-8	187
1971	29.8	0.0-350	237	0.45	0.01-3	57
1972	40.9	0.0-170	48			
1975				0.53	0.05-1.5	4
1976				0.78	0.04-2.2	4
1977	4.4	0.0-58	19	0.85	0.03-1.9	10
1983				0.23	0.01-1.5	49
1985	3.4	0.0-51	49			
1987				0.29	0.01-1.4	38
1990	1.9	0.0-16	47	0.33	0.17-0.53	6
1992				0.19	0.01-0.58	29
1993				0.27	0.06-0.58	20

The data suggest that fish in the downstream lake reflected mercury concentrations available in water, rather than mercury in sediments. If mercury was being methylated from the upstream sediments into the water column, the downstream lake water may have been in equilibrium with the upstream sediments, rather than in equilibrium with the local sediments which contained much less mercury.

Therefore, if one attempted to predict mercury levels in fish in Lake St. Clair based on the lake sediment data (using relationship outlined in Section 6 below), the fish mercury levels would have been substantially underestimated.

The implication for the Oak Ridges study is that the mercury mass balance in the Watts Bar Reservoir and East Fork Poplar Creek should be carefully examined. The EFPC is diluted by the much larger Clinch River which would reduce concentrations of mercury in water of the reservoir further downstream.

5. RELATION OF FISH TO WATER MERCURY CONCENTRATION (CONCENTRATION FACTOR CF)

The ratio of fish mercury level to water mercury concentrations is termed the Concentration Ratio (CR). The estimated CR of mercury for bluegill sunfish from the Watts Bar Reservoir at Tennessee River Mile (TRM) 545 was 7500 (range 5000 - 11000) (Blaylock et. al. nd). Consistent use of units is important when calculating and comparing CF and CR values between studies. Blaylock et. al. generally use fish mercury in ug/g (ppm) and water mercury also in µg/g. Most studies however, report water mercury is µg/L (ppb), which is roughly equivalent to ng/g. The same ratios can be achieved if fish values are reported in ng/g (ppb) and water values in µg/L.

We found only two studies in the general literature that provided data on mercury levels in biota and water from field studies (Parks 1984; Hildebrand et. al. 1980). Those two studies contained data on mercury in five different taxa (crayfish, northern pike, yellow perch, rock bass and hog sucker). The biota mercury levels were plotted against mercury concentrations in water in Figure 3 (data provided Table B1, Appendix B).

Overall, there was a relatively good relationship between mercury and biota and mercury in water as described by the equation:

$$\text{Log biota Hg(ppb)} = 0.853 \text{ (log water Hg (ppt))} + 1.44, \quad r^2 = 0.576, p < 0.01$$

Within the two studies, the correlation between biota mercury levels and mercury levels in water was stronger for the data from the English-Wabigoon River system in northern Ontario (Parks et.al. 1984) compared with the relationship produced from data from Hildebrand et.al. (1980) from the North Fork Holston River in Virginia. Data from those studies are provided in Appendix B.

In a laboratory study, Niimi and Kissoon (1994) exposed subadult rainbow trout (20 g) to four concentrations each of inorganic mercury ($HgCl_2$) and methylmercury (CH_3HgCl) until death. Using relatively high water mercury concentrations produced an inverse relationship between tissue residue levels and water mercury concentrations.

There was a positive correlation between tissue mercury accumulation and death, supporting the concept of a critical body burden related to mortality. Mercury accumulation increased with increasing exposure, and since fish lived longer at lower doses, tissue residue levels were actually inversely related to water mercury concentration. This is illustrated by Figure 4 which compares the Concentration Factor for both inorganic and organic mercury versus water concentration.

Thus, there appear to be conflicting trends from the field and laboratory studies. However, the concentrations (doses) used by Niimi and Kissoon (1994) are substantially higher than levels reported in the field even from contaminated sites.

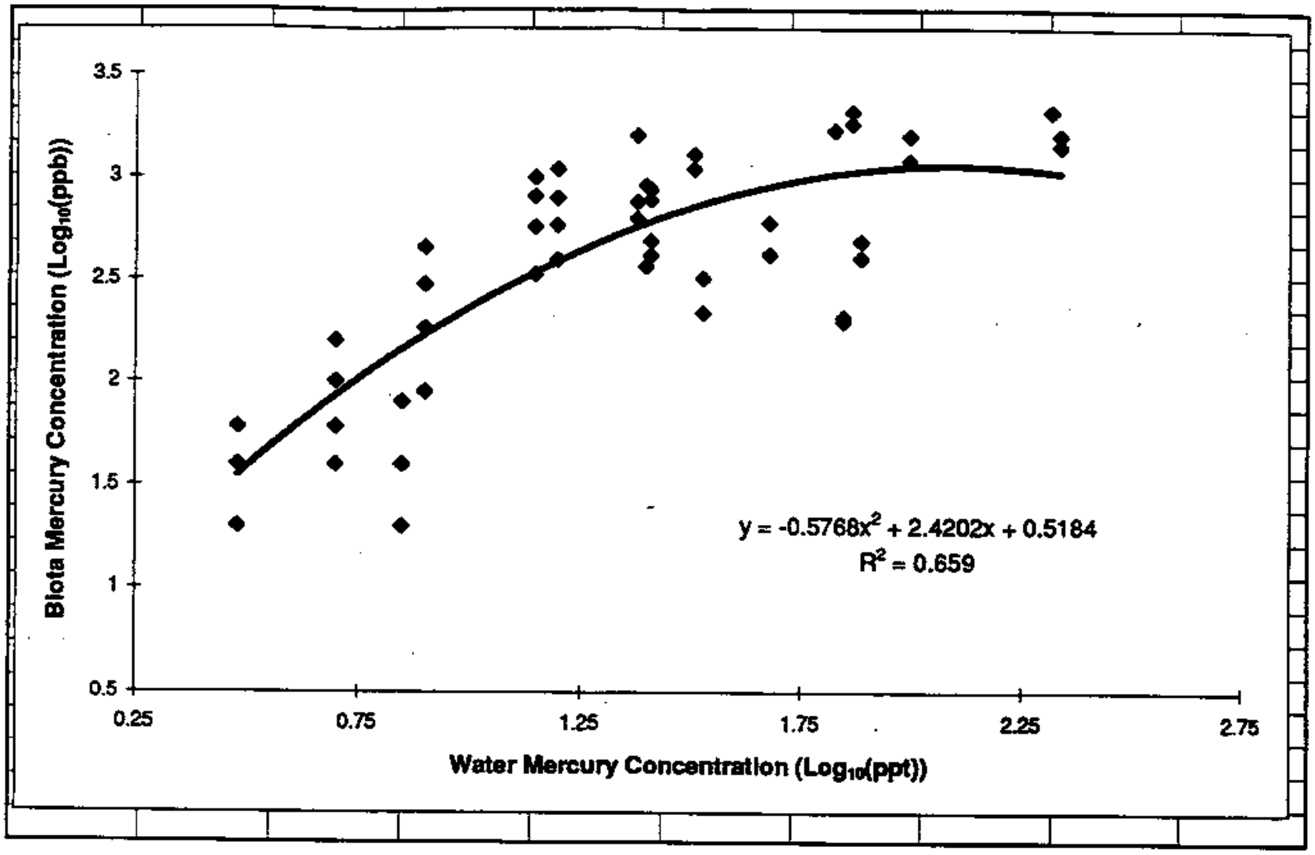


Figure 3a. Relationship of fish mercury concentration to water mercury (data from table B1).

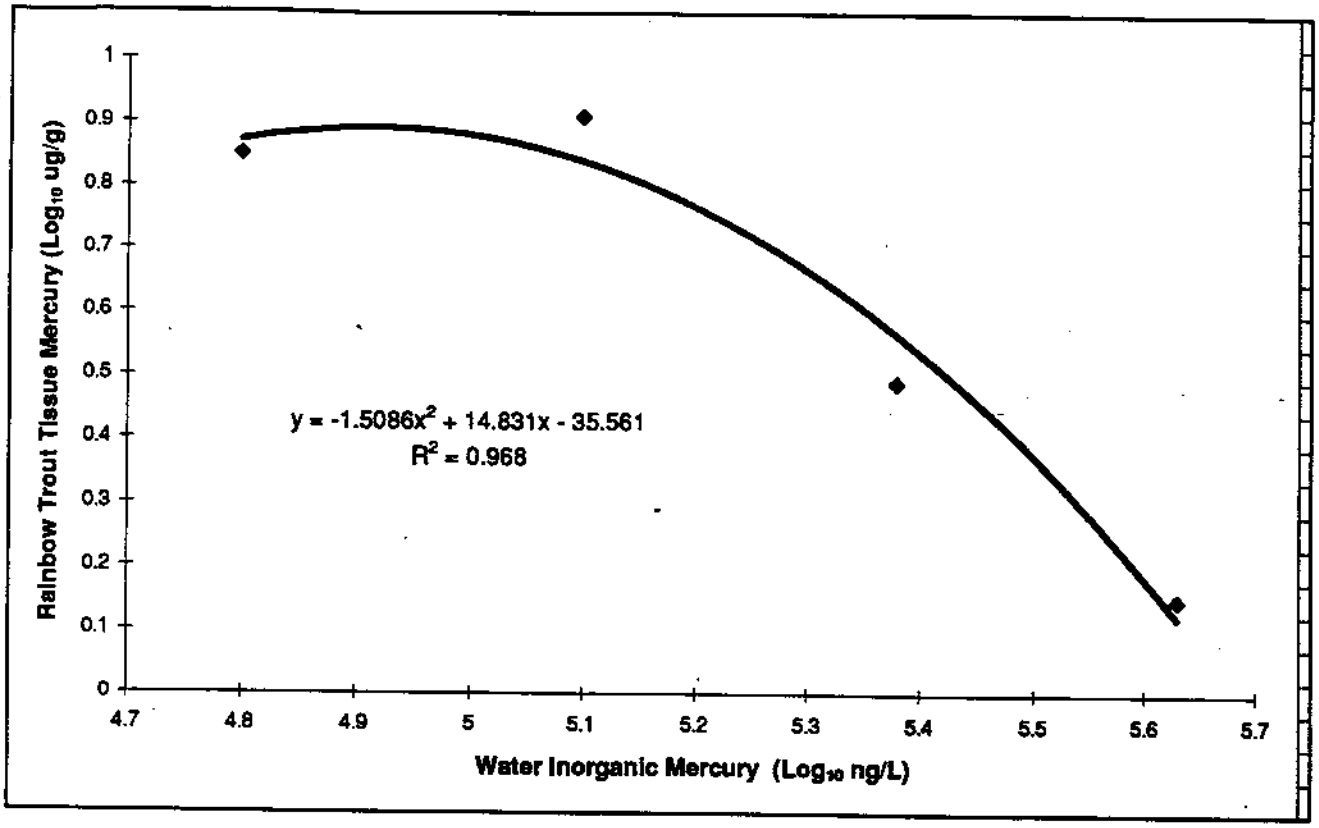
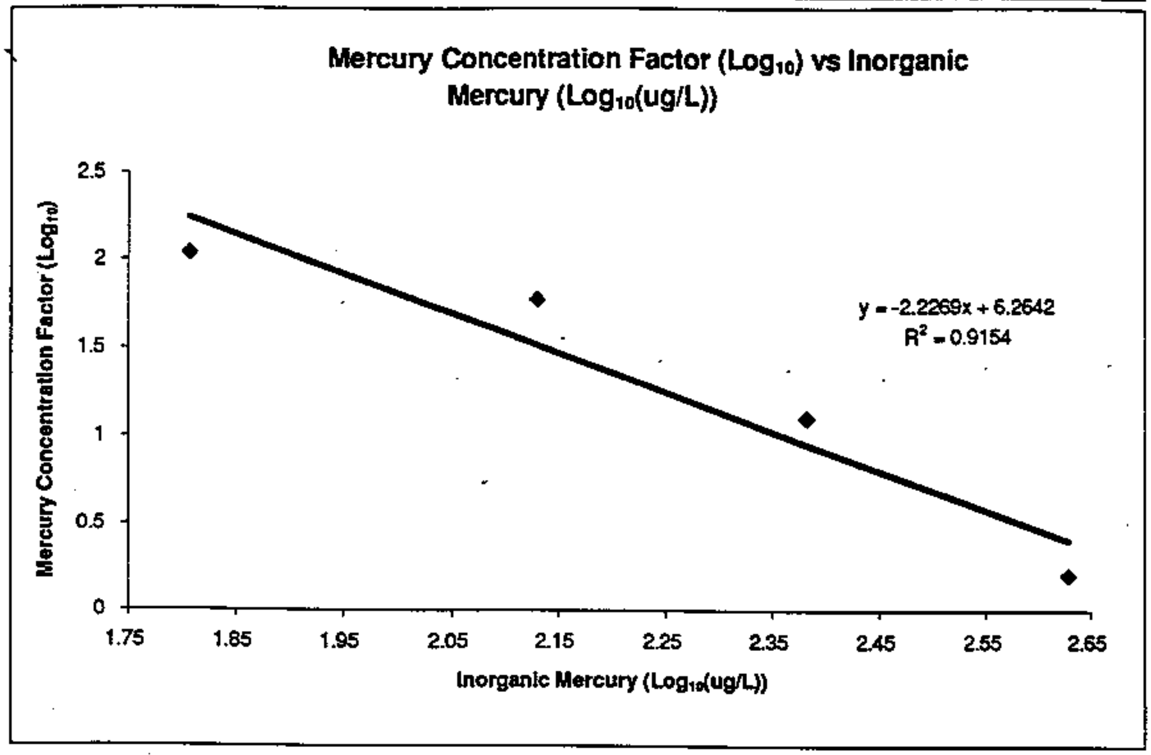
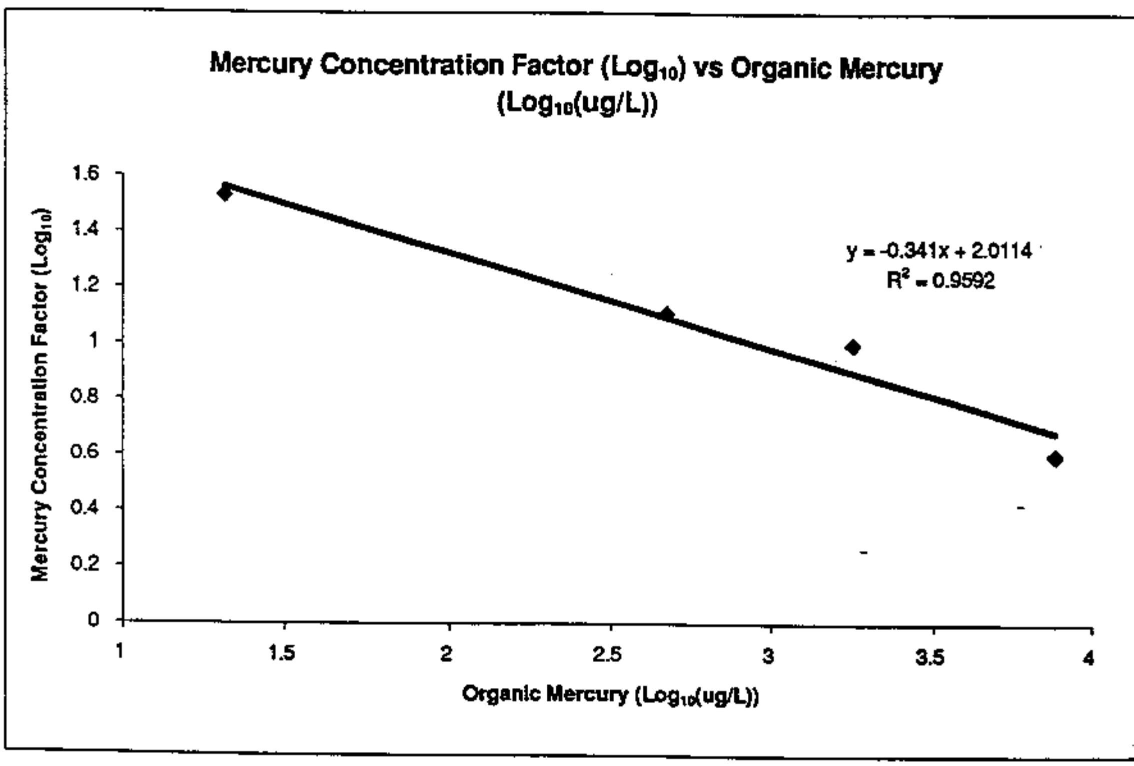


Figure 4a. Relationship of fish tissue mercury to inorganic mercury (data from Niimi and Kissoon 1994).





Niimi et. al., 1994

Figure 4. Mercury Concentration Factor in rainbow trout versus inorganic mercury (upper graph) and organic mercury (lower graph). data from Niimi and Kissoon (1994).

6. RELATION OF FISH TO SEDIMENT MERCURY CONCENTRATION (CONCENTRATION RATIO CR)

Several studies have examined the correlation between mercury levels in fish and mercury in sediments (Table 3). From Table 3 it is apparent that significant (positive) correlations between fish and sediment mercury are reported primarily at locations receiving direct anthropogenic input of mercury.

When data from three different studies are grouped, there is a strong correlation ($r^2 = 0.81$, $n = 61$) between mercury in biota and mercury levels in sediments (Figure 5). The data from the three different geographical areas used (Parks et.al. 1984; Hildebrand et.al. 1980; OMOEE unpubl. data) to generate Figure 5 are summarized in Appendix B (Table B2). Additional data are available from the St. Clair river system but only mercury concentrations for pike and perch were used to correspond with species used by Parks et. al. (1984).

The relationship between mercury in fish and mercury in sediments was highly significant ($p < 0.01$; $r^2 = 0.811$, $n = 61$) as described by the equation:

$$\log \text{fish Hg (ppb)} = 0.514 (\log \text{sediment Hg (ppb)}) + 1.096$$

Concentration Ratio (CR) is the term used by Blaylock et.al. to define the ratio fish mercury/sediment mercury concentrations. Concentration ratios for the data in Figure 5 were calculated and plotted against sediment mercury concentrations in Figure 6. It is apparent that the rate of mercury uptake by fish decreases as the sediment level increases. A similar relationship was developed for terrestrial plants and soil mercury concentrations (Bruce et. al. 1995). This may also suggest that the linear regression relationship between fish mercury and sediment mercury (eg. Figure 6) is more accurate for mid range sediment mercury levels (e.g. <50ppm).

Thus, relationships between fish mercury and sediment mercury from contaminated sites should be useful for reconstructing doses in the Oak Ridge study.

Blaylock et. al. used predicted water mercury concentrations to estimate historical mercury levels in fish. However, the water mercury concentrations were based on a dissociation constant (estimated) applied to sediment core data. This appears to introduce an extra, unnecessary, step in the dose reconstruction process.

Table 3. Summary of Studies That Examined Relation Between Mercury in Fish and Sediments

Location	Species	N[1]	Point Source[2]	Correlation[3]	Reference
Wabigoon-English R.	craylish perch pike	 8 8	yes	pos.	Parks, 1988
N. Fork Holston R.	hog sucker rockbass	11 9	yes yes	pos. - pos.	Hildebrand *et al.*, 1980
Wisconsin lakes	perch	10	no	pos.	Cope *et al.*, 1990
Upper Missouri basin	walleye	10	no	no	Phillips *et al.*, 1987
Flin Flon, Manitoba	pike white sucker	5	no[4]	neg.	McFarlane and Franzin, 1980
Flin Flon, Manitoba	pike white sucker	13	no[4]	neg.	Harrison and Klaverkamp, 1990
Upper Wisconsin R.	carp, walleye	6	yes[5]	no	Rada *et al.*, 1986
Ontario lakes	various	14	no	v[6]	Johnson, 1987
Swedish lakes	pike	1456	ND	v[6]	Hakanson *et al.*, 1988
Swedish lakes	perch	75	–	v[6]	Anderson and Hakanson, 1991
Ontario lakes	smallmouth bass walleye lake trout	66 44 43	no no no	no no no	Wren, 1988 " "
St. Clair system	perch walleye pike	6 7 6	yes yes yes	pos. pos. pos.	MOEE unpublished data Appendix A

Footnotes:

1 Number of co-occurring locations or years
2 Point source discharge of mercury into receiving waters
3 Pos = positive significant correlation
Neg = negative significant correlation
4 Near a base metal smelter
5 Point source ceased 20 years prior to fish survey
6 V = sediment Hg included as only 1 of several variables

ND = no data

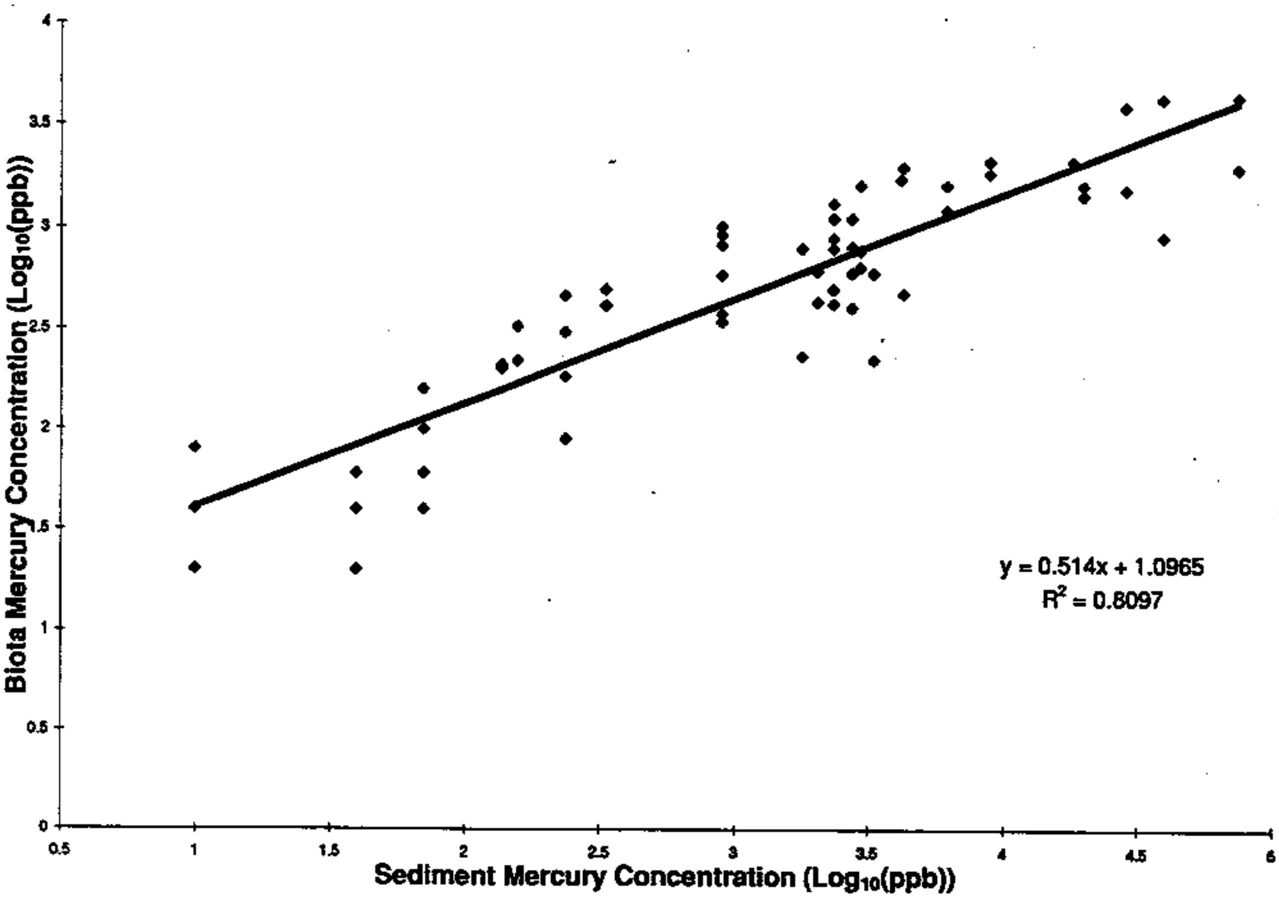


Figure 5. Relationship between Mercury Concentrations in Biota and Mercury in Sediments (data from Table B1)

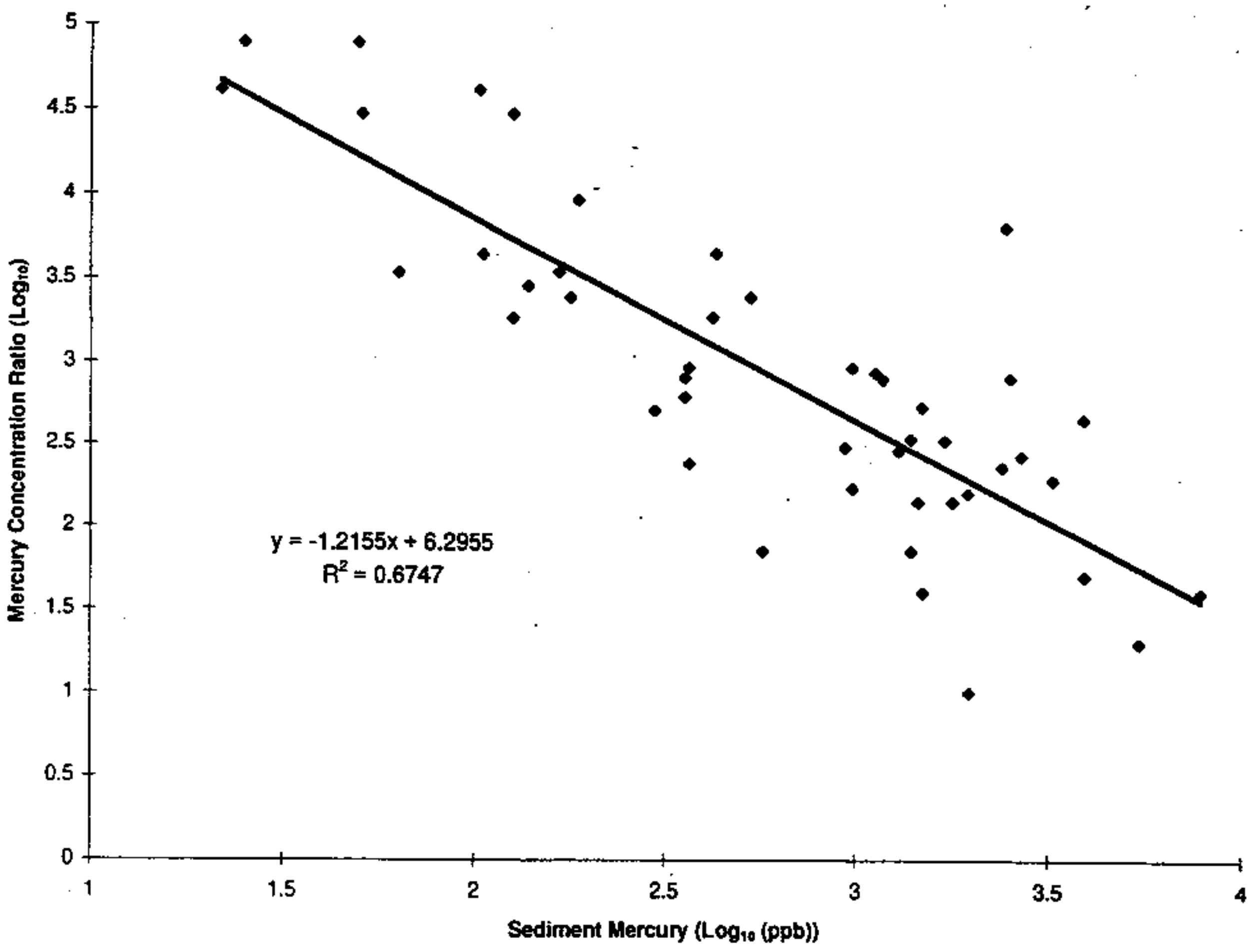


Figure 6. Relationship between Mercury Concentration in Sediments and the Fish/Sediment Concentration Ratio (CR)

7. MERCURY IN TURTLES

A number of studies have measured mercury levels in various groups of reptiles (Hall 1980), with some emphasis on turtles. The published information pertaining to mercury levels in turtles is not nearly as extensive as for fish, birds or mammals. The available data suggest that turtles do accumulate mercury, but not to very high levels, and it does not appear to be in proportion to ambient mercury loading. Therefore, turtles appear to have limited value as bioindicators of ambient mercury levels. In contrast, some species such as the common snapping turtle (*Chelhydra serpentina*) appear to be excellent indicators of environmental loading of organochlorine chemicals (Bishop et. al. 1991).

The following paragraph presents observations and data from studies that reported mercury levels in tissues collected from freshwater turtles.

In a review of chemical levels in reptiles, Hall (1980) reported very low levels of mercury (0.09 to 0.6 ug/g) in various species of reptiles surveyed. In a study of snapping turtles in Minnesota, Helwig and Hora (1983) reported that mercury levels were low (0.05 to 0.3 ug/g) in muscle tissue, even in areas subject to general industrial contamination where PCB levels were elevated in turtle tissue.

Galluzzi (1981; cited in Albers et. al. 1986) collected specimens of diamondback terrapins *(Malaclemys terrapin terrapin)* from the contaminated Hackensack Meadowlands in New Jersey. The author reported somewhat higher mercury levels in livers from two specimens (3.6, 7.6 ug/g) than reported elsewhere, but suggested that the tissue mercury levels did not reflect the extent of known mercury concentration in the contaminated area. Albers et. al. (1986) collected specimens of snapping turtles from the contaminated Hackensack Meadowlands as well as from a non-contaminated reference marsh in Maryland. Mercury levels in liver tissue of snapping turtles from the contaminated area were marginally higher (1.29 ug/g) than mercury levels in turtles from the reference area (0.90 ug/g). However, kidney mercury levels were not significantly different between the two areas, and the tissue mercury levels did not reflect mercury contamination of the Hackensack Meadowlands. Sediment mercury levels at Hackensack ranged to over 300 ug/g, while they were at background concentrations at the reference marsh.

Meyers-Schone et.al. (1993) collected snapping turtles and pond sliders (*Trachemys scripta*) from White Oak Lake on the U.S. Department of Energy Oak Ridge, Tennessee, property, and from a reference lake. Mercury levels in sediments of the White Oak Lake were in the range of 3.0 to 5.9 ug/g d.w., while sediment levels in the reference lake were "at background" (presumably < 0.3 ug/g). Mercury levels were higher in snapping turtles than in the predominantly vegetarian pond slider. Mercury levels were higher in turtles from White Oak Lake compared with the reference site but not remarkably higher. For example, kidney mercury levels from White Oak Lake and reference turtles were 1.3 ug/g and 0.34 ug/g, respectively, while mercury levels in muscle were 0.17 and 0.10 ug/g, respectively.

8. LITERATURE CITED

Albers, P.H., L. Sileo and B.M. Mulhern. 1986. Effects of Environmental Contaminants on Snapping Turtles of a Tidal Wetland. Arch. Environ. Contam. Toxicol. 15, 39-49.

Armstrong, F.A.J. and D.P. Scott. Decreases in mercury content of fishes in Ball Lake, Ontario since imposition of controls on mercury discharges. J. Fish. Res. Board Can. 36: 670-672.

Bishop, C.A., R.J. Brooks, J.H. Carey, P.Ng, R.J. Nortsrom and D.R. Lean. 1991. The case for a cause-effect linkage between environmental contamination and development in eggs of the common snapping turtle from Ontario, Canada. J. Toxicol. Environ. Health. 33:521-547.

Blaylock, B.G., M.L. Frank, C.R. Olson and R.R. Turner. no date. Estimation of the concentration of mercury in bluegill (*Lepomis macrochirus*) in the Lower End Watts Bar Reservoir from 1946 to 1988 and potential health risks to humans. Unpublished manuscript. Chemrisk Document 1314. 24 pp + Append.

Bruce, G.M., S.M. Flack and T.R. Mongan. 1995. Initial Task 2 Progress Report. Oak Ridge Dose Reconstruction. Prepared for Tennessee Department of Health. Chemrisk. 88 pp + Append.

Cope, W.G., J.G. Wiener and R.G. Rada. 1990. Mercury accumulation in yellow perch in Wisconsin seepage lakes: relation to lake characteristics. Environ. Toxicol. Chem. 9: 931- 940.

Fimreite, N. and L.M. Reynolds. 1973. Mercury contamination of fish in northwestern Ontario. J. Wild. Manage. 37(1): 62-68.

Galluzzi, P. 1981. Mercury concentrations in mammals, reptiles, birds and waterfowl collected in the Hackensack Meadowlands. New Jersey. In: New Jersey Academy of Sciences. Rutgers University, Piscataway, NJ. pp 1-24.

Gillespie, D.C. 1972. Mobilization of mercury from sediments into guppies (*Poecilia reticulata)*. J. Fish. Res. Bd. Canada 29:1035-1041.

Government of Canada/Government of Ontario. 1984. Mercury pollution in the Wabigoon-English River system in Northwestern Ontario and possible remedial options. Technical Report ISBN 0-662-13099-5. 538 pp.

Hakonson, L. 1980. The quantitative impact of pH, bioproduction and Hg-contamination on the Hg-content of fish (pike). Envir. Pollut. (Series B):285-304.

Hakonson, L. A. Nilsson and T. Andersson. 1988. Mercury in fish in Swedish lakes. Environ. Pollut. 49:145-162.

Hall, R.J. 1980. Effects on Environmental Contaminants on Reptiles: A Review. United States Department of the Interior, Fish and Wildlife Service. Special Scientific Report - Wildlife No. 228, Washington, D.C.

Harris, R. and W. J. Snodgrass. 1992. A mechanistic mercury model for aquatic systems. A discussion of mercury cycling based on application of the model to three systems. Abstract from Proc. of the International Conference on mercury as a Global Pollutant. Monterey, California. 1992. USEPA and EPRI.

Harrison, S.E. and J.F. Klaverkamp. 1990. Metal contamination in liver and muscle of northern pike (*Esox lucius*) and white sucker (*Catostomus commersoni)* and in sediments from lakes near the smelter at Flin Flon, Manitoba. Environmental Toxicology and Chemistry. Vol. 9, pp.941-956.

Helwig, D.D. and M.E. Hora. 1983. Polychlorinated Biphenyl, Mercury and Cadmium Concentrations in Minnesota Snapping Turtles. Bull. Environ. Contam. Toxicol. 30, 186-190.

Hildebrand, S.G. R. H. Strand and J. Huckabee. 1980. Mercury accumulation in fish and invertebrates of the north fork Holston River. J. Environ. Quality. 9(3): 393-400.

Jernelov, A. and H. Lann. 1973. Studies in Sweden on feasibility of some methods for restoration of mercury contaminated bodies of water. Environ. Sci. Technol. &:712-715.

Johnson, M.G. 1987. Trace element loading to sediments of fourteen Ontario lakes and correlations with concentrations in fish. Can. J. Fish. Aq. Sci. 44:3-13.

Lodenius, M. 1991. Mercury Concentrations in an Aquatic Ecosystem During Twenty Years Following Abatement the Pollution Source. Water, Air and Soil Pollut. 56:323-332.

Matida, Y. et. al. 1971. Toxicity of mercury compounds to aquatic organisms and accumulation of the compounds by the organisms. Bull. Freshw. Fish. Res. Lab. 21:197-227.

McFarlane, G.A. and W.G. Franzin. 1980. An examination of Cd, Cu and Hg concentrations in livers of northern pike, *Esox lucius*, and white sucker, *Catostomus commersoni*, from five lakes near a base metal smelter at Flin Flon, Manitoba. Can. J. Fish. Aquat. Sci. 37:1573-1578.

McKim, J.M. et. al. 1976. Long term effects of methylmercuric chloride on three generations of brook trout: toxicity, accumulation , distribution and elimination. J. Fish. Res. Board Can. 33:2726-2739.

Meyers-Schöne, L., L.R. Shugart, J.J. Beauchamp and B.T. Walton. 1993. Comparison of Two Freshwater Turtle Species as Monitors of Radionuclide and Chemical

Contamination: DNA Damage and Residue Analysis. Environ. Toxicol. and Chemistry. Vol.12, pp. 1487-1496.

Niimi, A.J. and G.P. Kissoon. 1994. Evaluation of the critical body burden concept based on inorganic and organic mercury toxicity to rainbow trout. Arch. Environ. Contam. Toxicol. 26:169-178.

Olsson, M. 1976. Mercury levels in biota from the Morrum River during a 10 year clean-up period.

Parks, J.W. 1988. Selected ecosystem relationships in the mercury contaminated Wabigoon-English river system, Canada, and their underlying causes. Water, Air Soil Pollut. 42: 267-279.

Phillips, G.R. et. al. 1987. Factors affecting the mobilization, transport and bioavailability of mercury in reservoirs of the Upper Missouri River basin. United States Dept. of the Interior. Fish and Wildlife Service Tech. Rep. 10. Washington, 64 p.

Rada, R.G., J.E. Findley and J.G. Wiener. 1986. Environmental fate of mercury discharged into the upper Wisconsin River. Water Air Soil Pollut. 29:57-76.

Rodgers, D.W. 1994. You are what you eat and a little bit more: Bioenergetics-based models of methylmercury accumulation in fish revisited. *In: Mercury Pollution - Integration and synthesis.* C. J. Watras and J. Huckabee (ed). pp. 427-440. Proc. from papers presented at the International Conference on mercury as a Global Pollutant. Monterey, California. 1992. Lewis Publishers.

Sorenson, J.A. et. al. 1990. Airborne mercury deposition and watershed characteristics in relation to mercury concentrations in water, sediments, plankton and fish of eighty northern Minnesota lakes. Environ. Sci. Technol. 24(11):1716-1727.

Southworth, G.R., R.R. Turner, M.J. Peterson and M.A. Bogle. 1995. Form of Mercury in Stream Fish Exposed to High Concentrations of Dissolved Inorganic Mercury. Chemosphere, Vol.30, No.4, 779-787.

Suns, K., Hitchin, G., Loescher, B., Pastorek, E. and Pearce, R. 1987. Metal accumulation in fishes from Muskoka-Haliburton lakes in Ontario (1978-1984). Ont. Min. Envir. Tech. Rep.

Watras, C.J., K.A. Morrison and N.S. Bloom. 1995. Chemical Correlates of Hg and Methyl-Hg in Northern Wisconsin Lake Waters Under Ice-Cover. Water, Air and Soil Pollut. 84: 253-267.

Wheatley, B., A. Barbeau and T.W. Clarkson. 1979. Methylmercury poisoning in Canadian Indians -- the elusive diagnosis. Can. J. Neurological Sciences. 6: 417-422.

Wobeser, G.A. and M. Swift. 1976. Mercury poisoning in a wild mink. J. of Wildlife Diseases. 12(3):335-340.

Wren, C.D. 1985. Probable case of mercury poisoning in a wild otter in northwestern Ontario. Can. Field Naturalist 99:112-114.

Wren, C.D. and P.M. Stokes. 1988. Depressed mercury levels in biota from acid and metal stressed lakes near Sudbury, Ontario. Ambio. 17:28-30.

Wright, D.A., P.M. Welbourn and A.V.M. Martin. 1991. Inorganic and Organic Mercury Uptake and Loss by the Crayfish *Orconectes Propinquus*. Water, Air and Soil Pollut. 56: 697-707.

APPENDIX A

Sediment and Fish Mercury Data from Lake St. Clair

1976 LAKE ST. CLAIR FISH MERCURY LEVELS

TABLE 2

SPECIES	N	MERCURY CONCENTRATION (ppm) MEAN	RANGE	% > =0.5ppm	LENGTH (cm) MEAN	RANGE	WEIGHT (g MEAN	R
BLACK CRAPPIE	48	0.69	0.22-2.0	63	23.3	18.0-28.4	258	10(
BLUEGILL	7	0.63	0.47-0.80	71	19.3	15.6-21.8	197	108
CARP	104	0.79	0.16-1.5	76	53.8	33.5-75.4	3434	835
CHANNEL CATFISH	56	0.77	0.35-1.9	82	53.1	22.3-67.8	22	20(
LARGEMOUTH BASS	16	1.3	0.89-2.1	100	32.0	22.9-39.6	596	204
MUSKELLUNGE	4	0.79	0.24-1.8	50	80.7	74.4-97.3	4629	3343
PIKE	50	1.6	0.20-3.8	92	68.4	45.4-91.9	2393	596
PUMPKINSEED	4	0.57	0.35-0.77	75	18.8	17.0-20.0	175	134
ROCK BASS	80	1.1	0.17-2.2	88	20.9	14.4-25.9	213	63
SMALLMOUTH BASS	28	1.2	0.11-2.9	96	35.1	17.6-46.3	802	153
WALLEYE	246	0.93	0.11-3.0	66	47.3	27.4-70.6	1273	205
WHITE BASS	61	0.91	0.10-2.0	77	31.5	20.9-44.3	617	154
WHITE SUCKER	24	0.83	0.06-1.9	70	42.5	34.6-49.9	1108	58(
YELLOW PERCH	14	0.98	0.11-2.9	71	22.4	17.7-26.5	159	7(

1975 LAKE ST. CLAIR FISH MERCURY LEVELS

TABLE 3

		MERCURY CONCENTRATION (ppm)			LENGTH (cm)		WEIGHT (g)	
SPECIES	N	MEAN	RANGE	%> = 0.5ppm	MEAN	RANGE	MEAN	RAN
BLACK CRAPPIE	30	0.48	0.16-0.98	40	23	20-25	-	-
BLUEGILL	4	0.74	0.71-0.80	100	20	18-20	-	-
CARP	33	0.57	0.14-1.0	61	50	41-56	-	-
CHANNEL CATFISH	82	0.65	0.18-1.7	57	46	33-56	-	-
FRESHWATER DRUM	29	0.79	0.23-1.5	83	31	23-43	-	-
GAR PIKE	1	4.10	-	-	69	-	-	-
GIZZARD SHAD	1	0.08	-	-	36	-	-	-
MOONEYE	3	0.47	0.38-0.61	33	31	30-33	-	-
MUSKELLUNGE	4	1.5	0.65-3.7	100	90	76-109	-	-
PIKE	4	1.8	0.88-2.2	100	73	66-79	-	-
QUILLBACK CARPSUCKER	22	0.38	0.09-1.3	27	41	36-48	-	-
REDHORSE SUCKER	20	1.1	0.21-2.4	75	43	36-56	-	-
ROCK BASS	33	0.83	0.45-1.7	97	20	15-25	-	-
WALLEYE	69	0.81	0.16-1.9	73	44	33-53	-	-
WHITE BASS	48	0.70	0.13-1.6	75	28	23-33	-	-
WHITE SUCKER	33	0.78	0.13-2.1	79	45	36-53	-	-
YELLOW PERCH	22	0.59	0.23-1.5	36	22	18-25	-	-

TABLE 4

1974 LAKE ST. CLAIR FISH MERCURY LEVELS

		MERCURY CONCENTRATION (ppm)			LENGTH (cm)		WEIGHT (g)
SPECIES	N	MEAN	RANGE	%>= 0.5 ppm	MEAN	RANGE	MEAN
BLACK CRAPPIE	67	0.89	0.17-3.7	76	23.0	13.0-29.5	247
BLUEGILL	45	0.84	0.35-1.2	87	19.2	12.3-23.0	191
BROWN BULLHEAD	2	1.0	0.97-1.1	100	32.3	31.9-32.7	436
CARP	67	0.69	0.09-1.5	70	48.0	37.5-83.3	2448
CHANNEL CATFISH	59	0.93	0.24-3.5	80	48.2	26.4-65.5	1752
FRESHWATER DRUM	62	0.64	0.08-4.1	48	28.5	19.5-47.5	297
LARGEMOUTH BASS	19	2.0	0.52-4.7	100	32.5	18.7-41.8	567
PIKE	50	2.5	0.90-6.8	100	74.1	46.7-92.7	2866
PUMPKINSEED	74	0.57	0.19-1.2	58	17.6	13.5-20.9	158
QUILLBACK CARPBUCKER	26	0.72	0.09-1.8	50	39.2	33.6-43.9	1378
REDHORSE SUCKER	51	0.92	0.12-2.2	69	37.8	23.3-55.3	899
ROCK BASS	69	1.1	0.22-2.4	93	20.2	13.4-28.0	191
SMALLMOUTH BASS	45	1.5	0.55-4.8	100	35.0	17.5-47.8	800
WALLEYE	590	0.98	0.10-3.2	78	41.8	14.3-67.7	959
WHITE BASS	70	0.79	0.19-2.2	60	26.4	19.9-34.7	354
WHITE CRAPPIE	2	0.23	0.17-0.29	0	24.8	23.0-26.5	234
WHITE SUCKER	51	0.93	0.11-2.1	73	40.8	27.6-50.2	900
YELLOW PERCH	259	0.36	0.08-1.68	23	17.0	5.5-28.2	87

TABLE 5

1973 LAKE ST. CLAIR FISH MERCURY LEVELS

SPECIES	N	MERCURY CONCENTRATION (ppm) MEAN	RANGE	%>= 0.5 ppm	LENGTH (cm) MEAN	RANGE	WEIGHT (g) MEAN	RAN
ALEWIFE	69	0.13	0.04-0.37	0	12.9	5.7-16.5	24	2-
BLACK CRAPPIE	162	0.61	0.06-2.6	57	18.1	5.3-33.5	142	5-
BLUEGILL	194	0.62	0.17-1.5	53	14.0	3.0-22.0	101	2-
BOWFIN	4	2.7	1.1 -4.5	100	51.9	45.5-60.0	1343	870-
BROOK SILVERSIDES	27	0.16	0.11-0.26	0	6.5	6.1- 7.0	1	1-
BROWN BULLHEAD	109	0.95	0.17-2.3	88	30.7	21.0-37.0	455	205-
CARP	105	0.91	0.12-2.6	83	50.1	28.0-74.0	2750	425-
CHANNEL CATFISH	100	0.97	0.37-2.5	96	50.8	30.5-66.5	1864	320-
EMERALD SHINER	48	0.23	0.12-0.43	0	7.7	5.0- 9.6	5	1-
FRESHWATER DRUM	102	0.84	0.14-2.5	75	31.7	18.0-56.0	431	65-
GAR PIKE	4	1.7	0.09-4.4	50	51.2	44.2-61.5	219	120-
GIZZARD SHAD	9	0.09	0.05-0.12	0	24.5	3.7-34.0	366	1-
GOLDEN SHINER	63	0.29	0.11-0.59	10	8.3	5.5-11.5	7	1-
LARGEMOUTH BASS	46	1.1	0.08-3.1	67	23.9	4.0-43.0	396	1-
MOONEYE	26	0.26	0.18-0.42	0	14.5	11.2-29.0	50	14-
MUSKELLUNGE	4	4.4	1.1 -8.5	100	85.9	73.5-91.0	5434	2860-
PIKE	101	2.5	0.30-6.5	97	65.6	27.3-92.5	2082	132-
PUMPKINSEED	136	0.68	0.13-1.6	70	15.5	7.5-20.5	117	10-
QUILLBACK CARPSUCKER	39	0.97	0.06-3.2	74	38.4	9.5-48	1325	8-
REDHORSE SUCKER	51	1.2	0.08-6.6	73	37.6	26.5-60.0	902	290-

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1973 LAKE ST. CLAIR FISH MERCURY LEVELS

TABLE 5 (Cont'd)

SPECIES	MERCURY CONCENTRATION (ppm) N	MEAN	RANGE	%>=0.5ppm	LENGTH (cm) MEAN	RANGE	WEIGHT (g) MEAN	
ROCK BASS	112	1.1	0.23-3.8	90	19.5	9.1-27.0	179	1
SMALLMOUTH BASS	66	1.4	0.43-3.5	94	33.2	22.5-49.5	738	21
SPOTTAIL SHINER	67	0.37	0.12-0.62	6	8.4	4.4-11.0	8	
TROUT PERCH	10	0.25	0.14-0.50	10	6.7	5.7- 9.0	4	
WALLEYE	291	1.1	0.13-5.0	80	40.2	13.0-67.5	853	2
WHITE BASS	99	1.2	0.19-2.0	86	27.3	10.5-33.5	406	1
WHITE CRAPPIE	10	0.32	0.07-1.2	20	11.2	5.6-24.0	46	
WHITE SUCKER	51	1.2	0.22-3.1	82	40.8	7.8-49.0	979	
YELLOW PERCH	375	0.45	0.08-2.1	30	16.2	6.6-29.0	69	

1972 LAKE ST. CLAIR FISH MERCURY LEVELS

TABLE 6

		MERCURY CONCENTRATION (ppm)			LENGTH (cm)		WEIGHT (g)	
SPECIES	N	MEAN	RANGE	%>= 0.5 ppm	MEAN	RANGE	MEAN	
BLACK CRAPPIE	39	1.1	0.23- 2.6	77	19.9	11.0-29.5	177	20-
BLUEGILL	16	1.2	0.69- 1.5	100	17.9	15.0-20.5	153	90-
BOWFIN	17	4.2	0.52-10.0	100	52.9	39.2-59.0	1407	535-
BROWN BULLHEAD	6	1.1	0.58-1.5	100	31.2	27.2-35.2	435	275-
BURBOT	2	4.1	3.3 -4.8	100	64.4	58.7-70.0	1933	1315-
CARP	31	1.1	0.31-2.3	84	49.7	36.5-60.4	2657	1035-
CHANNEL CATFISH	63	1.3	0.53-2.8	100	50.2	42.8-61.7	1781	910-
FRESHWATER DRUM	47	0.69	0.05-1.9	62	29.1	18.6-49.8	322	50-
LARGEMOUTH BASS	12	2.7	0.66-6.8	100	31.6	23.5-41.2	606	210-
MUSKELLUNGE	1	5.0	-	-	76.7	-	3970	
PIKE	38	4.3	2.3 -9.9	100	71.3	56.0-85.2	2479	1080
PUMPKINSEED	49	1.2	0.21-2.8	94	16.8	10.1-20.5	142	30
QUILLBACK CARPSUCKER	7	1.5	0.3 -3.8	71	39.6	33.1-45.0	1542	925
REDHORSE SUCKER	30	1.7	0.07-9.1	83	37.4	27.2-55.4	913	310
ROCK BASS	315	1.9	0.22-5.7	99	18.9	11.6-27.5	163	30
SMALLMOUTH BASS	87	2.4	0.30-6.7	99	33.4	19.5-48.2	696	115
WALLEYE	436	1.3	0.13-7.1	83	33.5	12.2-68.5	581	15
WHITE BASS	55	2.0	0.34-5.5	93	28.1	20.0-37.3	430	120
WHITE SUCKER	36	1.4	0.25-4.0	92	41.8	34.5-39.8	1033	585
YELLOW PERCH	357	0.9	0.05-3.3	67	17.9	5.0-28.9	87	

TABLE 7

1971 LAKE ST. CLAIR FISH MERCURY LEVELS

SPECIES	N	MERCURY CONCENTRATION (ppm) MEAN	RANGE	%>=0.5ppm	LENGTH (cm) MEAN	RANGE	WEIGHT (g) MEAN	RAN
BLUEGILL	9	1.2	0.69- 1.5	100	17.5	15.0-18.8	141	90-1
BOWFIN	13	6.0	0.75-11.6	100	53.7	39.2-65.5	1532	535-2
BROWN BULLHEAD	8	1.7	1.1 - 2.9	100	29.7	25.7-32.9	371	210-5
CARP	29	1.7	0.30- 3.3	93	48.6	30.0-58.2	2436	550-4
CHANNEL CATFISH	13	1.5	0.76- 2.8	100	52.0	48.3-56.2	2026	1350-2
FRESHWATER DRUM	30	1.3	0.18- 3.6	90	32.6	21.2-41.5	459	105-1
GIZZARD SHAD	3	0.16	0.04- 0.28	0	13.3	12.0-15.0	31	18-4
LARGEMOUTH BASS	1	3.2	-	-	30.1	-	490	-
MUSKELLUNGE	8	7.1	1.8 -23.0	100	91.3	71.5-116.5	6639	2930-
PIKE	43	3.9	0.29- 8.5	98	66.0	50.4-85.5	2155	905-
PUMPKINSEED	6	1.7	1.4 - 2.3	100	14.1	10.1-18.7	88	30-
ROCK BASS	40	3.10	1.4 - 6.3	100	20.4	14.5-25.2	211	80-
SMALLMOUTH BASS	79	3.3	1.1 - 7.2	100	32.8	19.9-39.9	670	130-
WALLEYE	350	1.8	0.13-13.1	96	35.1	15.0-63.1	599	38-
WHITE BASS	1	1.4	-	-	28.0	-	430	
YELLOW PERCH	70	1.5	0.13- 3.5	90	16.0	6.8-31.2	99	4-

1970 LAKE ST. CLAIR FISH MERCURY LEVELS

TABLE 8

		MERCURY CONCENTRATION (ppm)			LENGTH (cm)		WEIGHT (g)	
SPECIES	N	MEAN	RANGE	%>= 0.5 ppm	MEAN	RANGE	MEAN	
ALEWIFE	8	0.34	0.27-0.43	0	8.0	8.0- 8.0	5	5
BLACK CRAPPIE	25	3.3	1.0 -6.1	100	22.8	16.1-28.4	231	61
BLUEGILL	16	2.2	1.2 -3.2	100	14.7	11.3-19.8	88	25
BOWFIN	1	9.9	-	-	59.0	-	2000	
BROWN BULLHEAD	4	2.8	0.51-4.5	100	29.9	28.2-32.0	325	260
CARP	18	1.5	0.27-4.2	78	48.9	34.0-73.5	2323	680
CHANNEL CATFISH	56	1.1	0.33-3.0	86	36.2	15.4-56.7	1273	50
FRESHWATER DRUM	9	1.3	0.49-2.0	89	27.2	21.0-34.0	259	100
LARGEMOUTH BASS	2	3.9	2.9 -4.9	100	35.7	32.8-38.6	785	570
MUSKELLUNGE	7	4.3	1.7 -7.6	100	69.3	51.4-95.8	2449	700
PIKE	29	4.4	0.61-9.9	100	63.6	43.0-82.8	1932	500
PUMPKINSEED	29	2.1	0.68-4.7	100	18.2	17.1-20.0	170	105
QUILLBACK CARPSUCKER	4	2.3	1.3 -4.1	100	39.5	37.5-42.5	1329	118[illegible]
REDHORSE SUCKER	1	6.3	-	-	41.5	-	737	-
ROCK BASS	35	3.4	0.97-10.7	100	19.8	12.6-29.7	185	41
SMALLMOUTH BASS	30	3.0	1.0 - 6.9	100	32.3	22.0-44.0	625	22[illegible]
STURGEON	1	0.51	-	-	67.3	-	2310	
WALLEYE	615	2.1	0.23-14.0	99	34.9	11.7-65.0	640	1[illegible]
WHITE BASS	59	2.2	0.47- 5.7	98	25.7	11.5-33.4	314	21
YELLOW PERCH	245	1.9	0.02- 8.2	96	21.2	11.7-31.5	136	.8

Figure _._ Mean Annual Mercury Concentrations (ppm) for Lake St. Clair Fish from 1970 - 1993

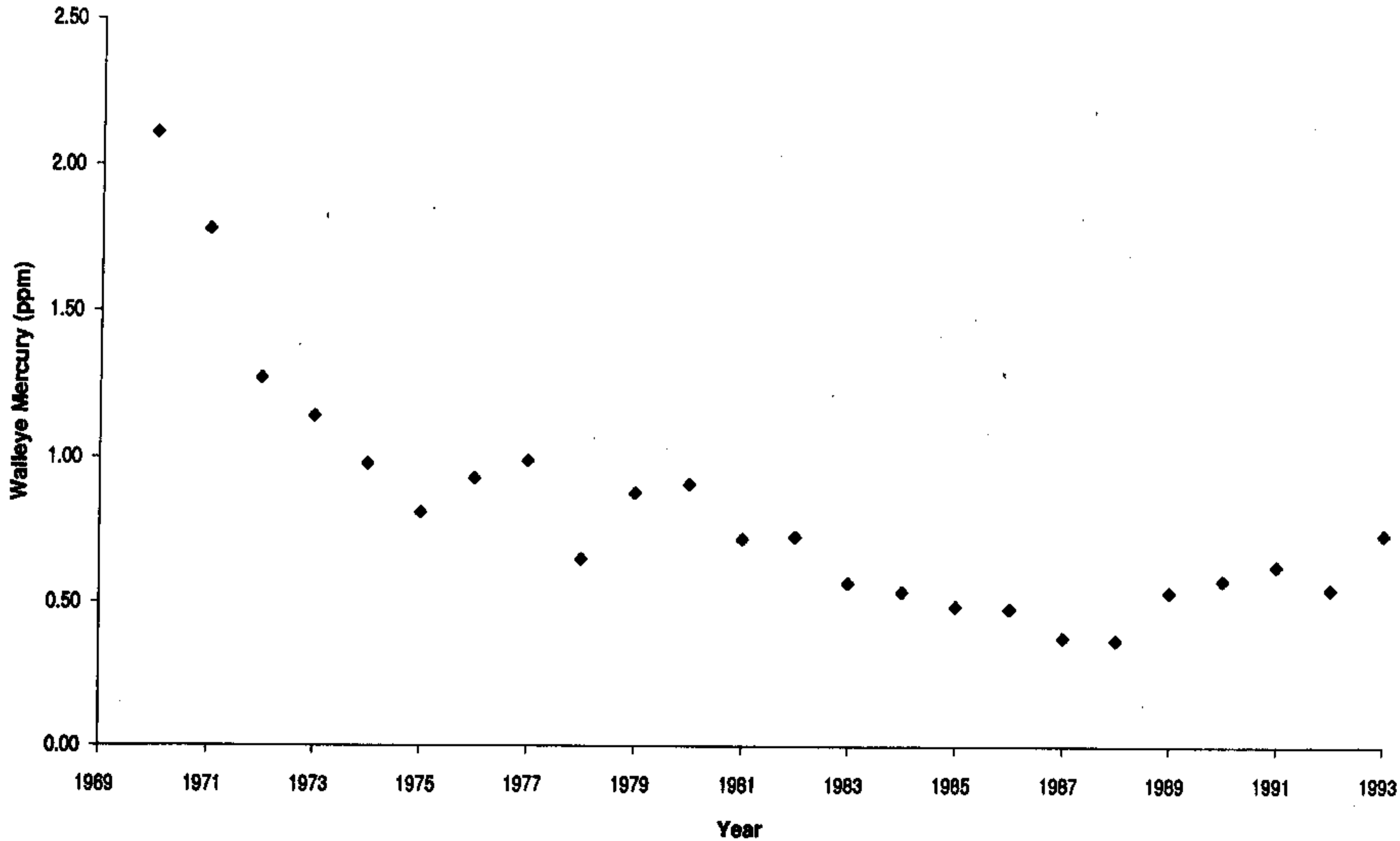


Figure _._ Mean Annual Mercury Concentrations (ppm) for Lake St. Clair Fish from 1970 - 1993

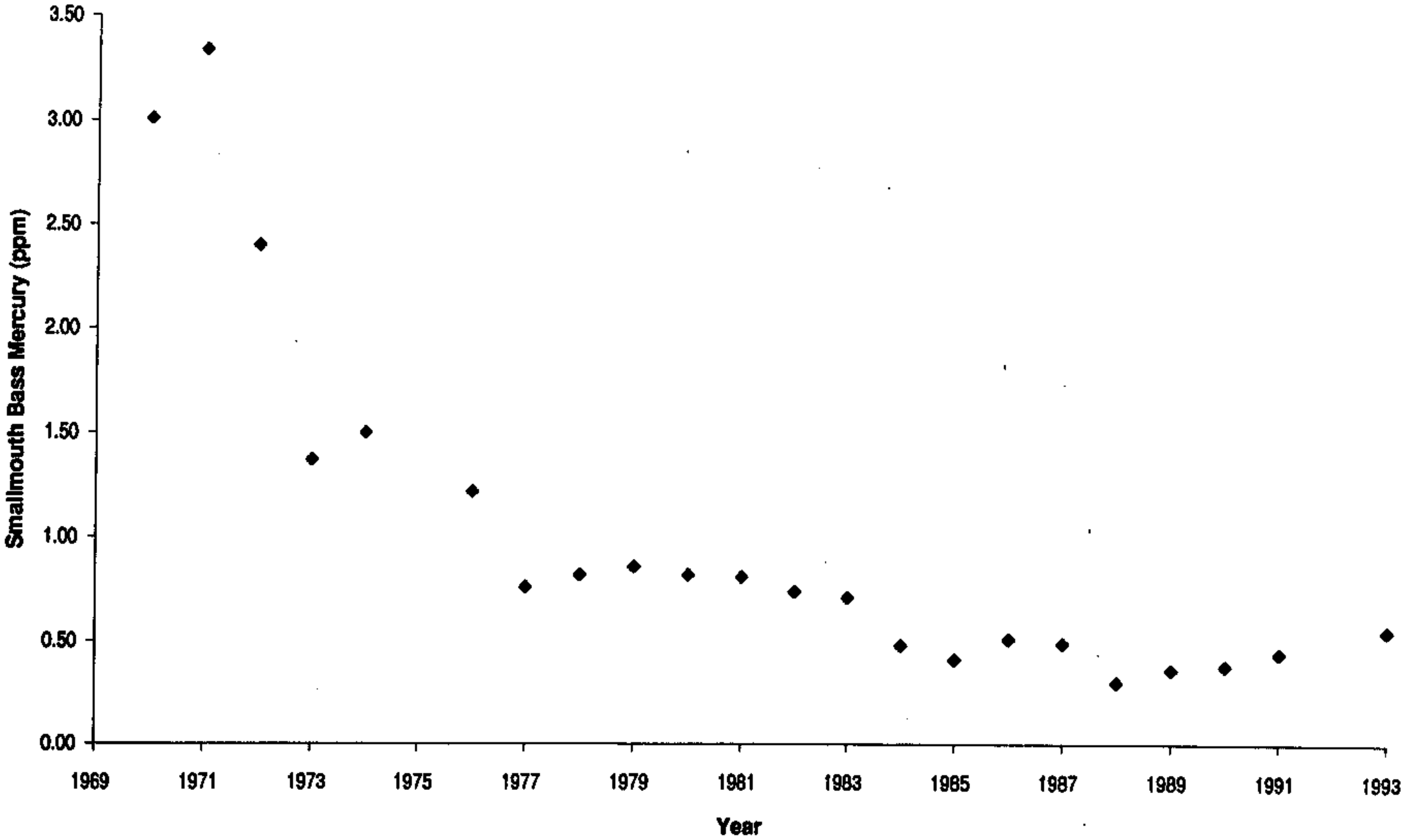


Figure _._ Mean Annual Mercury Concentrations (ppm) for Lake St. Clair Fish from 1970 - 1993

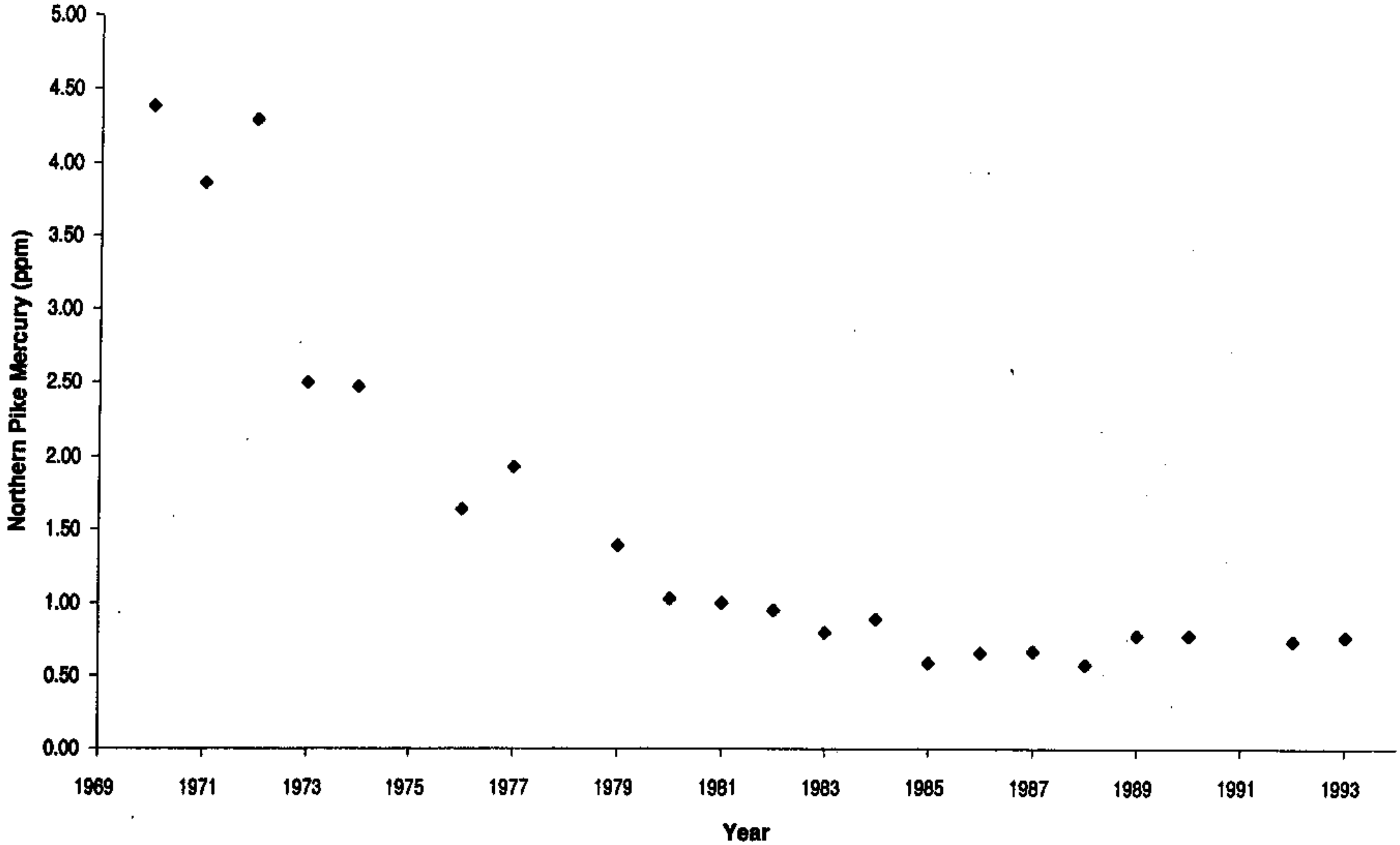
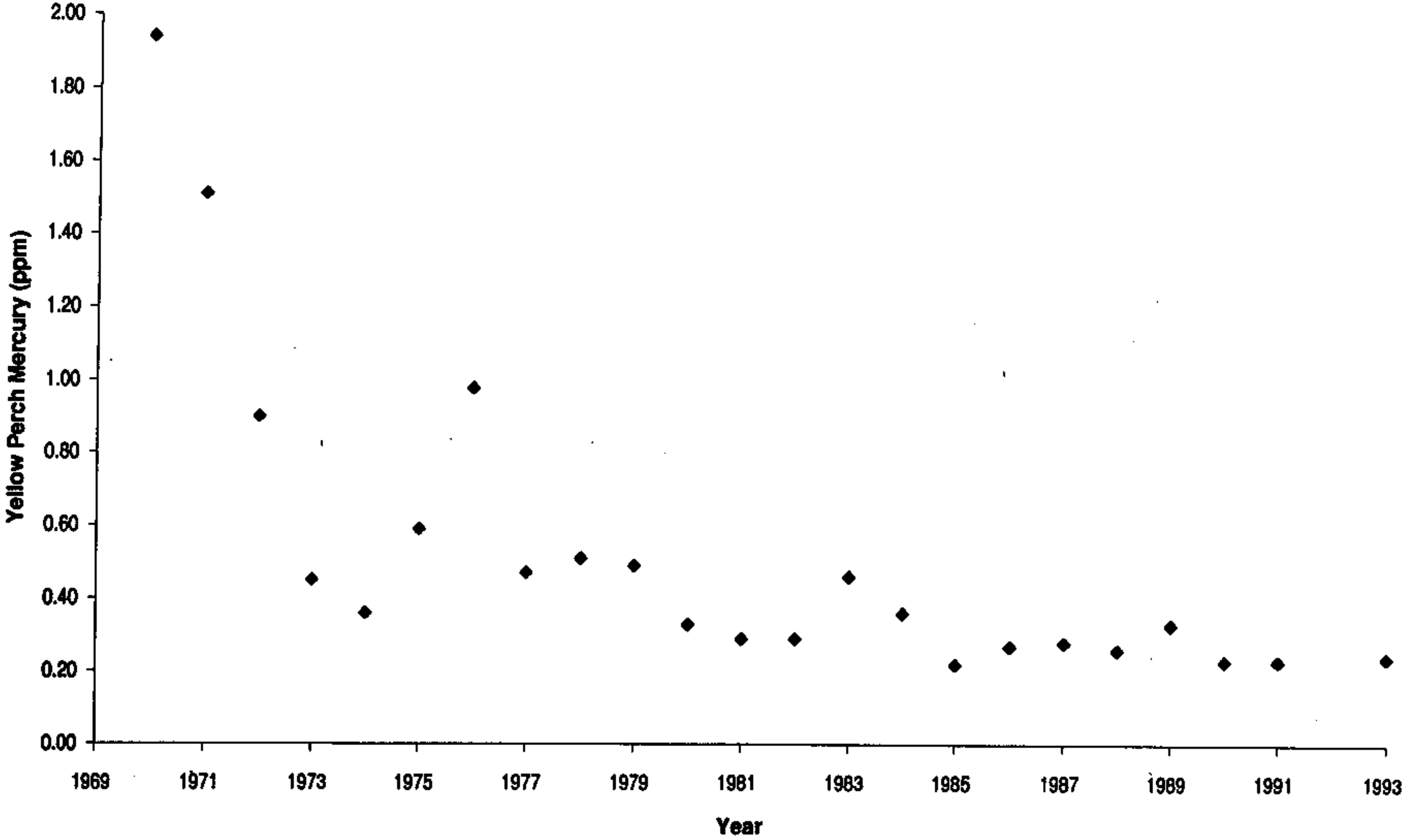


Figure _._ Mean Annual Mercury Concentrations (ppm) for Lake St. Clair Fish from 1970 - 1993



APPENDIX B

Supporting Data

Table B1. Summary of Mercury Concentrations in Water (ng/L), Sediment and Biota

Sediment		Water		Biota		Fish Species	Reference
ppb	$\log_{10}$ (ppb)	ppt	$\log_{10}$	ppb	$\log_{10}$ (ppb)		
10	1.00	7	0.85	80	1.90	Crayfish	Parks, 1988
40	1.60	3	0.48	60	1.78		water in ng/L
2,400	3.38	26	1.41	770	2.89		
3,000	3.48	24	1.38	1,600	3.20		
2,800	3.45	16	1.20	790	2.90		
920	2.96	14	1.15	1,000	3.00		
70	1.85	5	0.70	160	2.20		
240	2.38	8	0.90	460	2.66		
10	1.00	7	0.85	40	1.60	Pike (0+)	"
40	1.60	3	0.48	40	1.60		
2,400	3.38	26	1.41	490	2.69		
3,000	3.48	24	1.38	630	2.80		
2,800	3.45	16	1.20	590	2.77		
920	2.96	14	1.15	580	2.76		
70	1.85	5	0.70	60	1.78		
240	2.38	8	0.90	180	2.26		
10	1.00	7	0.85	80	1.90	Pike (1+)	"
40	1.60	3	0.48	60	1.78		
2,400	3.38	26	1.41	870	2.94		
3,000	3.48	24	1.38	750	2.88		
2,800	3.45	16	1.20	1,100	3.04		
920	2.96	14	1.15	810	2.91		
70	1.85	5	0.70	100	2.00		
240	2.38	8	0.90	300	2.48		
10	1.00	7	0.85	20	1.30	Perch	"
40	1.60	3	0.48	20	1.30		
2,400	3.38	26	1.41	420	2.62		
3,000	3.48	24	1.38	1,600	3.20		
2,800	3.45	16	1.20	400	2.60		

Table B1. Summary of Mercury Concentrations in Water (ng/L), Sediment and Biota

Sediment		Water		Biota		Fish Species	Reference
ppb	log_{10} (ppb)	ppt	log_{10}	ppb	log_{10} (ppb)		
920	2.96	14	1.15	340	2.53		
70	1.85	5	0.70	40	1.60		
240	2.38	8	0.90	90	1.95		
340	2.53	77	1.89	493	2.69	Rock Bass	Raw Data from Hildebrand *et al.* 1980, North Fork Holston River
20,200	4.31	220	2.34	1,600	3.20		
6,300	3.80	100	2.00	1,600	3.20		
1,700	3.32	48	1.68	600	2.78		
920	2.96	25	1.40	920	2.96		
140	2.14	70	1.85	210	2.32		
160	2.20	34	1.53	320	2.51		
9,200	3.96	74	1.87	180	3.26		
2,400	3.38	32	1.51	130	3.11		
340	2.53	77	1.89	410	2.61	Hog Sucker	
20,200	4.31	220	2.34	1,400	3.15		
6,300	3.80	100	2.00	1,200	3.08		
1,700	3.32	48	1.68	430	2.63		
18,500	4.27	210	2.32	2,100	3.32		
4,300	3.63	67	1.83	1,700	3.23		
920	2.96	25	1.40	370	2.57		
140	2.14	70	1.85	200	2.30		
160	2.20	34	1.53	220	2.34		
9,200	3.96	74	1.87	2,100	3.32		
2,400	3.38	32	1.51	1,100	3.04		
78,200	4.89			380	3.64	Pike	OMOEE, unpublished data
29,800	4.47			3,860	3.59		
40,900	4.61			4,290	3.63		
4,400	3.64			1,930	3.29		
3,400	3.53			590	2.77		

Table B1. Summary of Mercury Concentrations in Water (ng/L), Sediment and Biota

Sediment		Water		Biota		Fish Species	Reference
ppb	$\log_{10}$ (ppb)	ppt	$\log_{10}$	ppb	$\log_{10}$ (ppb)		
1,800	3.26			780	2.89		
78,200	4.89			1,940	3.29	Perch	
29,800	4.47			1,510	3.18		
40,900	4.61			900	2.95		
4,400	3.64			470	2.67		
3,400	3.53			220	2.34		
1,800	3.26			230	2.36		

Table B2. Mercury Concentration Ratio vs. Sediments (ppb)

Reference	Mercury Concentration Ratio	(log) Mercury Concentration Ratio	Sediment Mercury (ppb)	log Sediment Mercury (log ppb)
1	2000	3.30	10	1.00
1	1500	3.18	40	1.60
1	180	2.26	2400	3.38
1	140	2.15	2800	3.45
1	370	2.57	920	2.96
1	570	2.76	70	1.85
1	370	2.57	240	2.38
2	1400	3.15	340	2.53
2	2500	3.40	6300	3.80
2	1000	3.00	920	2.96
2	1500	3.17	140	2.15
2	2000	3.30	160	2.20
2	190	2.28	9200	3.96
2	540	2.73	2400	3.38
3	4000	3.60	50	1.70
3	8000	3.90	40	1.60
3	360	2.56	800	2.90
3	960	2.98	300	2.48
3	360	2.56	600	2.78
3	300	2.48	500	2.70
4	1000	3.00	170	2.23
4	1800	3.26	140	2.15
4	1400	3.15	70	1.85
4	5500	3.74	20	1.30
5a	50	1.70	78200	4.89
5a	129	2.11	29800	4.47
5a	105	2.02	40900	4.61

Table B2. Mercury Concentration Ratio vs. Sediments (ppb)

Reference	Mercury Concentration Ratio	(log) Mercury Concentration Ratio	Sediment Mercury (ppb)	log Sediment Mercury (log ppb)
5a	439	2.64	4400	3.64
5a	170	2.23	3400	3.53
5a	430	2.63	1800	3.26
5b	25	1.40	78200	4.89
5b	51	1.71	29800	4.47
5b	22	1.34	40900	4.61
5b	107	2.03	4400	3.64
5b	65	1.81	3400	3.53
5b	128	2.11	1800	3.26
5c	2600	3.41	790	2.90
5c	3955	3.60	450	2.65
5c	1528	3.18	530	2.72
5c	1190	3.08	780	2.89
5c	1160	3.06	850	2.93
5c	2478	3.39	230	2.36
5c	1310	3.12	290	2.46
5c	1757	3.24	330	2.52
5c	3310	3.52	190	2.28
5c	2741	3.44	270	2.43

1 = Yellow Perch (Parks *et al.*, 1984)
2 = Rockbass (Hildebrand, 1988)
3 = Carp (Rada *et al.*, 1986)
4 = Pumpkinseed Sunfish (Wren, 1983)
5 = MOEE unpublished data
5a = pike
5b = perch
5c = walleye

SUPPORTING INFORMATION

Parks et. al. (1984) reported a very strong positive correlation between mercury in age 1+ northern pike and water ($r^2 = 0.84$ for log data; Figure B1), as well as between mercury in yellow perch and water ($r^2 = 0.83$ for log data; Figure B2) for fish sampled from the Wabigoon-English River system. Sorenson et. al. (1990) also reported à positive correlation ($r^2 = 0.34$, n = 46) between mercury in northern pike and log total mercury concentration in a survey of northern Minnesota lakes. In multiple regression analysis, however, water pH and TOC were chosen over water mercury concentrations as good predictors of fish mercury burdens.

Hildebrand et. al. (1980) measured mercury levels in water, sediments and biota below a chloralkali plant in North Fork Holston River, Virginia.

There was no correlation between fish (rock bass and hog sucker) mercury concentrations and total mercury levels in water of the North Fork Halston River (Figures B3 and B4) as reported by Hildebrand et. al. (1980). When the fish CF is graphed against the total mercury level in water from these data there is no correlation ($r^2 = 0.1063$; Figure 5).

Hildebrand et al. (1980) observed that mercury levels in two fish species, rock bass and hog sucker, were highly correlated ($r^2 = 0.8$) with sediment mercury concentrations (Figure B5). The authors suggest that due to analytical constraints of accurately measuring mercury in water, sediment mercury levels may be a better indicator of overall mercury exposure.

Based on a study of approximately 1456 lakes in Sweden, Hakonson et. al. (1988) developed a simple model that related fish mercury levels to sediment mercury, conductivity, pH and lake area. Similarly, Cope et. al. (1990) reported a high correlation between surficial sediment mercury concentrations and either mercury concentration ($r = 0.67$) or total mercury burden ($r = 0.84$) in age 2 yellow perch from 10 lakes in Wisconsin (Figure B6). Approximately 80-90 % of the fish mercury burden could be explained with multiple regression containing only two independent variables, sediment mercury concentration and either pH or alkalinity. None of the lakes received direct mercury input from point sources.

Suns et. al. (1987) related mercury levels in yearling yellow perch from 16 lakes in Ontario were best correlated with the lake drainage area/lake volume ratio, followed by lake pH and dissolved organic carbon (DOC). Sediment mercury levels were not included in the analysis. Johnson (1987) found a very high correlation ($r = 0.78$) between mercury levels in Ontario fish and a mercury loading rates which were calculated from mercury levels in sediments and rate of sedimentation.

Phillips et. al. (1987) reported that mercury levels in fish were not related to mercury concentrations in surficial sediments in 10 reservoirs in the Upper Missouri River

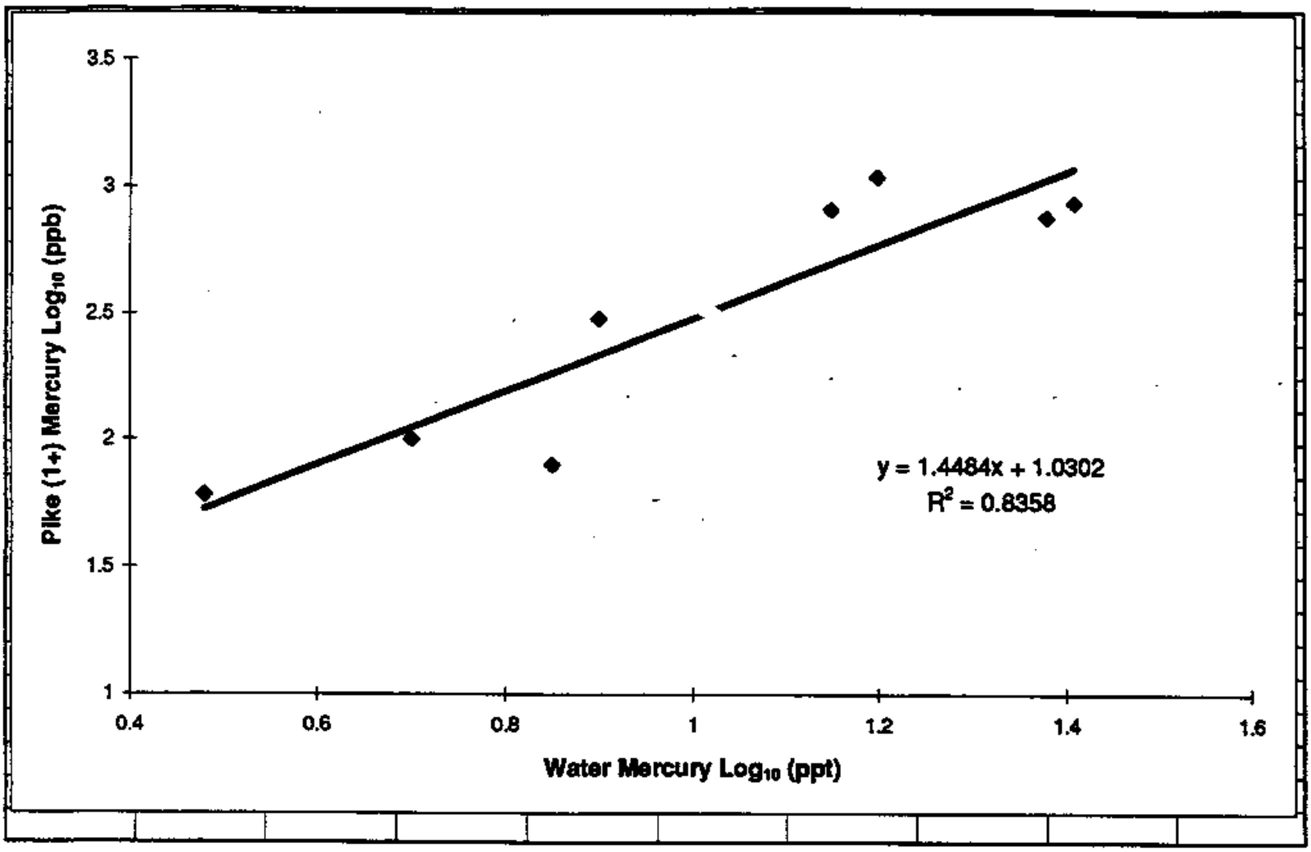


Figure B1. Mercury concentration in northern pike (age 1+) versus water mercury concentration in the English-Wabigoon River, Ontario (data from Parks et. al. 1984).

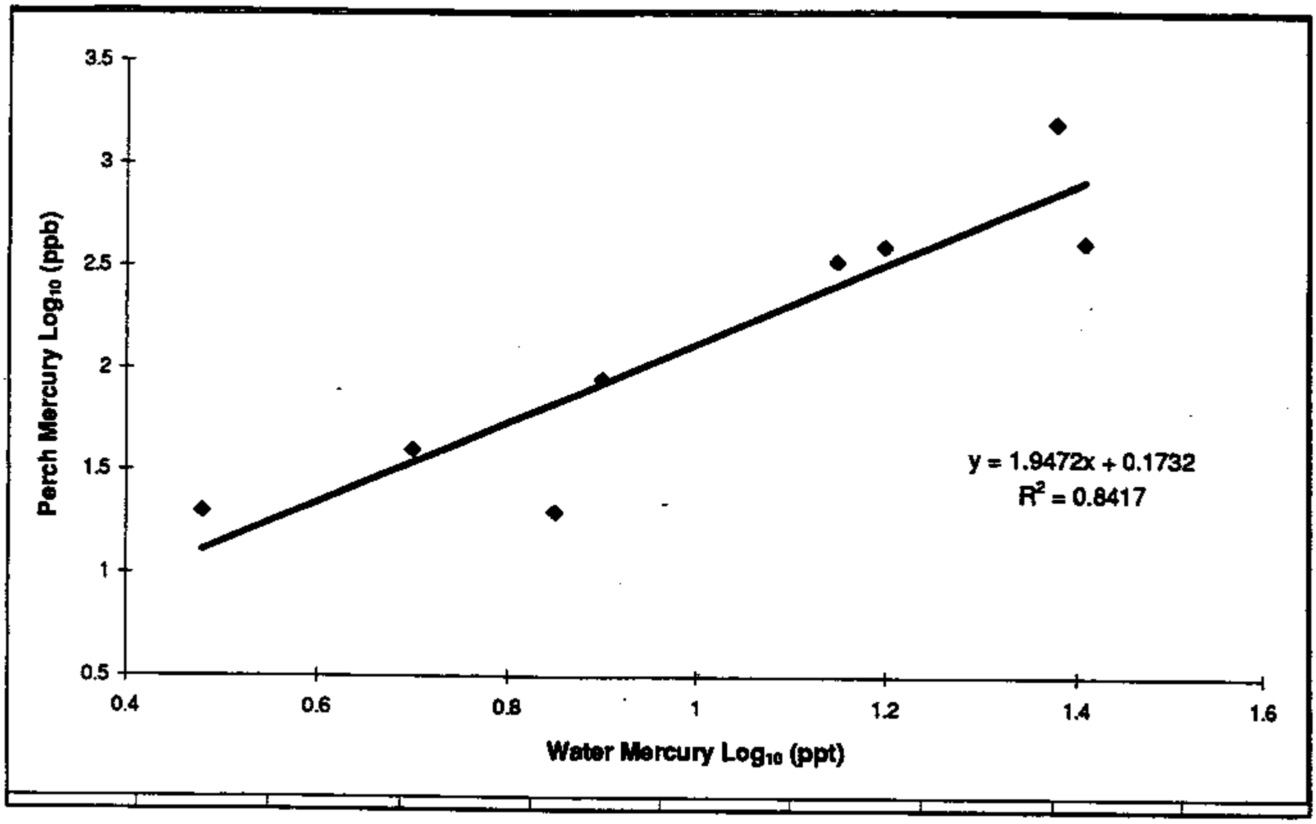


Figure B2. Mercury concentration in yellow perch versus water mercury concentration in the English-Wabigoon River, Ontario (data from Parks et. al. 1984).

Figure 3. Mercury Concentrations in Rock Bass (Log_{10}(ppb)) vs Water (Log10(ug/g x1000))

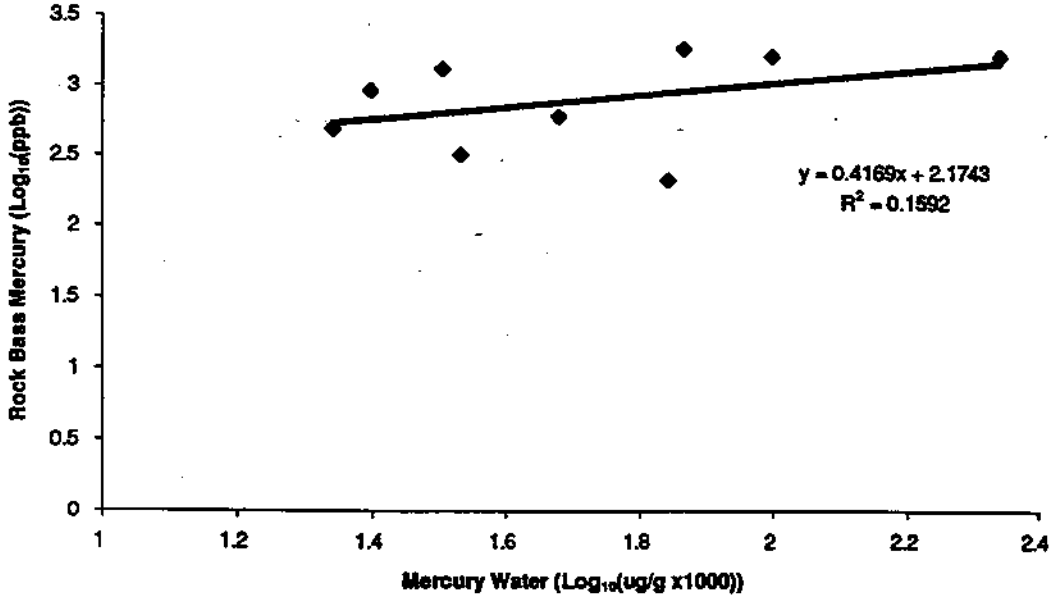
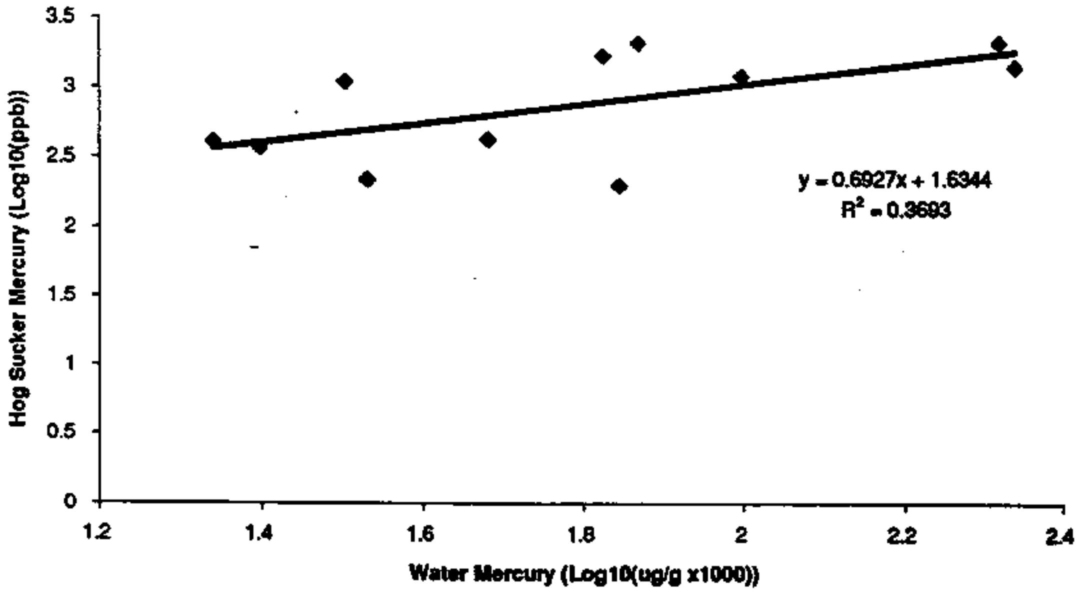
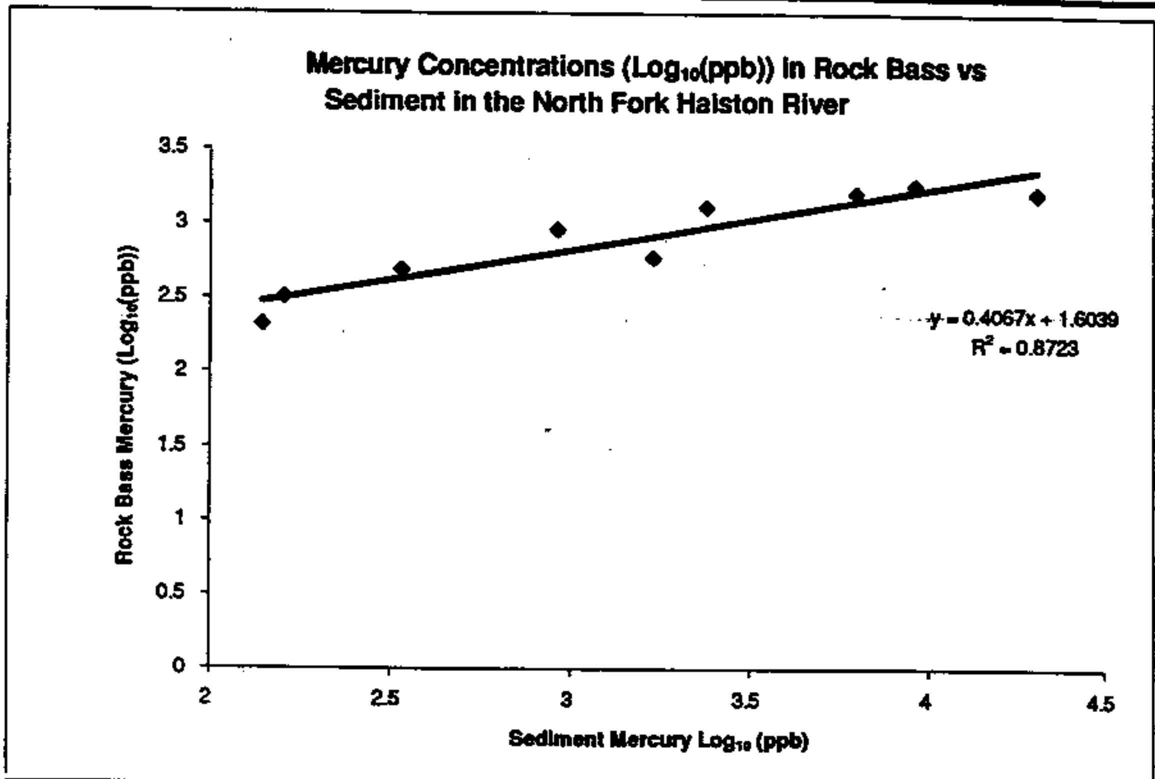


Figure 4. Mercury Concentrations in Hog Sucker (Log10(ppb)) vs Water (Log10(ug/g x1000))





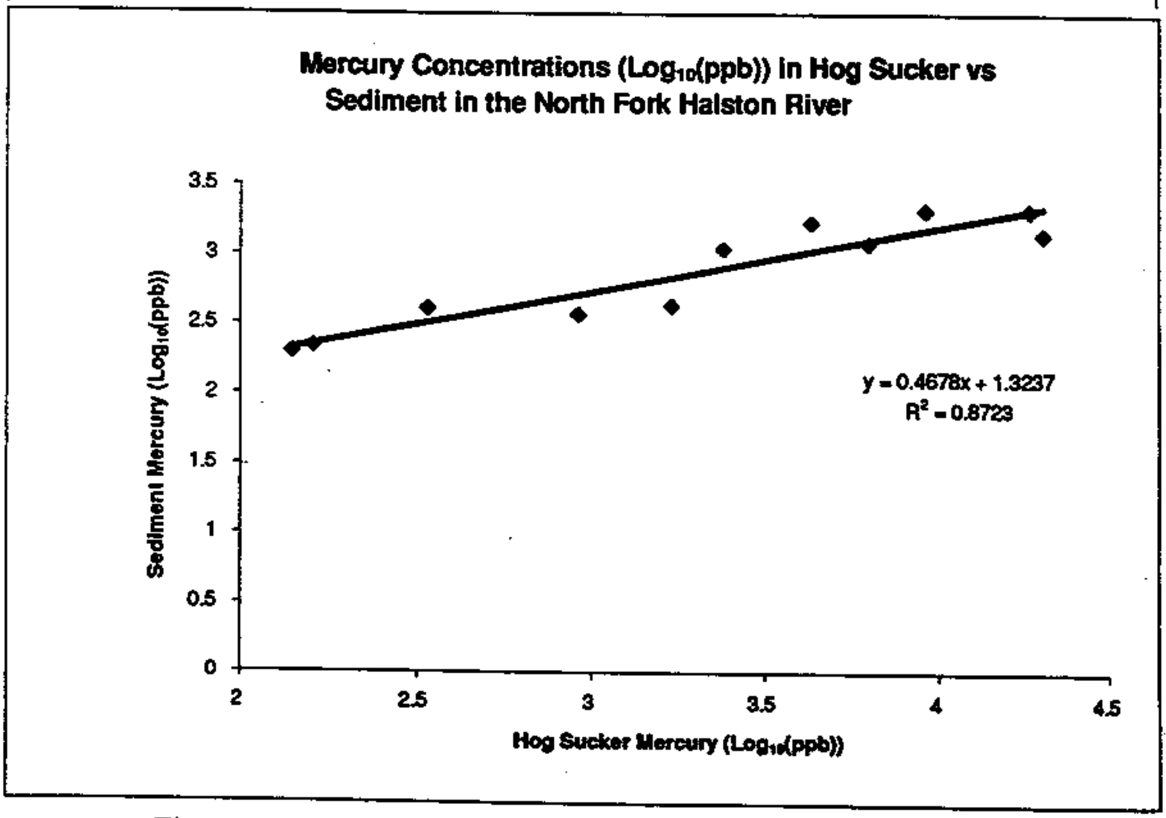
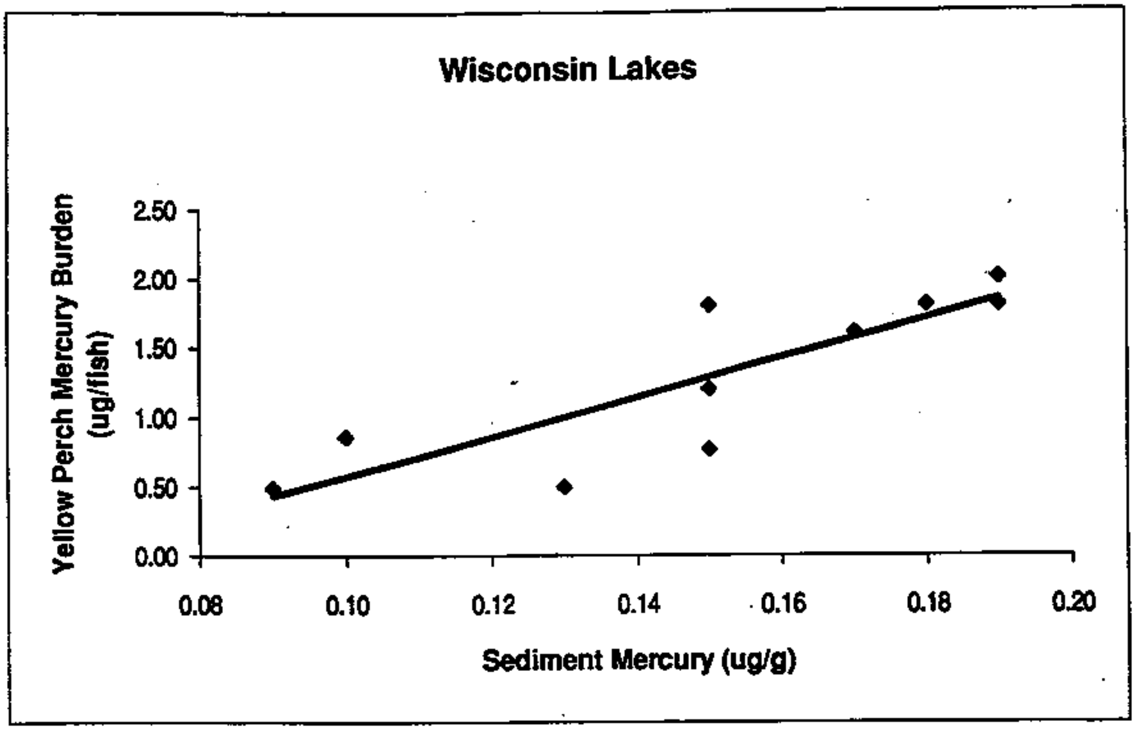


Figure B5. Mercury Concentrations (Log_{10}(ppb)) in Rock Bass (upper) and Hog Sucker (lower) vs. Sediment in the North Fork Halston River



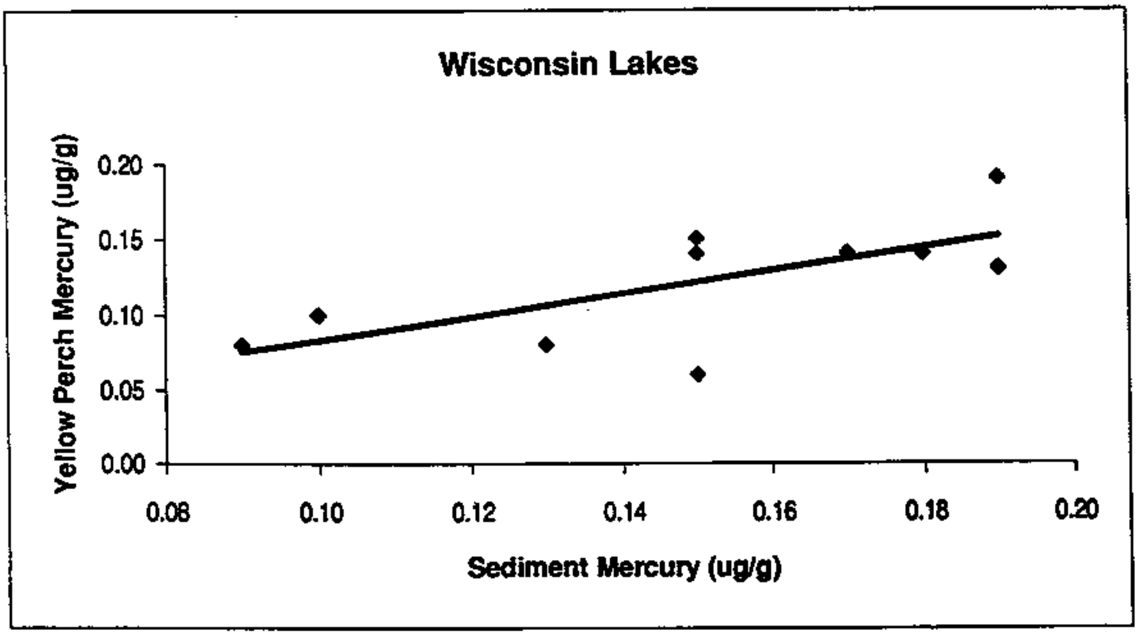


Figure B6. Mercury levels (ppm) and total body burden (µg/fish) in age 2 yellow perch from 19 Wisconsin Lakes (data from Cope et al. 1990) basin. Mercury levels in fish were correlated with variables that either facilitated or promoted mercury methylation. In a similar study, Jones et. al (1986) found no correlation between mercury levels in fish and surficial sediments of reservoirs throughout Canada. There was no correlation between mercury in sediments and in livers of pike from 5 lakes at Flin Flon, Manitoba contaminated with metals from a nearby smelter (McFarlane and Franzin, 1980).

Rada et. al. (1986) found no correlation between mercury in sediments and biota mercury levels below pulp and paper mills in the Upper Wisconsin River (Figure B7). However, that study was conducted in 1981, some 20-30 years after the primary loading of mercury had occurred. The mercury concentrations reported in the surficial sediments and fish are not particularly high relative to other contaminated situations. Sediment core profiles showed that mercury concentrations in the uppermost sediments were actually lower than at lower depths due to the more contaminated sediments being buried by cleaner depositional material. This process has been documented in other studies where the point sources have stopped. The rate of burial is of course dependant upon rate of sedimentation and whether sediment cores are collected in a depositional area or more active erosional zone.

The Wabigoon-English River system in northwestern Ontario is one of the most severely mercury polluted waterways in the world (Armstrong and Scott 1979). The primary source of pollution to the river and lake ecosystems is a paper mill complex. The mill began operation in 1913 and has discharged organic wastes since that time.

The mercury pollution was derived from the effluents of a chlor-alkali plant that operated from 1963 to 1975. Between 1963 and 1970, unrestricted quantities of inorganic mercury were released into the river. It is estimated that approximately 9-11 metric tonnes of mercury were discharged directly into the river (Gov. of Canada 1984). Direct discharges were severely curtailed in 1970, and in 1975 the chlor-alkali plant converted to a process that did not use mercury. However, residual mercury was still present in the effluent during the 1980's, with an estimated 5-10 kg of mercury being discharged annually.

The release of mercury resulted in elevated mercury concentrations in fish. Commercial fishing in the downstream lakes was banned in 1971. Sportfishing in the region continued although consumption advisories were placed on eating fish from the area. Native groups relying heavily upon fish from the area as a food source were suspected of suffering from Minimata disease, and extensive medical surveys were conducted with inconclusive results (eg. Wheatley et. al. 1979). There is also evidence to show that piscivorous wildlife in the area were affected by mercury poisoning even several years after mercury discharge stopped (Wren 1985).

The concentration of mercury in sediments declined with distance downstream of the mill point source. Although mercury levels declined over time in biological samples, there is no clear documentation of mercury in sediments from different years. Background sediment mercury concentrations were considered to be < 0.1 ug/g, with

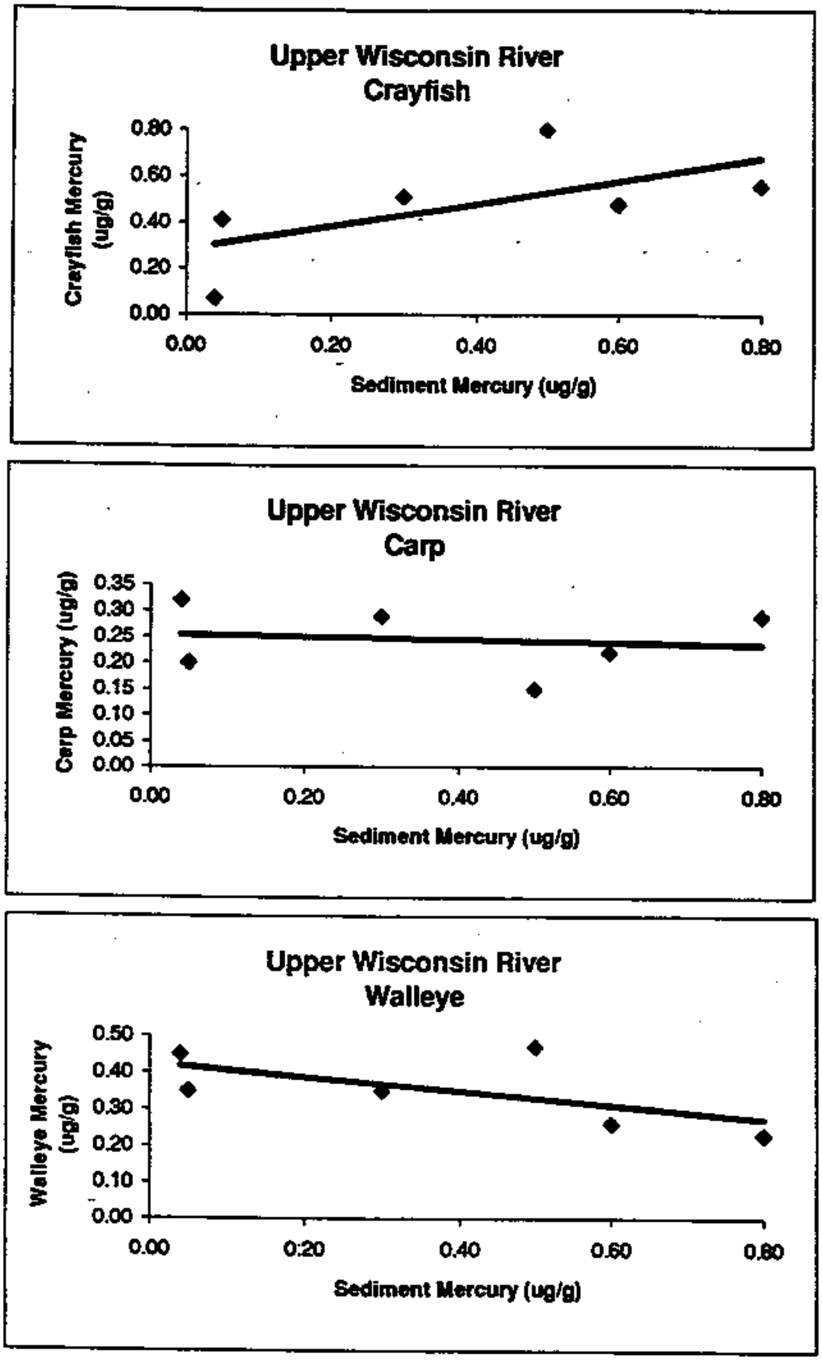


Figure B7. Mercury in biota and sediments from the Upper Wisconsin River (from Rada et al. 1986) the highest reported levels reaching 10-12 ug/g in sediments. Sediment cores collected in the early years (1971) illustrate that the surface sediments contained the highest concentration of mercury. However, in later surveys (1980) the surface layers were lower in mercury than sediments 2-4 cm deep due to smothering of the surface by "cleaner" sediments after mercury discharge was substantially reduced.

During 1978-1981, detailed surveys of mercury in water, sediments and biota were undertaken. Biota samples included crayfish, young-of-the year northern pike (*Esox lucius*), age 1+ northern pike and young-of-the year yellow perch (*Perca flavescens*). The reason for specific age class fish being used was to avoid interference from different lengths and ages of older fish, since mercury is known to accumulate with age and size of fish.

Tissue mercury levels in pike (Figure B8) and perch (Figure B9) were strongly correlated with total mercury levels in sediments ($r^2 > 0.9$). These findings were also presented by Parks (1988).

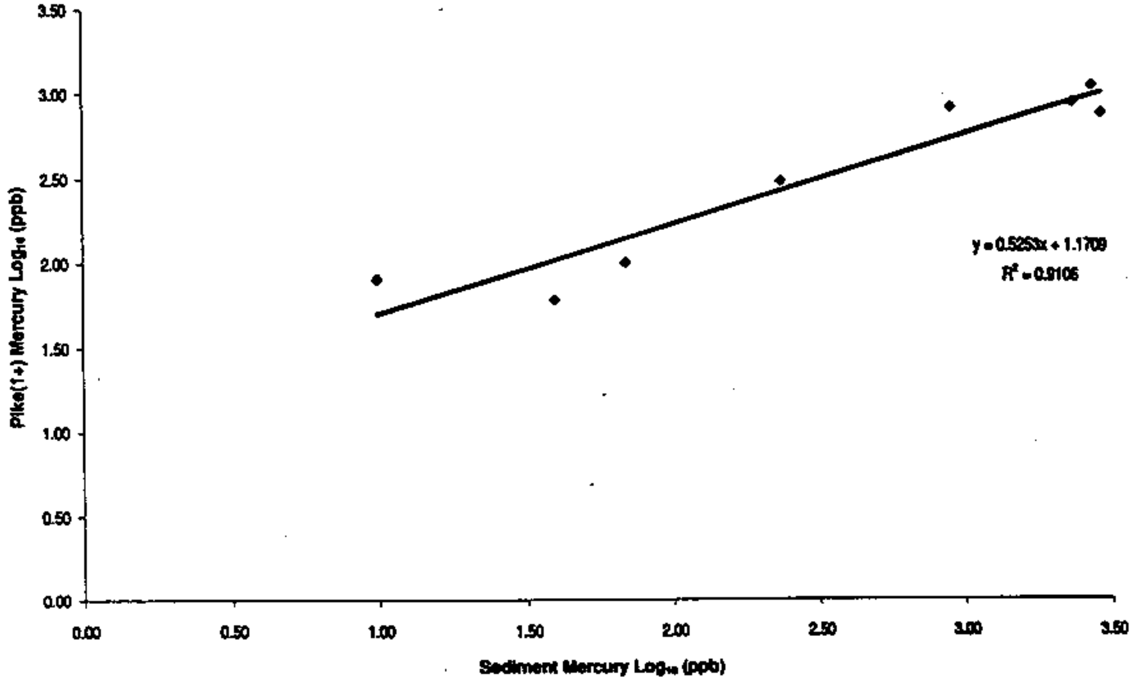


Figure B8. Mercury Concentrations Log_{10} (ppb) in Pike(1+) vs. Sediment

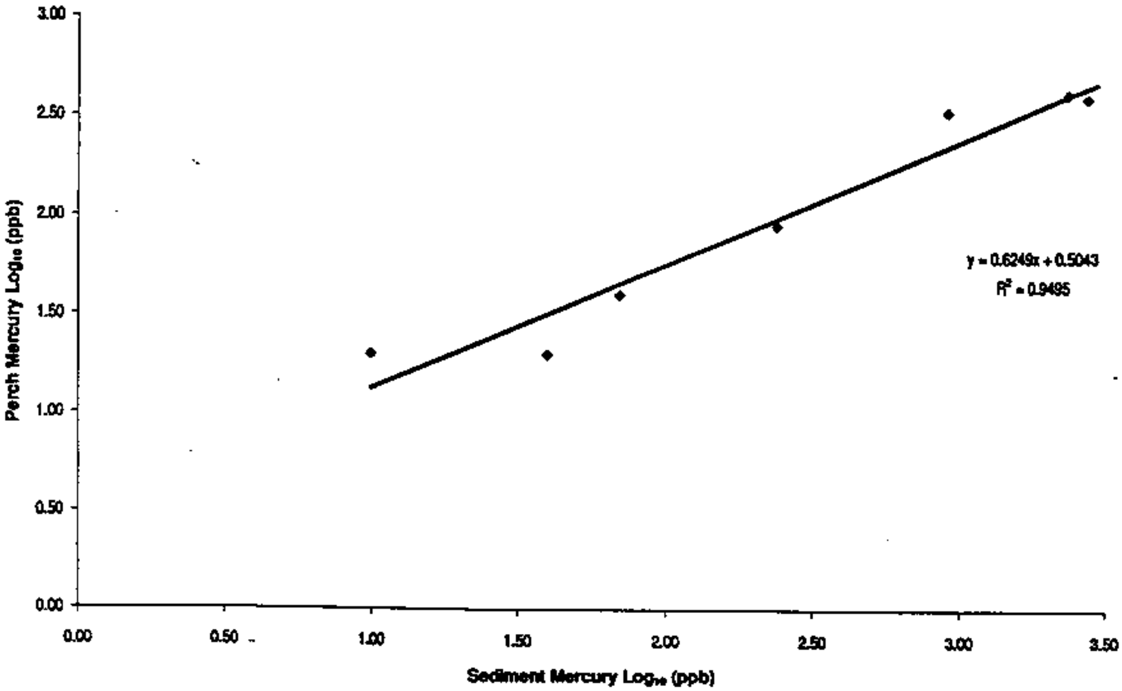


Figure B9. Mercury Concentrations Log_{10} (ppb) in Perch vs. Sediment

APPENDIX S

DETERMINATION OF DEPOSITION TO VEGETATION

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APPENDIX S

DETERMINATION OF DEPOSITION TO VEGETATION

This appendix describes the methodology used to characterize deposition of airborne mercury onto or into plant tissue. Airborne mercury, predominantly comprised of elemental mercury vapor (Hg^0), can be deposited on the ground as well as on plants and other surfaces. The principal sites of deposition of Hg^0 in plants are probably tissues of the leaf interior, suggesting that processes controlling gas exchange at the leaf surface (e.g., stomata) and mercury assimilation at the gas-liquid interface deep within the leaf interior have a dominant role in governing deposition of Hg^0 vapor to plant canopies (Lindberg et al. 1992).

The following sections describe the modeling approach used to estimate mercury deposition to vegetation, including above-ground exposed vegetables and pasture grass.

S.1 Modeling Approach

The term "deposition" describes the transfer of gases or particles to surfaces exposed to the atmosphere. The rate at which mercury is removed from the atmosphere and deposited on or absorbed by vegetation, including leafy vegetables, pasture, or forest canopy, is described by the "deposition velocity" parameter. The amount of mercury deposited to the ground that is intercepted by vegetation is described by the "mass interception factor" (*r/Y*). Deposition can occur under both dry and wet conditions (e.g., during precipitation) (Equation S.1).

$$V_{D\ (total)-veg} = \left[V_d \times \left(\frac{r}{Y}\right)_{dry} + V_w \times \left(\frac{r}{Y}\right)_{wet} \right] \qquad \text{(S.1)}$$

Where:

$V_{D\ (total)-veg}$	=	Total deposition onto vegetation ($m^3\ kg^{-1}\ d^{-1}$);
V_d	=	Total dry deposition velocity ($m\ d^{-1}$);
$(r/Y)_{dry}$	=	Mass interception factor for dry deposition onto vegetation ($m^2\ kg^{-1}$);
V_w	=	Total wet deposition velocity ($m\ d^{-1}$);
$(r/Y)_{wet}$	=	Mass interception factor for wet deposition onto vegetation ($m^2\ kg^{-1}$).

The modeling approach and input parameters used to estimate dry and wet deposition are described below.

S.2 Dry deposition

Dry deposition to vegetation can be described by the *total* dry deposition velocity (V_d) and the mass interception factor $(r/Y)_{dry}$. The *total* dry deposition velocity (V_d) relates the depositional flux of a gas or particle onto a unit area [mg m^{-2} s^{-1}] to the air concentration [mg m^{-3}], and is often expressed in units of centimeters per second [cm s^{-1}].

While the *total* dry deposition velocity (V_d) reflects deposition to all exposed surfaces, including vegetation, detritus, root mat, and soil, the *vegetation* dry deposition velocity (V_{d-v}) accounts for deposition to vegetation only. Many experiments that measure dry deposition velocity actually measure *vegetation* dry deposition velocity (V_{d-v}). The *vegetation* dry deposition velocity (V_{d-v}) can be mathematically described as the product of the *total* dry deposition velocity (V_d) and the interception fraction (r), which is the fraction of the net flux that is intercepted by and retained by vegetation (Equation S.2).

$$V_{d-v} = V_d \times r \qquad \text{(S.2)}$$

The *vegetation* dry deposition velocity (V_{d-v}) can be further normalized to the biomass of the vegetation (Y) [kg m^{-2}]. The *normalized* dry deposition velocity to vegetation (V_{D-v}) [cm^3 g^{-1} s^{-1}] is mathematically given as the product of the *total* dry deposition velocity (V_d) and the mass interception factor $(r/Y)_{dry}$ (Equation S.3).

$$V_{D-v} = V_d \times \left(\frac{r}{Y}\right)_{dry} \qquad \text{(S.3)}$$

The mass interception factor $(r/Y)_{dry}$ is specific to vegetation type (e.g., forest canopy, grasses, leafy vegetables, non-leafy vegetables).

Limited studies have been conducted investigating the deposition of mercury to vegetative surfaces. However, experimental data (Mosbaek et al. 1988) have demonstrated the ability of plants to accumulate mercury vapor from air. Lindberg et al. (1991) estimated weekly mean *vegetation* dry deposition velocities (V_{d-v}) for mercury vapor (Hg^0) and fine aerosol to a deciduous forest canopy in Walker Branch Watershed near Oak Ridge from April 1988 to March 1989, using measured concentrations of mercury in air above the forest canopy and a modified "big leaf" aerodynamic resistance model that accounts for total leaf resistance (Hicks et al. 1987, Hanson et al. 1989). The model incorporates transport resistances from the atmosphere to the leaf interior based on analogy to water vapor.

Lindberg et al. (1991) reported weekly mean *vegetation* dry deposition velocity (V_{d-v}) values for Hg^0 to the forest canopy ranging from approximately 0.01 - 0.12 cm s^{-1}, with maximum values occurring in summer. Weekly mean *vegetation* dry deposition velocities (V_{d-v}) for a typical growing season in Oak

Ridge (i.e., May 3 - September 27) ranged from 0.04 - 0.12 cm s^{-1} (35 - 104 m d^{-1}) with a mean of 0.084 cm s^{-1} (73 m d^{-1}). Similar ranges have been reported for other sites and for other plant types. For example, the *vegetation* dry deposition velocity (V_{d-v}) to tall grass canopy was reported to range from 0.06 to 0.1 cm s^{-1} (Barton et al. 1981) and the V_{d-v} to alfalfa plants was reported to range from 0.03 to 0.1 cm s^{-1} (Stein et al. 1996). Based on these data, the *vegetation* dry deposition velocity (V_{d-v}) for airborne mercury during the growing season was assumed to range from 0.03 to 0.12 cm s^{-1} (26 to 104 m d^{-1}). Although the *vegetation* dry deposition velocity (V_{d-v}) estimated by Lindberg et al. (1991) is based on deposition to a forest canopy, at a height ranging from 21 to 43 m above the ground surface, it is consistent with measurements made to grasses and forage. Therefore, the range including the Lindberg et al. (1992) data was considered appropriate for predicting dry deposition to ground vegetation. Other more soluble mercury species (such as mercuric chloride, $HgCl_2$) may exhibit more efficient removal by dry deposition (Lindberg et al. 1992). However, mercury vapor (Hg^0) is the predominant atmospheric species (comprising 98% or more of airborne mercury).

Because the dry deposition velocity (V_{d-v}) used in this assessment is assumed to be representative of deposition onto grasses and not of total deposition onto the ground area, the interception fraction (*r*) used to calculate the normalized dry deposition velocity (V_{D-veg}) (see Equation S.3) was set equal to one (Miller 1979a; Equation S.4).

$$V_{D-veg} = V_{d-v} \times \frac{1}{Y_{dry(veg)}} \qquad \text{(S.4)}$$

Equation S.4 is assumed to apply to deposition to grasses, including pasture. Reported values for the interception fraction (*r*) for forage grasses range from 0.23 to 0.82 (Miller 1979b). Minimal information is available describing the interception fraction for exposed vegetables or fruits (including leafy vegetables, broccoli, snap beans, and berries). Data for squash, soybean, and peanut plants indicate *r* values ranging from 0.06 to 1 (Miller 1979b, Pinder et al. 1988). Values of the interception fraction (*r*) for non-leafy vegetables and fruits are expected to be lower than values for forage grasses and leafy vegetables because of the lower surface area of non-leafy vegetables and fruits (Baes and Orton 1979). Based on these data, it was assumed that the range of interception fraction (*r*) values for exposed vegetables and fruits is consistent with values for forage grasses. Equation S.4 was therefore assumed to also apply to exposed fruits and vegetables.

Biomass density (*Y*) differs for leafy vegetables and pasture grass. Reported values for *Y* for leafy vegetables range from 0.36 to 5.3 [kg (fresh wt) m^{-2}] and values for non-leafy vegetables (e.g., broccoli, cauliflower, green beans, lima beans, and sweet corn) range from 0.17 to 1.6 [kg (fresh wt) m^{-2}] (Baes and Orton 1979). The 5^{th}, 50^{th}, and 95^{th} percentiles of the combined data sets are approximately 0.3, 1, and 4 [kg (fresh wt) m^{-2}], respectively. Based on these data, the biomass density for "exposed fruits and vegetables" ($Y_{fruits/vegetables}$) was assumed to range from 0.3 to 4 [kg (fresh wt) m^{-2}]. Values for Y_{forage} range from 0.04 to 1.6 [kg (dry wt) m^{-2}] (Baes and Orton 1979), with 5^{th}, 50^{th}, and 95^{th} percentile values of approximately 0.1, 0.3, and 0.9 [kg (fresh wt) m^{-2}], respectively. Based on these data, the biomass density for pasture ($Y_{pasture}$) was assumed to range from 0.1 to 0.9 [kg (fresh wt) m^{-2}]. Uniform distributions were assumed.

S.3 Wet Deposition Velocity

Wet deposition describes the scavenging of a material from the atmosphere by rain or snow. Wet deposition is episodic, and so the climatological conditions of an area must be considered when evaluating the relative importance of wet deposition as a removal process.

The degree of wet deposition is estimated from knowledge of the washout ratio (*WR*) where $C_{rainwater}$ and C_{air} are the concentrations of mercury in rainwater (at ground level) and in air in the gaseous phase (Equation S.5).

$$WR = \frac{C_{rainwater}\ [ng\ m^{-3}]}{C_{air}\ [ng\ m^{-3}]} \qquad \text{(S.5)}$$

The wet deposition velocity (V_w) is given as the product of the washout ratio (*WR*) and the average annual precipitation rate (*R*), defined as the amount of rain in 365 days [m d^{-1}] (Equation S.6).

$$V_w = WR \times R \qquad \text{(S.6)}$$

The transfer of mercury carried by precipitation to vegetation is described by the mass interception factor for wet deposition $(r/Y)_{wet}$ [m^2 kg^{-1} (dry)] (Equation S.1), defined as the fraction of the material in rain deposited per square meter of the ground surface intercepted and retained on the plant, normalized to the dry mass of the vegetation per unit area of soil.

Lindberg et al. (1994) measured mercury concentrations in rainfall in the Walker Branch Watershed during four rain events in August and September, 1991 and February 1992. Mercury concentrations measured in rainfall ranged from 7.6 to 11.9 ng L^{-1} (1.0 to 3.6 cm rainfall per event). During these periods, air concentrations of Hg^0 ranged from about 2 to 6 ng m^{-3}. Based on these measurements, Lindberg et al. (1994) estimated total mercury fluxes, due to wet deposition, ranging from 8.6 to 240 ng m^{-2} hr^{-1}. Lindberg et al. (1992) estimated that wet and dry deposition are of the same order of magnitude. Lindberg et al. (1992) approximated that wet deposition contributed 10 to 15 µg m^{-2} yr^{-1} of the total annual atmospheric deposition of mercury to the forest of about 30 to 40 µg m^{-2} yr^{-1}. Lindberg et al. (1992) indicates that dry deposition rates are likely higher in the summer (during the typical growing season) than the annual average. Observations at other sites support the assertion that wet deposition of mercury is equal to or less than dry deposition (Lindberg et al. 1992, Porcella 1994).

Based on the data collected by Lindberg et al. (1994), the estimated washout ratio (*WR*) for Hg^0 ranged from approximately 1,900 to 3,000 [$(ng\ m^{-3}_{rainwater})\ (ng\ m^{-3}_{air})^{-1}$]. This range is consistent with measurements at other sites, which suggest a washout ratio for Hg^0 ranging from <500 to about 10,000 (Logan 1996). Based on these data, the washout ratio (*WR*) parameter was estimated to range from 1,000 to 10,000, with a central value of 2,500 (triangular distribution).

Annual precipitation rates (*R*) were based on measurements by the US Weather Bureau at their Oak Ridge station (near downtown Oak Ridge) as presented in USGS (1967) (for 1953-1964) and the Oak Ridge Annual Environmental Monitoring Reports (for 1965-1991). Annual average precipitation at this location between 1931 and 1960 was 54.71 inches (139.0 cm). During a similar period (1935-1959), measurements of annual average precipitation by Union Carbide at K-25 and ORNL were 57.85 inches (146.9 cm) and 51.52 inches (130.9 cm), respectively (USGS 1967). Annual precipitation rates were used to estimate wet deposition velocity (V_w) for each year. Based on the variability between measurements at Oak Ridge, K-25, and ORNL, it was assumed that the uncertainty/ variability in annual precipitation measurements (as applied to different reference population locations) was ± 5%.

Many experimental values for the mass interception factor (*r/Y*) reported in the literature are based on measurements of radioactively labeled anions or cations of relatively large particle size that were intercepted and initially retained by vegetation. Studies of vegetation interception suggest that interception is lower with increasingly larger particle sizes (Simon 1990). While mass interception factors (*r/Y*) specific to deposition of mercury vapor were not identified, it was determined for this analysis that mass interception factors (*r/Y*) for small aerosols, mists, and gases were most appropriate for application to mercury vapor. Values for *(r/Y)* for iodine vapor (typically less than 0.001 µm), 1-µm particles, 30-µm spores, and a "fine spray" of unknown particle size, deposited to grasses, range from about 1 $m^2\ kg^{-1}$ to about 4.5 $m^2\ kg^{-1}$ dry weight (Chamberlain 1970, Miller 1979b). Mass interception factors *(r/Y)* for vegetables range from about 0.2 $m^2\ kg^{-1}$ to 0.5 $m^2\ kg^{-1}$ wet weight. The distributions were assumed to be uniform.

PDFs describing the inverse biomass yield (*1/Y*) and mass interception factors (*r/Y*) for dry and wet deposition, respectively, were assumed to be perfectly correlated (i.e., have a correlation coefficient of 1).

Table S-1 summarizes the PDFs used to describe deposition of airborne mercury to vegetation.

Table S-1: Probability Distribution Functions for Characterizing Deposition of Mercury to Vegetation

Parameter		PDF	
Symbol	**Description**	**Distribution**	**Description**
V_d	Dry deposition velocity	Uniform	Minimum = 26 m d^{-1} Maximum = 104 m d^{-1}
Y_{veg}	Biomass yield for above-ground fruits and vegetables (dry deposition)	Uniform	Minimum = 0.3 kg (fresh wt) m^{-2} Maximum = 4 kg (fresh wt) m^{-2}
Y_{past}	Biomass yield for pasture (dry deposition)	Uniform	Minimum = 0.1 kg (dry wt) m^{-2} Maximum = 0.9 kg (dry wt) m^{-2}
WR	Washout ratio	Triangular	Minimum = 1,000 Central Value = 2,500 Maximum = 10,000
R	Uncertainty in annual average precipitation rate	Uniform	Minimum = -5% Maximum = +5%
r/Y_{veg}	Mass interception factor for fruits and vegetables (wet deposition)	Uniform	Minimum = 0.2 m^2 kg^{-1} (fresh wt) Maximum = 0.5 m^2 kg^{-1} (fresh wt)
r/Y_{past}	Mass interception factor for pasture (wet deposition)	Uniform	Minimum = 1 m^2 kg^{-1} (dry wt) Maximum = 4.5 m^2 kg^{-1} (dry wt)

S.4 References

Baes and Orton 1979. C.F. Baes and T.H. Orton. Productivity of Agricultural Crops and Forage, Yv. Ch. 3.1 In: *A Statistical Analysis of Selected Parameters for Predicting Food Chain Transport and Internal Dose of Radionuclides*. F.O. Hoffman and C.F. Baes, eds. ORNL/ NUREG/TM-282.

Barton et al. 1981. S.C. Barton, N.D. Johnson, and J. Christison. Atmospheric mercury deposition in Ontario. *Proc. Annu. Meet. Air Pollut. Control Assoc*. 74, Pap. JAPCA-81-60.4.

Chamberlain 1970. A.C. Chamberlain. Interception and retention of radioactive aerosols by vegetation. *Atmos. Environ*. 4: 57-78.

Hanson et al. 1990. P.J. Hanson, K. Rott, G.E. Taylor, C.A. Gunderson, S.E. Lindberg, and B.M. Ross-Todd. NO_2 deposition to elements representative of a forest landscape. *Atmos. Environ*. 23(8): 1783-1794.

Hicks et al. 1987. B.B. Hicks, D.D. Baldocchi, T.P. Meyers, R.P. Hosker, and D.R. Matt. A preliminary multiple resistance routine for deriving dry deposition velocities from measured quantities. *Water, Air, and Soil Pollution*. 36: 311-330.

Hoffman 1977. F.O. Hoffman. A reassessment of the deposition velocity in the prediction of the environmental transport of radioiodine from air to milk. *Health Phys*. 32: 437-441.

Lindberg et al. 1994. S.E. Lindberg, J.G. Owens, and W.J. Stratton. Application of throughfall methods to estimate dry deposition of mercury. Ch. II.8 In: In: *Mercury Pollution, Integration and Synthesis*. C. J. Watras and J.W. Huckabee, eds. Lewis Publishers, Ann Arbor.

Lindberg et al. 1992. S.E. Lindberg, T.P. Meyers, G.E. Taylor, R.R. Turner, and W.H. Schroeder. Atmospheric/ surface exchange of mercury in a forest: Results of modeling and gradient approaches. *J. Geophys. Res*. 97: 2519-2528.

Lindberg et al. 1991. S.E. Lindberg, R.R. Turner, T.P. Meyers, G.E. Taylor, Jr., and W.H. Schroeder. Atmospheric concentrations and deposition of mercury to a decidious forest at Walker Branch watershed, Tennessee, USA. *Water, Air, Soil Pollut.* 56:577-594.

Miller 1979a. C.W. Miller. An analysis of measured values for the fraction of a radioactive aerosol intercepted by vegetation. *Health Phys.* 38: 705-712.

Miller 1979b. C.W. Miller. The Interception Fraction. Ch. 3.2 In: *A Statistical Analysis of Selected Parameters for Predicting Food Chain Transport and Internal Dose of Radionuclides*. F.O. Hoffman and C.F. Baes, eds. ORNL/ NUREG/TM-282.

Mosbaek et al. 1988. H. Mosbaek, J.C. Tjell, and T. Sevel. Plant uptake of airborne mercury in background areas. *Chemosphere*. 17(6): 1227-1236.

Pinder et al. 1988. J.E. Pinder, T.G. Ciravalo, and J.W. Bowling. The interrelationships among plant biomass, plant surface area, and the interception of particulate deposition by grasses. *Health Phys.* 55(1): 51-58.

Porcella 1994. D.B. Porcella. Mercury in the environment: Geochemistry. Ch. I.1 In: *Mercury Pollution, Integration and Synthesis*. C. J. Watras and J.W. Huckabee, eds. Lewis Publishers, Ann Arbor.

Simon 1990. S.L. Simon. An analysis of vegetation interception data pertaining to close-in weapons test fallout. *Health Phys.* 59(5): 619-626.

Stein et al. 1996. E.D. Stein, Y. Cohen, and A.M. Winer. Environmental distribution and transformation of mercury compounds. In: *Critical Reviews in Environmental Science and Technology*. T.R. Logan, ed. 26(1):1-43.

USGS 1967. United States Geological Survey. *Hydrologic Data for the Oak Ridge Area Tennessee.* Geological Survey Water-Supply Paper 1839-N. United States Government Printing Office, Washington, DC.

APPENDIX T

SUMMARY OF MERCURY PLANT UPTAKE DATA COLLECTED IN THE EFPC FLOODPLAIN BY ORAU AND SAIC

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APPENDIX T

SUMMARY OF MERCURY PLANT UPTAKE DATA COLLECTED IN THE EFPC FLOODPLAIN BY ORAU AND SAIC

Mercury concentrations in vegetables and forage grown in the City of Oak Ridge have been measured in two separate studies: the first was conducted by Oak Ridge Associated Universities (ORAU) between 1983 and 1987, and the second was conducted by SAIC as part of the EFPC RI in 1992. In both studies, mercury was measured in co-located soil and plant samples, and mercury biouptake factors were calculated to relate the mercury concentration in plants to concentrations in soil. Neither study considered the contribution of airborne mercury to plant concentrations.

Between 1983 and 1987, ORAU collected co-located plant and soil samples from locations throughout the City of Oak Ridge, including the EFPC floodplain, and analyzed the samples for total mercury (TDHE 1983, Gist 1987, Hibbitts 1984, Hibbitts 1986, Hadden 1996). Most of the samples were collected from areas of low to moderate soil mercury concentrations (i.e., within the City of Oak Ridge, at concentrations <10 mg kg^{-1}, dry wt). However, some samples were collected from locations in the floodplain with significantly higher soil concentrations (up to 1100 mg kg^{-1}, dry wt). In addition, a selection of garden vegetables was grown in a greenhouse at ORAU in various mixtures of uncontaminated and contaminated soil (from the floodplain). More than 100 sample pairs were collected, including leafy, vine, and root vegetables, forage, and pasture grass. Samples were washed prior to analysis to ensure that the data reflect mercury that is incorporated in the plant and not mercury on plant surfaces. Sampling data are summarized in Table T-1.

The second plant uptake study was conducted in the EFPC floodplain by SAIC in 1992. Sixteen co-located soil and plant sample pairs were collected from the Bruner's site and analyzed for total mercury. Concentrations of mercury in soil at this site were high (range 118 to 699 mg kg^{-1}, dry wt). Vegetables sampled include tomatos, kale, and beets. Sampling data are summarized in Table T-2.

References

Gist 1987. C.S. Gist. Soil Contaminant Uptake by Plants in the Terrestrial Food Chain in the Floodplain of East Fork Poplar Creek. Oak Ridge Associated Universities.

Hadden 1996. C.T. Hadden. Transmittal of SAIC plant uptake data for mercury. April 26, 1996.

Hibbitts 1984. H.W. Hibbitts. Transmittal of Environmental Sampling Data for Mercury. February – December 1984. (ChemRisk Repository No. 536).

Hibbitts 1986. H.W. Hibbitts. Transmittal of Environmental Sampling Data for Mercury. 1986.

TDHE, 1983. Tennessee Department of Health and Environment. Miscellaneous Correspondance to Oak Ridge Community Concerning DOE Mercury Analyses in the Oak Ridge Vicinity. Jan.– Nov.

Table T-1: Mercury Concentrations Measured in Co-located Soil and Vegetable Samples in Oak Ridge by ORAU

Location	Plant Sample Number	Plant Sample Date	Plant	Plant Type	Plant Conc. (mg/kg, dry)	Soil Sample Number	Soil Sample Date	Soil Conc. (mg/kg, dry)	Plant/Soil Ratio
ND	83-0126	ND	Carrot Root	Below ground	0.013	83-0121	ND	0.9	0.014
ND	83-0140	ND	Onion	Below ground	0.008	83-0189	ND	10.4	0.00077
ND	83-0726	ND	Beets	Below ground	0.010	83-0725	ND	0.24	0.042
W. Lincoln Rd.	84-1022B	ND	Onion- Bulb	Below ground	0.010	84-1024	5/16/84	0.2	0.050
Behind Dean Stallings Ford	84-1053B	ND	Wild Onion-Bulb	Below ground	0.29	84-1055	5/17/84	280	0.0010
Van Hicks Place (garden)	84-1156B	6/6/84	Onion-bulb	Below ground	0.036	84-1153	6/6/84	0.23	0.16
Delaware Avenue	84-1194B	6/11/84	Turnip bulb	Below ground	0.020	84-1283 (avg)	6/27/84	0.26	0.077
W. Lincoln Rd. (54,22)	84-1422	7/17/84	Potato	Below ground	0.031	84-1407	7/17/84	0.12	0.26
Greenhouse	ND	ND	Carrots	Below ground	3.1	ND	ND	340	0.0091
Greenhouse	ND	ND	Radish	Below ground	3.9	ND	ND	485	0.0080
Greenhouse	ND	ND	Beets	Below ground	8.3	ND	ND	520	0.016
ND	83-0177	ND	Rose Hips	Forage	0.020	83-0179	ND	440	Not calculated
ND	83-0178	ND	River Cane	Forage	0.020	83-0179	ND	440	Not calculated
Behind Dean Stallings Ford	84-1050	5/31/84	Box elder- Stems and Leaves	Forage	0.060	84-1049	5/17/84	160	0.00038
Behind Dean Stallings Ford	84-1052	5/31/84	Honey suckle- Stems and Leaves	Forage	0.080	84-1051	5/17/84	290	0.00028
Behind Dean Stallings Ford	84-1054	5/31/84	Grass	Forage	0.12	84-1051	5/17/84	290	0.00041
Behind Dean Stallings Ford	84-1056	5/31/84	Smilax	Forage	0.040	84-1055	5/17/84	280	0.00014
Bruners Center, Property 564 (20,60)	84-1604	8/23/84	Soladego foliage	Forage	0.41	84-1514 (avg)	8/3/84	730	0.00056
Bruners Center, Property 564 (20,60)	84-1605	8/23/84	Soladego roots	Forage	0.26	84-1514 (avg)	8/3/84	730	0.00036
Bruners Center, Property 564 (20,60)	84-1606	8/23/84	Sneezeweed- foliage	Forage	0.24	84-1514 (avg)	8/3/84	730	0.00033
Bruners Center, Property 564 (20,60)	84-1607	8/23/84	Misc. Grasses	Forage	0.51	84-1514 (avg)	8/3/84	730	0.00070
Bruners Center, Property 564 (20,60)	84-1608	8/23/84	Violets- foliage	Forage	0.22	84-1514 (avg)	8/3/84	730	0.00030
Greenhouse	ND	ND	Honeysuckle	Forage	1.3	ND	ND	640	0.0020
Greenhouse	ND	ND	Jewelweed	Forage	0.10	ND	ND	758	0.00013
Greenhouse	ND	ND	Sneezeweed	Forage	68.4	ND	ND	1140	Not calculated
ND	83-0128	ND	Zucchini Squash	Fruit	0.005	83-0121	ND	0.9	0.0056
ND	83-0131	ND	Green Tomato	Fruit	<0.002	83-0132	ND	0.39	0.0026
ND	83-0137	ND	Green Tomato	Fruit	0.032	83-0136	ND	0.21	0.15
ND	83-0180	ND	Blackberry	Fruit	<0.002	83-0181	ND	81	0.000012
ND	83-0185	ND	Blackberry	Fruit	<0.002	83-0186	ND	36	0.000028
ND	83-0191	ND	Green Tomato	Fruit	0.006	83-0189	ND	10.4	0.00058
ND	83-0254A	ND	Corn Kernals	Fruit	0.002	83-0256	ND	6.2	0.00032
ND	83-0254B	ND	Corn Whole Ear	Fruit	0.001	83-0256	ND	6.2	0.00016
ND	83-0287	ND	Green Pepper	Fruit	0.21	83-0286	ND	1.5	0.14
ND	83-0288	ND	Tomato	Fruit	0.15	83-0286	ND	1.5	0.10
ND	83-0289	ND	Yellow Squash	Fruit	0.007	83-0286	ND	1.5	0.0047
ND	83-0560	ND	Watermelon	Fruit	0.0006	83-0559	ND	0.55	0.0011
ND	83-0562	ND	Watermelon	Fruit	0.0008	83-0561	ND	0.8	0.0010
ND	83-0563	ND	Green Pea Pods	Fruit	0.008	83-0561	ND	0.8	0.010
ND	83-0583	ND	Tomato	Fruit	0.010	83-0584	ND	0.11	0.091
ND	83-0585	ND	Green Pepper	Fruit	0.002	83-0586	ND	0.16	0.013
ND	83-0592	ND	Tomato	Fruit	0.020	83-0591	ND	1	0.020
ND	83-0723	ND	Okra	Fruit	0.0029	83-0722	ND	0.5	0.0058
ND	83-0724	ND	Tomato	Fruit	0.0034	83-0722	ND	0.5	0.0068
ND	83-0728	ND	Green Beans	Fruit	0.00058	83-0272	ND	0.11	0.0053
ND	83-0732	ND	Tomato	Fruit	0.0044	83-0731	ND	0.19	0.023
ND	83-1088	ND	Tomato	Fruit	0.010	83-1089	ND	0.12	0.083
ND	83-1090	ND	Tomato	Fruit	0.010	83-1091	ND	0.09	0.11
W. Lincoln Rd.	84-1122	5/31/84	Strawberry	Fruit	<0.01	84-0963	5/15/84	0.29	0.017
Van Hicks Place (garden)	84-1155	6/6/84	Strawberry	Fruit	0.16	84-1154	6/6/84	30	0.0053
Delaware Avenue	84-1193	6/11/84	Squash	Fruit	0.010	84-1283 (avg)	6/27/84	0.26	0.038
W. Lincoln Rd. (47,16)	84-1424A	7/17/84	Green beans- Bean	Fruit	0.027	84-1407	7/17/84	0.12	0.23
W. Lincoln Rd. (54,27)	84-1425	7/17/84	Eggplant	Fruit	0.023	84-1408	7/17/84	0.15	0.15
W. Lincoln Rd. (54,27)	84-1426	7/17/84	Green pepper	Fruit	0.012	84-1408	7/17/84	0.15	0.080
W. Lincoln Rd. (40,30)	84-1428	7/17/84	Corn	Fruit	0.018	84-1401	7/17/84	0.2	0.090
W. Lincoln Rd. (40,30)	84-1429	7/17/84	Grapes	Fruit	0.024	84-1401	7/17/84	0.2	0.12
W. Lincoln Rd. (40,40)	84-1430	7/17/84	Corn	Fruit	0.026	84-1402	7/17/84	0.16	0.16
W. Lincoln Rd. (40,40)	84-1431	7/17/84	Okra	Fruit	0.018	84-1402	7/17/84	0.16	0.11

Table T-1: Mercury Concentrations Measured in Co-located Soil and Vegetable Samples in Oak Ridge by ORAU

Location	Plant Sample Number	Plant Sample Date	Plant	Plant Type	Plant Conc. (mg/kg, dry)	Soil Sample Number	Soil Sample Date	Soil Conc. (mg/kg, dry)	Plant/Soil Ratio
W. Lincoln Rd. (40,40)	84-1432	7/17/84	Tomato (green)	Fruit	0.0076	84-1402	7/17/84	0.16	0.048
W. Lincoln Rd. (50,40)	84-1434	7/17/84	Green watermelon	Fruit	0.014	84-1409	7/17/84	0.16	0.088
W. Lincoln Rd. (50,40)	84-1435	7/17/84	Tomato (green)	Fruit	0.0058	84-1409	7/17/84	0.16	0.036
W. Lincoln Rd. (54,37)	84-1437	7/17/84	Zucchini	Fruit	0.010	84-1409	7/17/84	0.16	0.063
W. Lincoln Rd. (54,37)	84-1438	7/17/84	Cucumber	Fruit	0.006	84-1409	7/17/84	0.16	0.038
W. Lincoln Rd. (40,20)	84-1439	7/17/84	Corn	Fruit	0.019	84-1400	7/17/84	0.16	0.12
W. Lincoln Rd. (40,20)	84-1440	7/17/84	Squash	Fruit	0.011	84-1400	7/17/84	0.16	0.069
Grandcove Lane	84-1455	7/25/84	Tomato	Fruit	0.013	84-1454 (avg)	7/25/84	1.3	0.010
Lind Place	84-1460	7/26/84	Tomato	Fruit	0.0098	84-1458 (avg)	7/26/84	0.22	0.045
Lind Place	84-1462	7/26/84	Cucumber	Fruit	0.014	84-1458 (avg)	7/26/84	0.22	0.064
Lind Place	84-1464	7/26/84	Banana Pepper	Fruit	0.023	84-1458 (avg)	7/26/84	0.22	0.10
Lind Place	84-1466	7/26/84	Squash	Fruit	0.028	84-1458 (avg)	7/26/84	0.22	0.13
North Purdue Avenue	84-1473	7/26/84	Tomato	Fruit	0.016	84-1474 (avg)	7/26/84	0.12	0.13
North Purdue Avenue	84-1475	7/26/84	Green pepper	Fruit	0.020	84-1474 (avg)	7/26/84	0.12	0.17
North Purdue Avenue	84-1477	7/26/84	Cucumber	Fruit	0.014	84-1474 (avg)	7/26/84	0.12	0.12
Lind Place	84-1491	7/26/84	Cucumber	Fruit	0.0066	84-1479 (avg)	7/27/84	0.2	0.033
Lind Place	84-1493	7/26/84	Tomato	Fruit	0.0092	84-1479 (avg)	7/27/84	0.2	0.046
Lind Place	84-1494	7/26/84	Pepper	Fruit	0.020	84-1479 (avg)	7/27/84	0.2	0.10
Lind Place	84-1496	7/26/84	Bell Pepper	Fruit	0.0098	84-1479 (avg)	7/27/84	0.2	0.049
Lind Place	84-1497	7/26/84	Squash	Fruit	0.010	84-1479 (avg)	7/27/84	0.2	0.050
Tusculum Drive	84-1511	8/21/84	Green Pepper	Fruit	0.017	84-1512	8/21/84	0.09	0.19
Amanda Drive	84-1570	8/14/84	Tomato	Fruit	0.031	84-1574 (avg)	8/14/84	0.06	0.52
Amanda Drive	84-1573	8/14/84	Tomato	Fruit	0.032	84-1574 (avg)	8/14/84	0.06	0.53
ND	83-0124	ND	Broccoli Heads	Leafy	0.003	83-0121	ND	0.9	0.0033
ND	83-0125	ND	Spinach Leaves	Leafy	0.006	83-0121	ND	0.9	0.0067
ND	83-0127	ND	Tomato-Stems & Leaves	Leafy	0.054	83-0121	ND	0.9	0.060
ND	83-0187	ND	Watercress	Leafy	0.024	83-0188	ND	37	0.00065
ND	83-0324	ND	Mint Plant	Leafy	0.16	83-0325	ND	29	0.0055
ND	83-0631	ND	Chard	Leafy	0.020	83-0630	ND	0.06	0.33
ND	83-0730	ND	Chard	Leafy	0.020	83-0729	ND	0.06	0.33
W. Lincoln Rd.	84-1022A	ND	Onion- Upper portion	Leafy	0.0092	84-1024	5/16/84	0.2	0.046
W. Lincoln Rd.	84-1023	ND	Lettuce	Leafy	0.030	84-1024	5/16/84	0.2	0.15
Behind Dean Stallings Ford	84-1053A	ND	Wild Onion-Upper portion	Leafy	0.18	84-1055	5/17/84	280	0.00064
W. Lincoln Rd.	84-1123	5/31/84	Lettuce	Leafy	0.13	84-0963	5/15/84	0.29	0.45
Van Hicks Place (garden)	84-1156A	6/6/84	Onion-leaf	Leafy	0.058	84-1153	6/6/84	0.23	0.25
Van Hicks Place (garden)	84-1157	6/6/84	Collard greens	Leafy	0.10	84-1158	6/6/84	0.08	1.3
West Outer Drive (garden)	84-1171	6/6/84	Lettuce	Leafy	0.11	84-1169	6/6/84	0.1	1.1
Delaware Avenue	84-1192	6/11/84	Lettuce	Leafy	0.02	84-1283 (avg)	6/27/84	0.26	0.077
Delaware Avenue	84-1194A	6/11/84	Turnip leaf	Leafy	0.04	84-1283 (avg)	6/27/84	0.26	0.15
W. Lincoln Rd.(47,16)	84-1424B	7/17/84	Green beans-Pod	Leafy	0.014	84-1407	7/17/84	0.12	0.12
W. Lincoln Rd.(50,30)	84-1427	7/17/84	White cabbage	Leafy	0.0087	84-1408	7/17/84	0.15	0.058
W. Lincoln Rd. (50,46)	84-1433	7/17/84	Red cabbage	Leafy	0.023	84-1410	7/17/84	0.07	0.33
Enfield Lane	84-1450	7/19/84	White Cabbage	Leafy	0.016	84-1449 (avg)	7/19/84	0.69	0.023
Brentwood Drive	84-1900	10/30/84	Broccoli	Leafy	0.023	84-1899	10/30/84	<0.01	4.6
Greenhouse	ND	ND	Carrots	Leafy	25.2	ND	ND	340	0.074
Greenhouse	ND	ND	Radish	Leafy	4.9	ND	ND	485	0.010
Greenhouse	ND	ND	Radish	Leafy	4.9	ND	ND	485	0.010
Greenhouse	ND	ND	Radish	Leafy	4.9	ND	ND	485	0.010
Greenhouse	ND	ND	Beets	Leafy	3.1	ND	ND	520	0.0060
Greenhouse	ND	ND	Beets	Leafy	3.1	ND	ND	520	0.0060
ND	83-0255	ND	Corn-Entire Plant	Stem	0.31	83-0253	ND	2.3	0.13
ND	83-0633	ND	Corn-Whole Plant	Stem	0.00093	83-0632	ND	0.05	0.019
Greenhouse	ND	ND	Radish	Stem	5.3	ND	ND	485	0.011
Greenhouse	ND	ND	Radish	Stem	5.3	ND	ND	485	0.011
Greenhouse	ND	ND	Radish	Stem	5.3	ND	ND	485	0.011
Greenhouse	ND	ND	Beets	Stem	1.0	ND	ND	520	0.0019
Greenhouse	ND	ND	Beets	Stem	1.0	ND	ND	520	0.0019
Greenhouse	ND	ND	Honeysuckle	Stem	0.60	ND	ND	640	0.00094

Table T-1: Mercury Concentrations Measured in Co-located Soil and Vegetable Samples in Oak Ridge by ORAU

Location	Plant Sample Number	Plant Sample Date	Plant	Plant Type	Plant Conc. (mg/kg, dry)	Soil Sample Number	Soil Sample Date	Soil Conc. (mg/kg, dry)	Plant/Soil Ratio
Greenhouse	ND	ND	Honeysuckle	Stem	0.60	ND	ND	640	0.00094
Greenhouse	ND	ND	Honeysuckle	Stem	0.60	ND	ND	640	0.00094
Greenhouse	ND	ND	Honeysuckle	Stem	0.60	ND	ND	640	0.00094
Greenhouse	ND	ND	Honeysuckle	Stem	0.60	ND	ND	640	0.00094
Greenhouse	ND	ND	Honeysuckle	Stem	0.60	ND	ND	640	0.00094
Greenhouse	ND	ND	Jewelweed	Stem	1.5	ND	ND	758	0.0020
Greenhouse	ND	ND	Jewelweed	Stem	1.5	ND	ND	758	0.0020
Greenhouse	ND	ND	Jewelweed	Stem	1.5	ND	ND	758	0.0020
Greenhouse	ND	ND	Jewelweed	Stem	1.5	ND	ND	758	0.0020
Greenhouse	ND	ND	Sneezeweed	Stem	239.4	ND	ND	1140	0.21
Greenhouse	ND	ND	Sneezeweed	Stem	239.4	ND	ND	1140	0.21
Greenhouse	ND	ND	Sneezeweed	Stem	239.4	ND	ND	1140	0.21
Greenhouse	ND	ND	Sneezeweed	Stem	239.4	ND	ND	1140	0.21
Greenhouse	ND	ND	Sneezeweed	Stem	239.4	ND	ND	1140	0.21

ND Not defined

TABLE T-2

Mercury Concentrations Measured in Co-located Soil and Vegetable Samples in the EFPC Flooplain by SAIC

Location	Plant Sample Number	Plant Type	Plant Conc. Dry Wt (ppm)	Soil Sample Number	Soil Conc. Dry Wt (ppm)	Plant / Soil Ratio
SAIC/ Bruner site 1	VG5311810	Tomato	<0.043	VG5312711	118	0.00018
SAIC/ Bruner site 1	VG5311822	Tomato	<0.030	VG5312711	118	0.00013
SAIC/ Bruner site 1	VG5311834	Tomato	<0.034	VG5312723	152	0.00011
SAIC/ Bruner site 1	VG5311846	Tomato	<0.056	VG5312735	281	0.00010
SAIC/ Bruner site 2	VG5311858	Tomato	0.42	VG5312747	236	0.00088
SAIC/ Bruner site 1	VG5311618	Kale	3.20	VG5312519	204	0.016
SAIC/ Bruner site 1	VG5311620	Kale	0.35	VG5312521	188	0.0019
SAIC/ Bruner site 1	VG5311632	Kale	0.17	VG5312533	141	0.0012
SAIC/ Bruner site 1	VG5311644	Kale	0.31	VG5312533	141	0.0022
SAIC/ Bruner site 2	VG5311656	Kale	0.18	VG5312545	270	0.00067
SAIC/ Bruner site 2	VG5311668	Kale	0.13	VG5312557	237	0.00056
SAIC/ Bruner site 2	VG5311670	Kale	1.28	VG5312569	699	0.0018
SAIC/ Bruner site 2	VG5311454	Beet	0.63	VG5312468	171	0.0037
SAIC/ Bruner site 2	VG5311466	Beet	0.76	VG5312468	171	0.0045
SAIC/ Bruner site 2	VG5311478	Beet	2.72	VG5312470	196	0.014
SAIC/ Bruner site 2	VG5311442	Beet	1.08	VG5312456	273	0.0040

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APPENDIX U

DERIVATION OF FACTORS FOR ESTIMATING THE BIOTRANSFER OF MERCURY TO MILK AND MEAT

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APPENDIX U

DERIVATION OF FACTORS FOR ESTIMATING THE BIOTRANSFER OF MERCURY TO MILK AND MEAT

U.1 Introduction

Biotransfer factors are used to estimate the transfer of an element or compound ingested or inhaled by livestock, game, etc. to milk or meat, and are usually presented as the ratio of the concentration of the element in the compartment of interest (e.g., milk or meat) to the daily intake rate. Biotransfer factors are used in the Task 2 evaluation to estimate the transfer of mercury taken up by grazing animals from ingestion of water, pasture grass, and soil. As discussed in Section 5.2, mercury is assumed to be present in each of these media in the vicinity of the ORR as a mixture of soluble and insoluble inorganic mercury (e.g., mercuric nitrate, mercuric oxide, mercuric sulfide) and/or elemental mercury.

A review of the scientific literature was conducted to identify factors for estimating biotransfer of mercury to milk and meat. Several studies were identified in which soluble inorganic mercury (e.g., mercuric chloride, mercuric nitrate) was administered to dairy cows and measured in milk. In addition, limited information describing the biotransfer of soluble inorganic mercury to meat was found. However, no studies were identified that investigated the transfer of less soluble forms of mercury from pasture grass or soil/sediment. It is likely that biotransfer factors derived using data on highly soluble species of mercury delivered to test animals in a readily available form (e.g., in water or food) will predict higher uptake than is likely following ingestion of the forms of mercury present in the environment near the ORR.

The following discussion describes the derivation of the biotransfer factors used in this assessment.

U.2 F_m (Biotransfer to Milk)

The transfer coefficient F_m represents the fraction of a cow's daily intake of an isotope or element that is secreted per liter of milk at equilibrium. This parameter has units "fractional day per liter" ($d\ L^{-1}$). Methods that can be used to estimate biotransfer to milk, using data from feeding studies in which stable elements or radioisotopes are administered to cows and subsequently measured in milk, and feeding studies investigating the transfer of mercury to cows' milk, are described below.

U.2.1 Methods for Estimating F_m from Isotope Feeding Studies

Methods for estimating F_m using data from isotope feeding studies are described below (Ng et al. 1977).

Method (1) *Calculation of F_m following administration of repeated doses*

Divide the estimated plateau concentration of an isotope in milk following daily or repeated dosing by the daily intake of the isotope:

$$F_m = \frac{\text{Concentration of isotope in milk at plateau } (Ci\ L^{-1} \text{ or } mg\ L^{-1})}{\text{Daily intake of isotope } (Ci\ d^{-1} \text{ or } mg\ d^{-1})}$$

or, alternatively:

$$F_m = \frac{\dfrac{\text{Concentration of isotope in milk at plateau } (Ci\ L^{-1} \text{ or } mg\ L^{-1})}{\text{Concentration of isotope in feed (dry wt) } (Ci\ kg^{-1} \text{ or } mg\ kg^{-1})}}{\text{Daily consumption of feed (dry wt) } (kg\ d^{-1})}$$

Method (2) *Calculation of F_m following administration of a single dose- Integration over time*

Integrate the fraction of the total dose secreted in milk over time, following administration of a single oral dose of an isotope and collection of milk at intervals (the curve approaches a value that represents the equilibrium concentration in milk):

$$F_m = \int_0^\infty \sum_{i=1}^{n} A_i\, e^{-\lambda_{MEi} t}\, dt = \sum_{i=1}^{n} \frac{A_i}{\lambda_{MEi}}$$

Where:

A_i	=	Coefficient of *i*th exponential term (L^{-1}) (i.e., the fraction of the total dose secreted per liter of milk)
λ_{MEi}	=	Effective elimination rate of the *i*th milk component (d^{-1})
t	=	Time of sample collection (d)
n	=	Total number of intervals of milk sample collection

The effective elimination rate of the *i*th milk component is approximated using the following equation:

$$\lambda_{MEi} = \frac{\ln 2}{T_R} + \frac{\ln 2}{T_{MBi}}$$

Where:

T_R = Radiological half-life of isotope (d)

T_{MBi} = Biological half-life of isotope in milk compartment (d)

Method (3) Calculation of F_m following administration of a single dose

Divide the total activity or mass of an isotope recovered in milk following administration of a single dose by the daily rate of milk secretion (Note: although it is sometimes possible to make reasonable estimates of the activity or mass of an isotope yet to be recovered in milk, it is desirable that the experiment be conducted for a long enough period so that most of the recoverable dose will have been secreted, i.e., approximately 6 days or longer):

$$F_m = \frac{\dfrac{Total\ activity\ or\ mass\ of\ isotope\ recovered\ in\ milk\ (Ci\ or\ mg)}{Total\ intake\ of\ isotope\ (Ci\ or\ mg)}}{Daily\ rate\ of\ milk\ secretion\ (L\ d^{-1})}$$

or, alternatively:

$$F_m = \frac{Average\ milk\ concentration\ (Ci\ L^{-1}\ or\ mg\ L^{-1})}{Daily\ intake\ of\ isotope\ (Ci\ d^{-1}\ or\ mg\ d^{-1})}$$

U.2.2 Calculation of F_m for Inorganic Mercury

Because dairy cows historically grazing in the EFPC floodplain after 1953 may have been exposed to mercury for prolonged periods, studies in which mercury was administered repeatedly over long periods of time are most relevant for predicting uptake of mercury in the Oak Ridge area. Only one study was identified in which inorganic mercury was repeatedly administered to dairy cattle; the remaining studies evaluated single doses. Studies investigating the transfer of mercury into cows' milk are described below.

U.2.2.1 Calculation of F_m following Repeated Dosing

Vreman et al., 1986: Repeated dosing with stable mercuric acetate in feed

Vreman et al. (1986) administered twelve dairy cows repeated doses of stable mercuric acetate in feed for three months. Milk was collected for analysis once a month on two consecutive days. Mercury concentrations were also measured in the milk of 12 control cows that received no additional (above background) dose.

The relevant experimental data for calculation of F_m are as follows:

Mercury intake (dosed cows)	=	1.7 mg d^{-1} for 3 mo. (artificial dose of 1.5 mg Hg/d as mercuric acetate + background of 0.2 mg Hg/d)
Mercury intake (controls)	=	0.2 mg Hg/day (background)
Daily dry matter intake	=	18 kg/day
Milk collection period	=	Once per month for two consecutive days for a total of three months
Milk concentration, dosed cows (mean)	=	0.0009 mg Hg/kg milk
Milk concentration, control cows (mean)	=	0.0023 mg Hg/kg milk

These data were not used to calculate an F_m value since the average concentration of mercury in milk from the 12 control cows (receiving no dose) was higher than that from the dosed cows, although the daily mercury intake by the controls was lower. Further, the milk concentrations from both groups were essentially equal to background levels in the Netherlands, where this study was conducted (i.e., 0.0012 mg Hg/kg milk) (Vreman et al. (1986)). Background concentrations of mercury in milk in the United States of up to 0.01 mg/kg have been reported (Hapke, 1991 as reported in ATSDR, 1994). Based on these data, Vreman et al. (1986) concluded that there was essentially no uptake of inorganic mercury in the dosed cows.

As the Vreman et al. (1986) study illustrates, the biotransfer of trace concentrations of a stable isotope is difficult to measure, since it is difficult to distinguish between the dose and background sources. The remaining studies, described below, evaluate the biotransfer of radiolabeled mercury.

U.2.2.2 Calculation of F_m following Single Doses

Mullen et al. (1975): Single oral dose of radiolabeled mercuric nitrate

Mullen et al. (1975) administered a single oral dose of radiolabeled mercuric nitrate ($^{203}Hg(NO_3)_2$) (dissolved in nitric acid solution in a gelatine capsule with a balling gun) to four dairy cows. Milk samples were collected six hours to 26 days after dosing. Peak activity in milk and the half-time for transfer to milk are reported.

Relevant experimental data for calculation of F_m, averaged for the four cows used in the study, are as follows:

Mercury intake	=	1.7 mCi administered at a specific activity of 3.9 mCi/mg Hg (total dose = 0.44 mg Hg)

Milk collection period	=	From 6 hours to 26 days after dosing
Volume of milk secreted	=	Not given
Recovery in milk (A)	=	Peak activity in milk was at 42 hours after dosing (peak concentration represented 0.00014% of the administered dose per liter) [$A \approx 1.4 \times 10^{-4}$%/L]
Radiological half-life of ^{203}Hg (T_R)	=	46.60 days
Half-time for transfer to milk (T_{MEi})	=	131 hours (5.5 days) from the time of peak activity in milk (42 hr) until sampling was discontinued (26 d after dosing), decay-corrected to the time of administration

Using these data, F_m was approximated as follows (Method (2)):

$$F_m = \frac{A}{\lambda_{MEi}} = \frac{A}{\frac{\ln 2}{T_R} + \frac{\ln 2}{T_{MBi}}} = \frac{1.4 \times 10^{-4}\%\ L^{-1}}{\frac{\ln 2}{46.60\ d} + \frac{\ln 2}{5.5\ d}} = 1.0 \times 10^{-5}\ d\ L^{-1}$$

This value is consistent with the value calculated by Steven et al. (1991) using these data of 9.2×10^{-6} d L^{-1}.

Based on the experimental results, Mullen et al. concluded that "in lactating cows, secretion in milk does not account for a large percentage of administered radiomercury, being approximately 0.01% of the oral intake" and that "these values applied to bovine ingestion of stable mercury would indicate little hazard from the ingestion of milk or milk-byproducts obtained from cows eating feed contaminated with inorganic mercury."

Potter et al. (1972): Single oral dose of radiolabeled mercuric chloride

Potter et al. (1972) administered two Holstein cows a single dose of radiolabeled mercuric chloride ($^{203}HgCl_2$) (adsorbed on anhydrous dextrose in a gelatin capsule with a balling gun). Milk samples were collected up to 144 hours after administration. The total and average recovery of mercury in milk and the biological half-time are reported.

The relevant experimental data for calculation of F_m, averaged for the two cows used in the study, are as follows:

Dose = 344 µCi (specific activity of mercury not given)

Milk collection period = 6 days

Volume of milk secreted = Average of approximately 92 kg of milk per cow over 6 days of milk collection, or approximately 15 L d^{-1} per cow

Recovery in milk (A) = 0.0097% of dose by 144 hours after administration (average of 0.000011 %/kg milk; $\Sigma A_i \sim 6.3 \times 10^{-4}$ %/L)

Radiological half-life of ^{203}Hg = 46.60 days

Biological half-life = 28.5 hr (Note: this is the half-life for *whole body burden*, not the milk component)

Whole body half-life largely reflects fecal excretion. More than 90% of mercury administered via the oral route is excreted in the feces. In the Potter et al. study, the fecal levels dropped after 48 hours, but the milk, urine, plasma, and erythrocyte levels remained relatively constant, suggesting that while the study duration (6 d) may have been sufficient to capture the whole body half-life, it likely was not sufficient to capture the half-time in milk.

F_m was approximated using two separate approaches:

Method (2):

$$F_m = \frac{A}{\frac{\ln 2}{T_R} + \frac{\ln 2}{T_{MBi}}} = \frac{6.3 \times 10^{-4}\,\%/L}{\frac{\ln 2}{46.60\ d} + \frac{\ln 2}{1.2\ d}} = \frac{6.3 \times 10^{-6}\ L^{-1}}{0.59\ d^{-1}} = 1.1 \times 10^{-5}\ d\ L^{-1}$$

NOTE: Since T_{MBi} in this equation is the whole-body half-life, not the half-life for the milk compartment, F_m is likely underestimated (i.e., a larger T_{MBi} will produce a larger F_m value).

Method (3):

$$F_m = \frac{Total\ activity\ recovered\ in\ milk}{Daily\ rate\ of\ milk\ secretion} = \frac{0.0097\%}{15\ L\ d^{-1}} = 6.5 \times 10^{-6}\ d\ L^{-1}$$

Neathery et al. (1974): Single oral dose of radiolabeled methylmercury. Three 3-y old Jersey cows in month 7 of lactation were given radiolabeled methylmercury ($CH_3^{203}HgCl$) via gelatin capsule. Others have reported that F_m values for methylmercury are approximately 40 times higher than for mercuric chloride (Ng, 1982).

The relevant experimental data for calculation of F_m are summarized below:

Dose	=	Unspecified (specific activity = 3.00 mCi/mg Hg)
Milk collection period	=	Cows milked two times daily at approximately 12 hour intervals for 14 days following dosing
Volume of milk secreted	=	Average of 4.1 kg of milk/cow-day (~ 57 L total/cow)
Recovery in milk	=	0.17% of Hg dose appeared in milk by 14 days after dosing, with peak on Day 3
Half-time in milk	=	Approximately 5.5 days

F_m (for methylmercury) was approximated using two approaches:

Method (2):

$$F_m = \frac{A}{\frac{\ln 2}{T_R} + \frac{\ln 2}{T_{MBi}}} = \frac{0.17\%/57L}{\frac{\ln 2}{46.60\ d} + \frac{\ln 2}{5.5\ d}} = \frac{3.0 \times 10^{-5}\ L^{-1}}{0.15\ d^{-1}} = 2.0 \times 10^{-4}\ d\ L^{-1}$$

Method (3):

$$F_m = \frac{Total\ activity\ recovered\ in\ milk}{Daily\ rate\ of\ milk\ secretion} = \frac{0.17\%}{4.1\ L\ d^{-1}} = 4.1 \times 10^{-4}\ d\ L^{-1}$$

Applying the assumption that F_m for inorganic mercury is 40-fold lower than that for methylmercury (Ng, 1982), an inorganic mercury F_m value of approximately 1×10^{-5} d L^{-1} is estimated.

U.2.2.3 Determination of a Parameter Distribution for F_m

Table U-1 summarizes the F_m values calculated for inorganic mercury. Based on these data, it was assumed that F_m for soluble forms of inorganic mercury ingested by cattle is larger than 5×10^{-6} d L^{-1} and less than 5×10^{-5} d L^{-1}. A uniform distribution was assumed, and was used to estimate the biotransfer of mercury in ingested water or pasture to milk. It is likely that mercury in soil ingested by cattle while grazing is less soluble than the forms of mercury ingested by cattle in these studies. For purposes of evaluating the biotransfer of mercury to milk following ingestion of soil, the F_m value for soluble forms of inorganic mercury was multiplied by the oral bioavailability factor for soil (described in Section 8.2).

U.3 F_f (Biotransfer to Beef)

The transfer coefficient F_f represents the fraction of a cow's daily intake of an isotope or element that is present in muscle at equilibrium. This parameter has units "fractional day per kilogram muscle (fresh weight)" (d kg^{-1}). Methods that can be used to estimate biotransfer to meat, using data from studies in which stable elements or radioisotopes are administered to an animal and subsequently measured in meat, and feeding studies investigating the transfer of inorganic mercury to meat, are described below.

U.3.1 Methods for Estimating F_f from Isotope Feeding Studies

Several methods have been established to estimate F_f following administration of stable or radioactive isotopes of an element of interest (Ng et al., 1977). Again, studies in which mercury was administered repeatedly would be most relevant for predicting uptake of mercury in the Oak Ridge area. However, most studies that estimate mercury biotransfer to meat evaluate single doses. Methods for estimating F_f using data from isotope feeding studies are described below (Ng et al. 1977).

Method (1) Calculation of F_f following administration of repeated doses

Divide the concentration in muscle at slaughter following prolonged continuous or repeated feeding of an isotope (radioactive or stable) by the daily intake of the isotope:

$$F_f = \frac{Concentration\ of\ isotope\ in\ muscle\ (fresh\ wt)\ (Ci\ kg^{-1}\ or\ mg\ kg^{-1})}{Daily\ intake\ of\ isotope\ (Ci\ d^{-1}\ or\ mg\ d^{-1})}$$

Method (2) *Calculation of F_f following administration of repeated doses*

Divide the accumulation factor (*AF*) by the muscle mass where *AF* is defined as the ratio of the activity or mass of the isotope in muscle after prolonged or continuous feeding and the daily intake of the isotope:

Method (3) *Calculation of F_f following administration of repeated doses*

$$F_f = \frac{\dfrac{Total\ activity\ or\ mass\ of\ isotope\ in\ muscle\ (Ci\ or\ mg)}{Daily\ intake\ of\ isotope\ (Ci\ d^{-1}\ or\ mg\ d^{-1})}}{Total\ muscle\ mass\ (fresh\ wt)\ (kg)}$$

Divide the concentration ratio (*CR*) by the kilograms of dry feed ingested daily where *CR* is defined as the ratio of the concentration of an isotope in wet muscle after prolonged continuous or repeated feeding of the isotope to that in dry feed.

Method (4) *Calculation of F_f following administration of a single dose- Integration over time*

Integrate the concentration in muscle at slaughter over time following administration of a single oral dose of a radioisotope tracer to a group of animals and sacrifice of individual animals at intervals (the time integral of the concentration in muscle following a single oral dose of a radioisotope reflects the equilibrium concentration in muscle following daily oral doses of the same activity of the isotope):

$$F_f = \int_0^\infty \sum_{i=1}^{n} A_i\, e^{-\lambda_{MEi} t} dt = \sum_{i=1}^{n} \frac{A_i}{\lambda_{MEi}}$$

Where:

A_i	=	Coefficient of *i*th exponential term (kg^{-1}) (i.e., the fraction of the total dose per kg of muscle)
λ_{MEi}	=	Effective elimination rate of the *i*th muscle component (d^{-1})
t	=	Time of sample collection (d)
n	=	Total number of intervals of muscle sample collection

And,

$$\lambda_{MEi} = \frac{\ln 2}{T_R} + \frac{\ln 2}{T_{MBi}}$$

Where:

T_R	=	Radiological half-life of isotope (d)
T_{MBi}	=	Biological half-life of isotope in the muscle compartment (d)

U.3.2 Calculation of F_f for Inorganic Mercury

Because beef cattle historically grazing in the EFPC floodplain after 1953 may have been exposed to mercury for prolonged periods, studies in which mercury was administered repeatedly over a long period of time are most relevant for predicting uptake of mercury in the Oak Ridge area. Only one study was identified in which inorganic mercury was repeatedly administered to cattle; the remaining studies evaluated single doses. Studies investigating the transfer of mercury into meat are described below.

U.3.2.1 Calculation of F_f following Repeated Dosing

Vreman et al., 1986: Repeated dosing with stable mercuric acetate in feed

Vreman et al. (1986) sacrificed four of the 12 dairy cows that were administered repeated doses of stable mercuric acetate in feed during the milk study, and concentrations of mercury in the muscle of the cows were measured.

The relevant experimental data for calculation of F_f are summarized below:

Mercury intake (dosed cows)	=	1.7 mg d^{-1} for three months (as stable mercuric acetate)
Mercury intake (control)	=	0.2 mg d^{-1}
Daily dry matter intake	=	18 kg d^{-1}
Duration of experiment	=	After 3 months of feeding, 4 cows from the experimental group and 1 from the control group were sacrificed and tissue samples taken
Muscle concentration, dosed cows (mean)	=	0.004 mg kg^{-1}
Muscle concentration, control cow (mean)	=	0.003 mg kg^{-1}

The concentration of mercury in muscle from the dosed cow was 0.001 mg kg^{-1} higher than that for the control cow (receiving no dose). Using these data, F_f was approximated as follows (Method (1)):

$$F_f = \frac{Concentration\ in\ muscle}{Daily\ intake} = \frac{0.001\ mg\ kg^{-1}}{1.7\ mg\ d^{-1}} = 6 \times 10^{-4}\ d\ kg^{-1}$$

Based on these data, Vreman et al. (1986) concluded that the data indicate very little uptake of inorganic mercury in dosed cows. As discussed above, the biotransfer of trace concentrations of elements is difficult to measure following administration of stable isotopes, since it is difficult to distinguish between mercury from background sources and the dosed mercury. Lactating cows were used in this study, and milk represents a route of excretion not present in beef cattle. However, most studies suggest transfer of inorganic mercury into milk is minimal such that the effect of lactation of reducing the overall body burden in the cow is likely minimal.

U.3.2.2 Calculation of F_f following Single Doses

Three studies were identified in which mercury concentrations were measured in muscle tissue of cows 42 hours to 30 days after administration of a single oral dose of radiolabeled inorganic mercury (Ansari et al. 1973; Mullen et al. 1975; Potter et al. 1972). Following administration of a single dose of a radioisotope, the equilibrium concentration of mercury in muscle resulting from repeated oral doses can be approximated based on the time integral of the concentration in muscle following the single oral dose (Method (4), above). However, since concentrations in muscle in a given cow were measured at only one point in time (i.e., after slaughter), none of these studies report half-times for mercury in muscle (a necessary parameter for integration of the concentration of mercury in muscle over time). The experimental data from these studies are described below.

Ansari et al. (1973): Single oral dose of radiolabeled mercuric chloride

Ansari et al. (1973) administered a single oral dose of radiolabeled mercuric chloride ($^{203}HgCl_2$) (in gelatine capsule via balling gun) to three 10-week old Holstein calves. Seven days after dosing, the animals were sacrificed and the recovery of mercury in muscle was measured.

The relevant experimental data for calculation of F_f are as follows:

Mercury intake (dosed calves)	=	1543 µCi at specific activity of 11,700 µCi/mg Hg administered (total dose = 0.13 mg Hg)
Daily dry matter intake	=	2.28 kg d^{-1}
Duration of experiment	=	Animals sacrificed seven days after dosing
Recovery in muscle	=	0.0030% of dose/kg muscle

Mullen et al. (1975): Single oral dose of radiolabeled mercuric nitrate

Mullen et al. (1975) administered a single oral dose of radiolabeled mercuric nitrate ($^{203}Hg(NO_3)_2$) (dissolved in nitric acid solution in a gelatine capsule with a balling gun) to two lactating dairy cows and one calf. From four to 31 days after dosing, the animals were sacrificed and the recovery of mercury in muscle was measured.

The relevant experimental data for calculation of F_f are as follows:

Mercury intake (calf)	=	1.2 mCi at specific activity of 3.9 mCi/mg Hg (total dose = 0.31 mg Hg), sacrificed four days after dosing
Mercury intake (cows)	=	1.7 mCi at specific activity of 3.9 mCi/mg Hg (total dose = 0.44 mg Hg), one cow was sacrificed 10 days after dosing and one 30 days after dosing
Recovery in muscle	=	Calf (4 days after dosing) = 0.002% dose/kg muscle; Cow (10 days after dosing) = <0.001% dose/kg muscle; Cow (31 days after dosing) = <0.001% dose/kg muscle

Potter et al. (1972): Single oral dose of radiolabeled mercuric chloride

Potter et al. (1973) administered one 103 kg calf a single dose of radiolabeled mercuric chloride ($^{203}HgCl_2$) (adsorbed on anhydrous dextrose in a gelatine capsule with a balling gun). Forty-two hours after dosing, the animals were sacrificed and the recovery of mercury in muscle was measured.

The relevant experimental data for calculation of F_f are as follows:

Mercury intake	=	490 µCi (specific activity of mercury not given)
Duration of experiment	=	Sacrificed after 42 hours
Recovery in muscle	=	0.001% dose/kg muscle
Whole-body half-life	=	In cows (two) administered 344 µCi Hg-203 at the same time, the first *whole-body* biological half-life based on recovery in milk, urine, and feces was 28.5 hrs (1.2 d), and the second half-life was ~48 hrs (2 d).

These studies report values for the fraction of total dose per kg muscle (*A*) ranging from <0.001% to 0.003% dose/ kg muscle. In calculating F_f for uptake into chickens, Ng et al. (1982) assumed that the half-life in muscle is equivalent to the half-life in the second whole-body component (based largely on recovery of the isotope in urine and feces). As reported by Potter et al. (1972), the second whole-body half-life in a cow administered radio-labeled mercuric chloride was 2 d. However, this second half-life probably largely reflects mercury that is immediately excreted in the feces and is never absorbed. Uptake to and elimination from muscle is probably significantly slower (a slower half-life results in a larger F_f value). For example, following ingestion, the (whole body) turnover rate of absorbed mercuric chloride (i.e., ingested mercury less that immediately excreted in the feces and never absorbed) is reported to be 30 days in humans and 13 days in rats.

Assuming half-lives of inorganic mercury in muscle of cows ranging from 10 to 30 days and values for the fraction of total dose per kg muscle (A) ranging from <0.001% to 0.003% dose/ kg muscle, estimated F_f values following single doses (Method (4)) range from approximately 1×10^{-4} to 8×10^{-4} d kg^{-1}.

U.3.2.3 Determination of a Parameter Distribution for F_f

Table U-1 summarizes the F_f values calculated for inorganic mercury. Based on the range of values presented and the uncertainties in the assumed values for the half-time of mercury in muscle, it was assumed that F_f for soluble forms of inorganic mercury ingested by cattle intake is larger than 1×10^{-4} d kg^{-1} and less than 9×10^{-4} d kg^{-1}. A uniform distribution was assumed. This distribution was used to estimate the biotransfer of mercury in ingested water or pasture to meat. It is likely that mercury in soil ingested by cattle while grazing is less soluble than the forms of mercury ingested by cattle in these studies. For purposes of evaluating the biotransfer of mercury to meat following ingestion of soil, the F_f value for soluble forms of inorganic mercury was multiplied by the oral bioavailability factor for soil (described in Section 8.2).

U.4 References

Ansari, M.S., W.J. Miller, R.P. Gentry, M.W. Neathery, and P.E. Stake. 1973. Tissue 203Hg distribution in young Holstein calves after single tracer oral doses in organic and inorganic forms. *J. Anim. Sci*. 36(2): 415-419.

ATSDR. 1994. Agency for Toxic Substances and Disease Registry. *Toxicological Profile for Mercury (Update).* Prepared for Clement International Corporation for the U.S. Department of Health and Human Services. May.

Mullen, A.L., R.E. Stanley, S.R. Lloyd, and A.A. Moghissi. 1975. Absorption, distribution, and milk secretion of radionuclides by the dairy cow IV. Inorganic radiomercury. *Health Phys*. 28:685-691.

Neathery, M.W., W.J. Miller, R.P. Gentry, P.E. Stake, and D.M. Blackmon. 1974. Cadmium-109 and methyl mercury-203 metabolism, tissue distribution, and secretion into milk of cows. *J. Dairy Sci*. 57(10): 1177-1183.

Neathery, M.W. and W.J. Miller. 1975. Metabolism and toxicity of cadmium, mercury, and lead in animals: A review. *J. Dairy Sci*. 58(12): 1767-1781.

Ng, Y.C., C.A. Burton, S.E. Thompson, R.K. Tandy, H.K. Kretner, and M.W. Pratt. 1968. *Prediction of the maximum dosage to man from the fallout of nuclear devices. IV. Handbook for estimating the maximum internal dose from radionuclides released to the biosphere*. UCRL-5163. Part IV. May 14.

Ng, Y.C., C.S. Colsher, D.J. Quinn, and S.E. Thompson. 1977. *Transfer Coefficients for the Prediction of the Dose to Man via the Forage-Cow-Milk Pathway from Radionuclides Released to the Biosphere*. Lawrence Livermore Laboratory, Livermore, California. UCRL-51939. July 15.

Ng, Y.C. 1982. A review of transfer factors for assessing the dose from radionuclides in agricultural products. *Nucl. Saf*. 23(1):57-71.

Ng, Y.C., C.S. Colsher, and S.E. Thompson. 1982. *Transfer Coefficients for Assessing the Dose from Radionuclides in Meat and Eggs*. Lawrence Livermore National Laboratory, Livermore, CA. NUREG/CR-2976. November.

Potter, G.D., McIntyre, D.R., and G.M. Vattuone. 1972. Metabolism of ^{203}Hg administered as $HgCl_2$ in the dairy cow and calf. *Health Phys*. 22: 103-106.

Stevens, J.B. 1991. Disposition of toxic metals in the agricultural food chain. 1. Steady-state bovine milk biotransfer factors. *Environ. Sci. Technol*. 25(7): 1289-1294.

Vreman, K., N.G. van der Veen, E.J. van der Molen, and W.G. de Ruig. 1986. Transfer of cadmium, lead, mercury, and arsenic from feed into milk and various tissues of dairy cows: chemical and pathological data. *Neth. J. of Ag. Sci*. 34: 129-144.

TABLE U-1
SUMMARY OF STUDIES USED TO ESTIMATE THE BIOTRANSFER OF MERCURY TO MILK AND MEAT

Study	Mercury Species	Frequency of Dosing	Route of Administration	F_m (d L^{-1})	F_f (d kg^{-1})
Vreman et al. (1986)	Mercuric acetate (stable)	Repeated (daily for 3 months)	Oral (in feed)	ND	6×10^{-4}
Mullen et al. (1975)	Mercuric nitrate (radiolabeled)	Single dose	Oral (gelatine capsule/ balling gun)	1×10^{-5}	1×10^{-4} to 5×10^{-4} (b)
Potter et al. (1972)	Mercuric chloride (radiolabeled)	Single dose	Oral (gelatine capsule/ balling gun)	7×10^{-6} to 1×10^{-5}	1×10^{-4} to 3×10^{-4} (c)
Neathery et al. (1974)	Methylmercury (radiolabeled)	Single dose	Oral (gelatine capsule/ balling gun)	1×10^{-5} (a)	ND
Ansari et al. (1973)	Mercuric chloride (radiolabeled)	Single dose	Oral (gelatine capsule/ balling gun)	ND	4×10^{-4} to 8×10^{-4} (d)

ND Not determined

a Based on estimated F_m value of 2×10^{-4} d L^{-1} for methylmercury and the assumption that F_m values for inorganic mercury are approximately 40-fold lower (Ng, 1982).

b Based on reported fraction of total dose/ kg muscle of <0.001% to 0.002% and assumed half-time in muscle of 10 to 30 days.

c Based on reported fraction of total dose/ kg muscle of 0.001% and assumed half-time in muscle of 10 to 30 days.

d Based on reported fraction of total dose/ kg muscle of 0.003% and assumed half-time in muscle of 10 to 30 days.

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APPENDIX V

DESCRIPTION OF PARAMETER DISTRIBUTIONS CHARACTERIZING EXPOSURE TO THE REFERENCE POPULATIONS

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1.0 PARAMETER DISTRIBUTIONS FOR TRANSFER OF MERCURY FROM AIR TO VEGETATION

1.1 Transfer to Vegetables

1.1.1 Weathering Rate for Vegetables, d^{-1}

Parameter Symbol: k_w

Assessment Endpoint(s): Wolf Valley farm family
Scarboro Community resident
East Fork Poplar Creek Floodplain farm family

Period of Time Averaging: Annual average

Rationale: Removal processes, described by the term "weathering", contribute to reduction in the initial quantity of contaminant deposited on vegetation. Weathering processes include the effects of wind and water, grazing by insects and larger herbivores, cuticle sloughing, and growth dilution. The weathering rate constant, k_w, is used to characterize the reduction in initial concentration.

The weathering rate constant for vegetation is characterized as a function of the weathering half-life, T_w, as follows:

$$k_w = \frac{0.693}{T_w}$$

Reported annualized values for T_w for particulates on grasses and vegetables (young cabbage plants) range from 8.7 to 14 days with an arithmetic mean of about 11 days (Miller and Hoffman, 1979). T_w for iodines on pasture grass (annual average) ranges from about 6 to 17 days (Hoffman et al. 1998). A T_w for mercury vapor was not identified. T_w tends to be shorter during the growing season, due to growth dilution. Because of the uncertainty in the true value of this parameter for mercury, T_w was characterized by a range of 6 to 14 days. This range corresponds to a weathering rate constant of 0.05 to 0.12 d^{-1}.

Distribution(s): Uniform {minimum = 0.05 d^{-1}; maximum = 0.12 d^{-1}}

1.1.2 Period of Exposure of Standing Crop Biomass for Vegetables, d

Parameter Symbol: $T_{g(v)}$

Population(s): Wolf Valley farm family
Scarboro Community resident
East Fork Poplar Creek Floodplain farm family

Period of Time Averaging: Not applicable

Rationale: It was assumed that the typical period of exposure of standing crop biomass to contamination during the growing season, for leafy or other above-ground (exposed) vegetables, is about 60 days. However, some crops (e.g., lettuce) may be picked shortly after sprouting above the ground surface while others (e.g., tomatoes or peppers) may be exposed for a much longer period of time.

This parameter was characterized by a uniform distribution with a minimum of 10 days and a maximum of 90 days.

Distribution(s): Uniform {minimum = 10 d; maximum = 90 d}

1.1.3 Fraction of Contaminant Remaining On Vegetables After Washing, unitless

Parameter Symbol: f_w

Assessment Endpoint(s): Wolf Valley farm family
Scarboro Community resident
East Fork Poplar Creek Floodplain farm family

Period of Time Averaging: It is assumed that this parameter is not sensitive to averaging time

Rationale: Literature on losses of contaminants from food during processing and preparation are limited. Ng et al. (1978) present data on the losses of radionuclides from fruits and vegetables during processing. The data presented do not distinguish between losses of activity originating from deposition on plant surfaces or from root uptake. The reported activity remaining in fruits and vegetables, including cabbage, sweet corn, cucumbers, snap beans, potatoes, tomatoes, melons, and apples, after preparation and processing for consumption, ranges from 50% to 100%. Ranges provided by IAEA assume that the fraction of contaminant remaining after washing ranges between 20 and 70% (IAEA 1992, 1994)

It is likely that surficial contamination will be more readily removed as the result of processing (including washing) than will internal contamination. The removal of protective coverings such as skins or husks will also likely reduce the amount of contaminant that remains in vegetables prepared for consumption. However, mercury in air is primarily absorbed into plants, as opposed to being deposited on the surface as particulate, and thus is not likely to be efficiently removed during washing or preparation.

The amount of mercury remaining in vegetables after preparation and processing is characterized by an uniform distribution with a minimum value of 50% and a maximum value of 100%.

Distribution(s): Uniform {minimum = 0.5; maximum = 1.0}

1.2 Transfer to Pasture

1.2.1 Weathering Rate for Pasture, d^{-1}

Parameter Symbol: k_w

Assessment Endpoint(s): Wolf Valley farm family
East Fork Poplar Creek Floodplain farm family

Period of Time Averaging: Annual average

Rationale: The weathering rate constant for pasture was assumed to be the same as that for vegetables (Section 1.1.1).

Distribution(s): Uniform {minimum = 0.05 d^{-1}; maximum = 0.12 d^{-1}}

1.2.2 Period of Exposure of Standing Crop Biomass for Pasture, d

Parameter Symbol: $T_{g(p)}$

Assessment Endpoint(s): Wolf Valley farm family
East Fork Poplar Creek Floodplain farm family

Period of Time Averaging: Not applicable

Rationale: This parameter was characterized by a uniform distribution with a minimum of 10 days and a maximum of 60 days.

Distribution(s): Uniform {minimum = 10 d; maximum = 60 d}

2.0 PARAMETER DISTRIBUTIONS FOR INTAKE OF MERCURY BY DAIRY AND BEEF CATTLE

2.1 Intake by Dairy Cattle

2.1.1 Feed Intake (Dry Weight) by Dairy Cattle, kg d^{-1}

Parameter Symbol: $Q_{feed(d)}$

Assessment Endpoint(s): Wolf Valley farm family
East Fork Poplar Creek Floodplain farm family

Period of Time Averaging: Annual average

Rationale: Numerous feed intake studies have been conducted for dairy cattle. However, most studies characterize feed intake for dairy cattle at commercial dairies. In order to maximize milk production, feed intake for dairy cattle at commercial dairies is typically higher than would be expected for "backyard" cows, and the diets of commercial dairy cattle consist of a greater percentage of concentrates (grains) versus hay and silage ("green chop"). For these reasons, feed intakes for commercial dairy cattle were excluded from the data set used to characterize backyard dairy cattle feed intake.

In addition to the differences in feed intake by backyard cows vs. commercial cows, it is likely that rates of feed intake during the 1950s and 1960s were lower than current rates. For example, Shor and Fields (1980) report that "the average milk production per cow has increased by 45% in the past 15 years", based on data reported by the Dairy Herd Improvement Association (DHIA). An increase in milk production would likely be correlated with an increase in feed intake. However, it is likely that the majority of cows included in the DHIA study are commercial cows or cows from large, well-managed herds. The increase in milk production or feed ingestion among "backyard" cows would likely not be as significant.

Dreicer et al. (1990) estimated dry matter intakes by dairy cows in the eastern United States in the 1950s based on the weight of cows and daily milk yield reported to the DHIA by herd managers between 1953 and 1963. Total daily dry matter intakes are estimated to range between 12.8 and 15.2 kg d^{-1}. Dreicer et al. (1990) indicate that these values should be considered maximum values since the methodology used to calculate the intakes is intended to provide maximum dry matter intakes and since the cows that participated in the study are likely to have weighed more and produced more milk than those not participating. These estimates are within the range of dry matter intakes of 9 to 17 kg d^{-1} reported in the literature for dairy cows in the 1950s (Dreicer et al. 1990).

Based on data from these studies and the likelihood that daily dry matter intakes by backyard cows were on average lower than dry matter intakes reported for commercial cows, feed ingestion rates for backyard dairy cows in the Oak Ridge area were assumed to be larger than 7 kg d^{-1} and less than 14 kg d^{-1} (dry weight). The minimum value was based on recommendations for minimum feed ingestion rates by dairy cattle from the DHIA. It was assumed that the most likely feed ingestion rate was 10 kg d^{-1}.

Distribution(s): Triangular {minimum = 7 kg (dry wt) d^{-1}; maximum = 14 kg (dry wt) d^{-1}; mode = 10 kg (dry wt) d^{-1}}

2.1.2 Fraction of Feed Consumed by Dairy Cattle that was Pasture, unitless

Parameter Symbol: $f_{p(d)}$

Assessment Endpoint(s): Wolf Valley farm family
East Fork Poplar Creek Floodplain farm family

Period of Time Averaging: Annual average

Rationale: Several authors report feed intakes rates for beef and dairy cattle with discussion of the fraction of various feed types (Koranda 1965, Shor and Fields 1980, Boone et al. 1981, Sumerling et al. 1984). Shor and Fields summarize Dairy Herd Improvement Association (DHIA) data on feed intake from about 3000 dry-lot dairy herds and about 11,500 partially pastured dairy herds during 1976-77, or about 11% of the entire U.S. dairy cow population (Shor and Fields 1979). The annual feed consumption of different feed types is presented, including concentrates, dry forage, and succulents. Data reported by Shor and Fields (1980) indicate that an average of 60% of the dry intake by the dairy cows surveyed was dry forage and succulents (assumed to represent intake from green pasture as well as hay and dry forage), with the remainder being concentrates.

Koranda (1965) reports an average forage ingestion rate by dairy cows in the South Central United States during the summer “high pasture” feeding season of 0.9 tons forage (dry weight)/cow-season. Assuming a summer feeding season of 3 months, this ingestion rate equates to 8.9 kg fresh forage/cow-day during this season, or approximately 80% of the total feed consumed.

In the Oak Ridge area, it is assumed that the grazing season lasts year-round and that the high pasture season occurs for 8 months of the year (e.g., mid-February to mid-October) and low pasture season for 4 months of the year (e.g., mid-October to mid-February). Assuming that fresh pasture comprises approximately 75% and 20% of total feed consumed during high and low pasture seasons, respectively, on an annualized basis fresh pasture is estimated to comprise approximately 60% of the total feed consumed. This estimate is consistent with the value derived using the Shor and Fields (1980) data.

Based on these data, it was assumed that the central value for the fraction of feed ingested by backyard dairy cows that was pasture was 60%, on an annual basis. For backyard cows in the Oak Ridge area, a minimum of 40% and a maximum of 75% were assumed.

Distribution(s): Triangular {minimum = 0.4; maximum = 0.75; mode = 0.6}

2.1.3 Soil Intake by Dairy Cattle, kg d^{-1}

Parameter Symbol: $Q_{soil(d)}$

Assessment Endpoint(s): East Fork Poplar Creek Floodplain farm family

Period of Time Averaging: Annual average

Rationale: The rate of soil ingestion by cattle has been found to vary depending upon the rate of consumption of fresh pasture and the time of year, as well as on such site-specific factors as farm management procedures, pasture type, soil type, and number of cattle grazing a given area (Healy 1968, Fries et al. 1982, Thornton and Abrahams 1983, Zach and Mayoh 1983, Sumerling et al. 1984). Soil ingestion rates per unit of fresh pasture consumed have been reported to be significantly higher during low pasture season (i.e., winter months when pasture growth was sparse) than during high pasture season.

During a year-long survey of grazing dairy cattle in New Zealand, Healy (1968) reported monthly average soil ingestion rates ranged from 2 to 19% of total pasture intake during low pasture season and from 1 to 9% of total pasture intake during high pasture season (Healy, 1968). The annual average soil ingestion rate for five dairy farms ranged from 4 to 8% of total pasture intake. This data set was used to derive the soil ingestion PDF since it represents the only available year-round data set. Other studies report soil ingestion rates for one to three periods during the year, particularly the spring and summer months (Mayland et al. 1977, Kirby and Stuth 1980, Thornton and Abrahams 1983). These data sets are consistent with the data reported by Healy (1968). Soil ingestion rates were higher for arid and semiarid regions (Mayland et al., 1977; Kirby and Stuth, 1980).

Based on these data, the soil ingestion rate distribution for dairy cattle was defined as a function of the total pasture consumption rate. It was assumed that other feeds that are consumed (e.g., grains, concentrates, etc.) are not contaminated with soil. Soil ingestion rate was assumed to have a uniform distribution with minimum and maximum values corresponding to 0.04 and 0.08 times the total pasture intake.

Distribution(s): Uniform distribution, Calculated {minimum = 0.04 × Ingestion Rate of Feed by Dairy Cattle, kg d^{-1} × Percent of Feed that is Pasture; maximum = 0.08 × Ingestion Rate of Pasture by Dairy Cattle, kg d^{-1} × Percent of Feed that is Pasture}

2.1.4 Fraction of Soil Ingested by Dairy Cattle that was Contaminated, unitless

Parameter Symbol: f_{sdc}

Assessment Endpoint(s): East Fork Poplar Creek Floodplain farm family

Period of Time Averaging: Annual average

Rationale: It was assumed that dairy cattle raised on farms on or near the floodplain grazed exclusively on the floodplain. Therefore, the fraction of soil ingested by dairy cattle that was contaminated was assumed to be 1.0.

Distribution(s): Point estimate {1.0}

2.1.5 Surface Water Intake by Dairy Cattle, L d^{-1}

Parameter Symbol: $Q_{water(d)}$

Assessment Endpoint(s): East Fork Poplar Creek Floodplain farm family

Period of Time Averaging: Annual average

Rationale: Water ingestion rates for beef and dairy cattle from three sources were reported by McKone (1988). For dairy cattle, The water ingestion rates ranged from 38 to 60 L d^{-1}. Since it was assumed that the milk production rate of backyard dairy cattle was likely less than the dairy cattle upon which these data are based, it was assumed that water ingestion rates by dairy cattle were larger than 32 L d^{-1} and less than 60

L d^{-1}. The range is consistent with values presented by other sources for use in radiological exposure assessment (NCRP 1985).

Distribution(s): Uniform {minimum = 32 L d^{-1}; maximum = 60 L d^{-1}}

2.1.6 Fraction of Water Ingested by Dairy Cattle that was from EFPC, unitless

Parameter Symbol: f_{cw}

Assessment Endpoint(s): East Fork Poplar Creek Floodplain farm family

Period of Time Averaging: Annual average

Rationale: Individuals who historically lived in and raised cattle in the floodplain indicated that dairy cattle grazing in the floodplain were not provided with an external source of drinking water and that East Fork Poplar Creek was the only drinking water source. Therefore, it was assumed that 100% of water ingested by dairy cattle that grazed in the floodplain was from East Fork Poplar Creek.

Distribution(s): Point estimate {1.0}

2.2 Intake by Beef Cattle

2.2.1 Feed Intake (Dry Weight) by Beef Cattle, kg d^{-1}

Parameter Symbol: $Q_{feed(b)}$

Population: Wolf Valley farm family
East Fork Poplar Creek Floodplain farm family

Rationale: Several studies report feed ingestion rates intended to apply to both beef and dairy cattle (U.S. NRC 1977, Zach 1985, McKone 1988). However, dairy cattle tend to have higher nutritional requirements than beef cattle (about 50 to 100% higher), such that feed ingestion rates reported for dairy cattle tend to be higher than those for beef cattle (Ng et al. 1978). Reported feed ingestion rates specific to beef cattle are as follows:

Feed Intake Rate kg (dry wt) d^{-1}	*Reference*
8.0	Baes et al. 1984
9.2	Whicker and Kirchner 1987
9.3	Ng et al. 1978
9.5	Mayland et al. 1977
12.0	NCRP 1985

It is likely that the majority of these values are based on dry matter intakes by commercial cattle. Dry matter intakes by backyard beef cattle were likely lower. In addition, it is likely that dry matter intakes by cattle in the 1950s and 1960s are lower than current intake rates.

Based on these data, it is assumed that daily ingestion rates by backyard beef cattle in the Oak Ridge area during the 1950s and 1960s were larger than 6 kg (dry wt) d^{-1} and less than 13 kg (dry wt) d^{-1}. It was assumed that the typical intake rate was 9 kg (dry wt) d^{-1}.

Distribution(s): Triangular {minimum = 6 kg (dry wt) d^{-1}; maximum = 13 kg (dry wt) d^{-1}; mode = 9 kg (dry wt) d^{-1}}

2.2.2 Fraction of Feed Consumed by Beef Cattle that was Pasture, unitless

Parameter Symbol: $f_{p(b)}$

Assessment Endpoint(s): Wolf Valley farm family
East Fork Poplar Creek Floodplain farm family

Period of Time Averaging: Annual average

Rationale: The fraction of feed ingested by beef cattle that was pasture was assumed to be the same as that for dairy cattle (Section 2.1.2).

Distribution(s): Triangular {mode = 0.6; minimum = 0.4; maximum = 0.75}

2.2.3 Soil Intake by Beef Cattle, kg d^{-1}

Parameter Symbol: $Q_{soil(b)}$

Assessment Endpoint(s): East Fork Poplar Creek Floodplain farm family

Period of Time Averaging: Annual average

Rationale: The rate of soil ingestion by beef cattle was assumed to be the same as that for dairy cattle (Section 2.1.3).

Distribution(s): Uniform distribution, Calculated {minimum = 0.04 × Ingestion Rate of Feed by Beef Cattle, kg d^{-1} × Percent of Feed that is Pasture; maximum = 0.08 × Ingestion Rate of Pasture by Beef Cattle, kg d^{-1} × Percent of Feed that is Pasture}

2.2.4 Fraction of Soil Ingested by Beef Cattle that was Contaminated, unitless

Parameter Symbol: f_{sbc}

Assessment Endpoint(s): Wolf Valley farm family
East Fork Poplar Creek Floodplain farm family

Period of Time Averaging: Annual average

Rationale: It was assumed that beef cattle raised on farms on or near the floodplain grazed exclusively on the floodplain. Therefore, the fraction of soil ingested by beef cattle that was contaminated was assumed to be 1.0.

Distribution(s): Point estimate {1.0}

2.2.5 Surface Water Intake by Beef Cattle, L d^{-1}

Parameter Symbol: $Q_{water(b)}$

Assessment Endpoint(s): East Fork Poplar Creek Floodplain farm family

Period of Time Averaging: Annual average

Rationale: Water ingestion rates for beef and dairy cattle from three sources are reported by McKone (1988). For beef cattle, the water ingestion rates range from 38 to 50 L d^{-1}. As discussed in Section 2.1.5, water ingestion rates for dairy cattle were assumed to range from 32 to 60 L d^{-1}, and water ingestion rates for dairy cattle were assumed to be greater than those for beef cattle. Based on the limited data, it was assumed that water ingestion rates by beef cattle were greater than 22 L d^{-1} and less than 50 L d^{-1}. This range is consistent with values presented in other sources for use in radiological exposure assessment (NCRP 1985).

Distribution(s): Uniform {minimum = 22 L d^{-1}; maximum = 50 L d^{-1}}

2.2.6 Fraction of Water Ingested by Beef Cattle that was from EFPC, unitless

Parameter Symbol: f_{wbc}

Assessment Endpoint(s): East Fork Poplar Creek Floodplain farm family

Period of Time Averaging: Annual average

Rationale: Individuals who historically lived in and raised cattle in the floodplain indicated that beef cattle grazing in the floodplain were not provided with an external source of drinking water and that East Fork Poplar Creek was the only drinking water source. Therefore, it was assumed that 100% of water ingested by beef cattle that grazed in the floodplain was from East Fork Poplar Creek.

Distribution(s): Point estimate {1.0}

3.0 PARAMETER DISTRIBUTIONS FOR INTAKE BY REFERENCE POPULATIONS

3.1 Body weight, kg

Parameter Symbol: *BW*

Assessment Endpoint(s):
Wolf Valley farm family
Scarboro Community resident
Robertsville School student
East Fork Poplar Creek Floodplain farm family
Oak Ridge Community resident

Population Subgroup(s):
Adult female (age 18 - 35 years)
Child (age 6 months - 3 years)
Child male (age 12 -15 years)

Rationale: Height and body weight data were collected for over 20,000 individuals of various ethnicities in the United States during the second National Health and Nutrition Examination Survey (NHANES II), conducted from February 1976 through February 1980 by the National Center for Health Statistics (NCHS). The study was designed so that certain subgroups thought to be at high risk of malnutrition (e.g., persons with low incomes, preschool children, and the elderly) were over sampled (USEPA 1995). Body weights were collected at various times of the day and at different seasons of the year to reflect fluctuations with recency of food and water intake and daily activities. Data are summarized by cumulative percentiles (i.e., 5th through 95th percentiles) for males and females of different ethnicities (i.e., "white", "black", and "all ethnicities") and for different age groups (i.e., ages 6 months to 74 years) (USEPA 1995).

Results of this survey are considered to comprise the most comprehensive and reliable data set for body weights in the United States (Finley et al., 1994). Age- and sex-specific data for "all ethnicities" were used to derive PDFs for body weights of adult females, young children (age 6 mo - 3 yrs), and male children (age 10 - 14 yrs). Although data were collected in 1976-1980 and are summarized for the United States as a whole, because of the size and diversity of the sample population, these data are considered to be an appropriate representation of the range of body weights of individuals living in the Oak Ridge area in the 1950s and 1960s.

Adult Female

The body weight PDF for adult females was based on body weights reported by USEPA (1995) for females of all ethnicities ages 18 - 34 years (assumed to represent child-bearing age). Body weights for this population group were lognormally distributed with an arithmetic mean of 62 kg and a standard deviation of 9.5 kg.

Child (6 mo - 3 yrs)

The body weight PDF for the child (6 mo - 3 yrs) receptor was based on body weights reported by USEPA (1995) for male and female children of all ethnicities ages 6 months to 3 years. Data for male and female children were combined to derive the PDF since body weights of male and female children in this age group are similar. Body weights for this population group were normally distributed with an arithmetic mean of 12 kg and a standard deviation of 2.2 kg.

Child Male (10 - 14 yrs)

The body weight PDF for the child (10 - 14 yrs) receptor was based on body weights reported by USEPA (1995) for male children of all ethnicities ages 10 - 14 yrs. Body weights for this population group were lognormally distributed with an arithmetic mean of 46 kg and a standard deviation of 13 kg.

Distribution(s):

Adult female: Lognormal {arithmetic mean = 62 kg; standard deviation = 9.5 kg}

Child (6 mo - 3 yrs): Normal {arithmetic mean = 12 kg; standard deviation = 2.2 kg}

Child male (10 - 14 yrs): Lognormal {arithmetic mean = 46 kg; standard deviation = 13 kg}

3.2 Inhalation of Mercury in Air

3.2.1 Inhalation Rate, m^3 d^{-1}

Parameter Symbol: U_{air}

Assessment Endpoint(s):
Wolf Valley farm family
Scarboro Community resident
Robertsville School student
East Fork Poplar Creek Floodplain farm family
Oak Ridge Community resident

Population Subgroup(s):
Adult female (age 18 - 35 years)
Child (age 6 months - 3 years)
Child male (age 12 -15 years)

Period of Time Averaging: Annual average

Rationale: Inhalation rates averaged over prolonged periods can be described as a function of an individual's metabolic oxygen requirements associated with average daily energy expenditures (Finley et al. 1994). Layton (1993) developed regression equations correlating inhalation rate with body weight and energy utilization for males and females in different age groups. These data and assumptions about the duration spent in various activities were used to estimate daily inhalation rates for adult females and children.

Adult Female

Most reported inhalation rates for adult females are based on individuals living a largely sedentary lifestyle. However, it is assumed that women residing in rural and suburban settings in the 1950s and 1960s engaged in more strenuous activities for a greater portion of the day. In this assessment, the breathing rate of adult females was calculated based on data reported by Layton (1993) for individuals of different gender and age groups engaged in activities of different intensities. The central value for the PDF for inhalation rate of an adult female was characterized for a female aged 18 to <30 years assumed to spend 7.5 hours per day sleeping, 4 hours per day in sedentary activity (e.g., sitting, listening to the radio, television viewing, driving, reading), 7 hours per day in light activity (e.g., standing, floor sweeping, office work), 5 hours per day in moderate activity (e.g., carpet sweeping, dish washing, preparing a meal, walking), and 0.5 hour per day in heavy activity (e.g., sports events, heavy industrial work). Based on these assumptions and activity-specific inhalation rates presented by Layton (1993), the total daily inhalation rate was estimated to be approximately 16.8 m^3 d^{-1}. This inhalation rate was assumed to represent the most likely inhalation rate for an adult female from a rural farm family. The 95^{th} percentile was about 22 m^3 d^{-1}.

In general, inhalation rates can be characterized by lognormal distributions (Finley et al. 1994). Based on these assumptions, the inhalation rate of an adult female from a rural farm family was characterized by a lognormal distribution with an arithmetic mean of 17 m^3 d^{-1} and a standard deviation of 3.2 m^3 d^{-1}.

Child (6 mo - 3 yrs)

The PDF for the inhalation rate of a child less than 3 years of age was based on distribution percentiles calculated for this age group by Finley et al. (1994) from the Layton (1993) data. Based on these data, the child inhalation rate was characterized by a lognormal distribution with an arithmetic mean of 5.9 m^3 d^{-1} and a standard deviation of 1.1 m^3 d^{-1}.

Child Male (12 - 15 yrs)

The PDF for the inhalation rate of a male child ages 12 to 15 years was calculated based on data reported by Layton (1993) for breathing rates of individuals of different gender and age groups engaged in activities of different intensities. The central value for the PDF for inhalation rate of an child male ages 12 to 15 years was characterized using data for males aged 10 <15 years assumed to spend 9 hours per day sleeping, 8 hours per day in sedentary activity (e.g., sitting, television viewing, reading), 4 hours per day in light activity (e.g., standing, school work), 2 hours per day in moderate activity (e.g., walking), and 1 hour per day in heavy activity (e.g., sports events). Based on these assumptions and activity-specific inhalation rates presented by Layton (1993), the total daily inhalation rate was estimated to be approximately 13.8 m^3 d^{-1}. The 95^{th} percentile value was 20 m^3 d^{-1}. Based on these data, the inhalation rate was characterized by a lognormal distribution with an arithmetic mean of 16 m^3 d^{-1} and a standard deviation of 3.0 m^3 d^{-1}.

Distribution(s):

Adult female: Lognormal {arithmetic mean = 17 m^3 d^{-1}; standard deviation = 3.2 m^3 d^{-1}}

Child (6 mo - 3 yrs): Lognormal {arithmetic mean = 5.9 m^3 d^{-1}; standard deviation = 1.1 m^3 d^{-1}}

Child male: Lognormal {arithmetic mean = 16 m^3 d^{-1}; standard deviation = 3.0 m^3 d^{-1}}

3.2.2 Fraction of Time at Home or at School, unitless

Parameter Symbol: f_h or f_s

Assessment Endpoint(s):
Wolf Valley farm family
Scarboro Community resident
Robertsville School student
East Fork Poplar Creek Floodplain farm family
Oak Ridge Community resident

Population Subgroup(s):
Adult female (age 18 - 35 years)
Child (age 6 months - 3 years)
Child male (age 12 -15 years)

Period of Time Averaging: Annual average

Rationale: The fraction of time an individual was exposed to contaminated air was estimated based on the time the individual spent at home or at school (for the Robertsville School student). In this assessment, it was assumed that an individual was exposed to contaminated air only while at home or at school.

Adult Female

The PDF for fraction of time adult females ages 18 through 35 were at home was derived assuming that some individuals worked or spent time away from home for five to seven days per week and that some spent nearly 100% of their time at home. The minimum fraction of time at home for an adult female was based on an individual assumed to spend 10 h d^{-1} for 5 d wk^{-1} working or in another activity away from home (this equates to spending to approximately 68% of the time at home). The maximum fraction of time exposed to contaminated air was assumed to be 98%.

It was assumed that a "typical" woman who was a member of a farm family in the Oak Ridge area in the 1950s and 1960s would have spent only a small fraction of her time away from home, or about 10 or fewer hours per week, while a typical woman who lived in a more suburban setting in Scarboro or the City of Oak Ridge would have spent a greater fraction of her time away from home, or about 20 hours per week. Based on these assumptions, the central value for fraction of time spent at home by an adult female who was a member of a farm family was assumed to be 94%. For members of the Scarboro Community or City of Oak Ridge populations, the central value was assumed to be 88%.

Child (6 mo - 3 yrs)

The PDF for fraction of time that preschool-aged children (i.e., less than 3 years of age) spent at home was derived assuming that most children of this age spent the majority of their time at home. The minimum fraction of time at home was based on a child who spent 4 h d^{-1} for 5 d wk^{-1} away from home (equivalent to approximately 88% of the time at home). The maximum fraction of time at home was assumed to be 1.0 (100%). It was assumed that a "typical" preschool-aged child in the Oak Ridge area in the 1950s and 1960s would have spent only a small fraction of time away from home, or about 6 or fewer hours per week. Based on these assumptions, the fraction of time a child spent at home was assumed to be larger than 0.88 (88%), with a most likely value of 0.96 (96%).

Child Male (12 - 15 yrs)

The PDF for fraction of time that junior high-school-aged children (i.e., 12-15 years of age) were at school was derived assuming that children of this age spent a significant fraction of their time at school, either to attend classes or for extracurricular activities. For this receptor, it was assumed that the fraction of time exposed to contaminated air consisted only of time spent at school; it was assumed that during the remainder of the time, the child inhaled uncontaminated air. The most likely fraction of time at school was based on a child who spent 7 h d^{-1} for 5 d wk^{-1} for 36 wk yr^{-1} at the school during the school year, plus 3 hr d^{-1} for 5 days wk^{-1} during the summer or weekends (equivalent to approximately 15% of the time at the school). The maximum fraction of time at school was assumed to be 0.18 (18%), equivalent to about 42 h wk^{-1} for 36 wk yr^{-1} plus about 3 h d^{-1} for 20 d yr^{-1}. The minimum was assumed to be 0.13 (13%), assuming that a child missed approximately 20 days of school per year.

Distribution(s):

Adult female, farm families: Triangular {minimum = 0.68; maximum = 0.98; mode = 0.94}

Adult female, Scarboro Community and City of Oak Ridge Community residents: Triangular {minimum = 0.68; maximum = 0.98; mode = 0.88}

Child (6 mo - 3 yrs): Triangular {minimum = 0.88; maximum = 1.0; mode = 0.96}

Child male (12 - 15 yrs): Triangular {minimum = 0.13; maximum = 0.18; mode = 0.15}

3.2.3 Fraction of Time at Home or at School spent Outdoors, unitless

Parameter Symbol: f_{ho} or f_{so}

Assessment Endpoint(s):
Wolf Valley farm family
Scarboro Community resident
Robertsville School student
East Fork Poplar Creek Floodplain farm family
Oak Ridge Community resident

Population Subgroup(s):
Adult female (age 18 - 35 years)
Child (age 6 months - 3 years)
Child male (age 12 -15 years)

Period of Time Averaging: Annual average

Rationale:

The air inside a building is expected to have different concentrations of mercury that the air outside of the building, unless there is free exchange of air through open windows or doors. When windows and doors are closed, air is exchanged between indoors and outdoors through openings due to imperfect sealing or through ventilation systems. For a given outdoor concentration of mercury, air concentrations indoors during the 1950s and 1960s were likely higher than at present, due to greater use of open windows for ventilation, as opposed to air conditioning systems or fans, and to less efficient sealing. Annualized average intakes of mercury from inhalation were therefore estimated taking into account the fraction of the time spent at home or at school that an individual was outdoors and the fraction of time spent indoors multiplied by a ratio to take into account the reduction in indoor air concentrations (see Section 3.2.4).

Adult Female

It was assumed that women who lived on rural farms during the 1950s and 1960s spent, on average, more time outdoors than women living in more suburban settings. It was assumed that adult females of child bearing age who were members of farm families spent, on average, between about 1.5 and 6 h d^{-1} outdoors, with a most likely value of about 4 h d^{-1} (corresponding to minimum, most likely, and maximum values for fraction of time at home of 0.064, 0.18, and 0.28, respectively). Adult females of child bearing age who were members of the Scarboro Community or City of Oak Ridge community populations were assumed to spend, on average, between about 1.5 and 5 h d^{-1} outdoors, with a most likely value of about 3 h d^{-1} (corresponding to minimum, most likely, and maximum values for fraction of time at home spent outdoors of 0.071, 0.14, and 0.25, respectively).

Child (6 mo - 3 yrs)

It was assumed that preschool-aged children (i.e., less than 3 years of age) spent, on average, between about 0.5 and 5 hr d^{-1} outdoors. The most likely value was assumed to be about 2 hr d^{-1}. These values correspond to minimum, most likely, and maximum values for fraction of time at home spent outdoors of 0.022, 0.087, and 0.22, respectively.

Child Male (12 - 15 yrs)

It was assumed that students at Robertsville School spent time outdoors at school coming and going from school, during recess, and engaged in physical education classes and after school activities. It was assumed that the typical student spent about 8 hr wk^{-1} for 36 weeks at school outdoors, plus about 10 additional hours over the course of the year, or an annual average of about 0.8 hr d^{-1}. The minimum amount of time spent outdoors at school was assumed to be about 6 hr wk^{-1} for 33 weeks, or an annual average of about 0.6 hr d^{-1}. The maximum was assumed to be about 12.5 hr wk^{-1} for 36 weeks, plus about 50 additional hours over the course of the year, or an annual average of about 1.4 hr d^{-1}. These correspond to minimum, most likely, and maximum values for fraction of time at school spent outdoors of 0.16, 0.23 and 0.39, respectively.

Distribution(s):

Adult female, farm families: Triangular {minimum = 0.064; maximum= 0.28; mode = 0.18}

Adult female, Scarboro Community and City of Oak Ridge Community residents: Triangular {minimum = 0.071; maximum = 0.25; mode = 0.14}

Child (6 mo - 3 yrs): Triangular {minimum = 0.022; maximum = 0.22; mode = 0.087}

Child male (12 - 15 yrs): Triangular {minimum = 0.16; maximum = 0.39; mode = 0.23}

3.2.4 Indoor-to-Outdoor Ratio

Parameter Symbol: r_{io}

Assessment Endpoint(s):

Wolf Valley farm family
Scarboro Community resident
Robertsville School student
East Fork Poplar Creek Floodplain farm family
Oak Ridge Community resident

Population Subgroup(s): Adult female (age 18 - 35 years)
Child (age 6 months - 3 years)
Child male (age 12 -15 years)

Period of Time Averaging: Annual average

Rationale: The air inside a building is expected to have different concentrations of mercury that the air outside of the building, unless there is free exchange of air through open windows or doors. When windows and doors are closed, air is exchanged between indoors and outdoors through openings due to imperfect sealing or through ventilation systems. For a given outdoor concentration of mercury, air concentrations indoors during the 1950s and 1960s were likely higher than at present, due to greater use of open windows for ventilation, as opposed to air conditioning systems or fans, and to less efficient sealing. Annualized average intakes of mercury from inhalation were therefore estimated taking into account the fraction of the time spent at home or at school that an individual was outdoors and the fraction of time spent indoors multiplied by a ratio to take into account the reduction in indoor air concentrations.

Indoor-to-outdoor ratios for gaseous sulfur dioxide (SO_2), carbon monoxide (CO), and other gaseous substances ranging from 20% to 100% have been reported (Benson et al., 1972; Andersen 1972), with most measurements indicating values larger than 30%.

Based on these data, the indoor-to-outdoor ratio for airborne mercury (assumed to consist almost entirely of mercury vapor) was characterized by a uniform distribution, with a minimum value of 0.30 (30%) and a maximum value of 0.95 (95%). A maximum value less than 100% was assumed because this ratio is used to evaluate annual average exposures, and it is unlikely that free airflow between indoors and outdoors would occur during winter months.

Distribution(s): Uniform {minimum = 0.30; maximum = 0.95}

3.3 Consumption of Fruits and Vegetables

3.3.1 Consumption Rate of Homegrown Above-Ground Fruits and Vegetables, kg d^{-1}

Parameter Symbol: U_{veg}

Assessment Endpoint(s): Wolf Valley farm family
Scarboro Community resident
East Fork Poplar Creek Floodplain farm family
Oak Ridge Community resident

Population Subgroup(s): Adult female (age 18 - 35 years)
Child (age 6 months - 3 years)

Period of Time Averaging: Annual average

Rationale: The United States Department of Agriculture (USDA) periodically conducts Nationwide Food Consumption Surveys (NFCSs) to analyze food consumption behaviors and dietary status of Americans. These surveys utilize a statistical sampling technique designed to ensure that all seasonal, geographic, demographic, and socioeconomic variations are represented. Data reported include intake rates for various food products.

Data from the 1987-88 NFCS were used to describe the daily consumption of homegrown fruits and vegetables by rural and suburban families in the South (USEPA 1995). The researchers collected data from households for a one-week period, then adjusted the data for possible seasonal variability in consumption rates. Compiled data reflect annualized average per capita consumption of homegrown fruits and consumption of homegrown vegetables by different age groups. A separate table presents the percentage of fruits and vegetable grown below ground or grown above ground.

Adult Female

Based on NFCS figures, 50th and 95th percentile homegrown fruit consumption rates by adult females (age 20 to 39 years) in the South were 0.081 kg d^{-1} and 0.37 kg d^{-1}, respectively, or about 0.18 lb d^{-1} and 0.82 lb d^{-1}. For homegrown vegetables, 50th and 95th percentile consumption rates by adult females were 0.071 kg d^{-1} and 0.34 kg d^{-1}, respectively, or about 0.16 lb d^{-1} and 0.75 lb d^{-1}. The data were lognormally distributed.

Data compiled by USEPA (1995) suggest that 100% of fruit consumed and approximately 62% of vegetables consumed can be categorized as above-ground. Based on these data, the 50th percentile daily consumption of homegrown above-ground exposed fruits and vegetables by adult females was estimated to be approximately 0.13 kg d^{-1}. The 95th percentile of the distribution was assumed to be about 0.58 kg d^{-1}. These data support an arithmetic mean of 0.20 kg d^{-1} (about 0.44 lb d^{-1} of homegrown fruits and vegetables) and a standard deviation of 0.22 kg d^{-1} (about 1.3 pounds of homegrown fruits and vegetables per day at the 95th percentile of the distribution).

Child (6 mo - 3 yrs)

Based on NFCS figures, 50th and 95th percentile homegrown fruit consumption rates by young children (1 to 3 years of age) in the South were 0.020 kg d^{-1} and 0.094 kg d^{-1}, respectively, or about 0.044 lb d^{-1} and 0.21 lb d^{-1}. For homegrown vegetables, 50th and 95th percentile consumption rates by young children were 0.045 kg d^{-1} and 0.32 kg d^{-1}, respectively, or about 0.099 lb d^{-1} and 0.71 lb d^{-1}. The data were lognormally distributed.

Assuming that 100% of fruit consumed and approximately 62% of vegetables consumed can be categorized as above-ground, the 50th percentile daily consumption of homegrown above-ground fruits and vegetables by young children was estimated to be approximately 0.048 kg d^{-1}. The 95th percentile of the distribution was assumed to be about 0.29 kg d^{-1}. These data support an arithmetic mean of 0.087 kg d^{-1} (about 0.19 lb d^{-1} of homegrown above-ground fruits and vegetables) and a standard deviation of 0.133 kg d^{-1} (about 0.64 pounds of homegrown above-ground fruits and vegetables per day at the 95th percentile of the distribution), assuming the data are lognormally distributed.

Distribution(s): Adult female: Lognormal {arithmetic mean = 0.20 kg d^{-1}; standard deviation = 0.22 kg d^{-1}}

Child (6 mo - 3 yrs): Lognormal {arithmetic mean = 0.087 kg d^{-1}; standard deviation = 0.133 kg d^{-1}}

3.3.2 Consumption Rate of Homegrown Below-Ground Vegetables, kg d^{-1}

Parameter Symbol: U_{veg}

Assessment Endpoint(s): Wolf Valley farm family
Scarboro Community resident
East Fork Poplar Creek Floodplain farm family
Oak Ridge Community resident

Population Subgroup(s): Adult female (age 18 - 35 years)
Child (age 6 months - 3 years)

Period of Time Averaging: Annual average

Rationale: The data described in Section 3.3.1 were used to estimate consumption of homegrown below-ground vegetables. For purposes of this assessment, only below-ground vegetables were assumed to have been contaminated by mercury in soil, since mercury is not readily taken up from soil through the roots of plants.

Adult Female

Based on NFCS figures, 50th and 95th percentile homegrown vegetable consumption rates by adult females (age 20 to 39 years) in the South were 0.071 kg d^{-1} and 0.34 kg d^{-1}, respectively, or about 0.16 lb d^{-1} and 0.75 lb d^{-1}. The data were lognormally distributed.

Data compiled by USEPA (1995) suggest that approximately 38% of vegetables consumed can be categorized as below-ground. Based on these data, the 50th percentile daily consumption of homegrown below-ground vegetables by adult females was estimated to be approximately 0.027 kg d^{-1}. The 95th percentile of the distribution was assumed to be about 0.13 kg d^{-1}. These data support an arithmetic mean of 0.043 kg d^{-1} (about 0.095 lb d^{-1} of homegrown below-ground vegetables) and a standard deviation of 0.052 kg d^{-1} (about 0.3 pounds of homegrown below-ground vegetables per day at the 95th percentile of the distribution).

Child (6 mo - 3 yrs)

Based on NFCS figures, 50th and 95th percentile homegrown vegetable consumption rates by young children (1 to 3 years of age) in the South were 0.045 kg d^{-1} and 0.32 kg d^{-1}, respectively, or about 0.099 lb d^{-1} and 0.71 lb d^{-1}. The data were lognormally distributed.

Assuming that approximately 38% of vegetables consumed can be categorized as below-ground., the 50th percentile daily consumption of homegrown below-ground vegetables by young children was estimated to be approximately 0.017 kg d^{-1}. The 95th percentile of the distribution was assumed to be about 0.12 kg d^{-1}. These data support an arithmetic mean of 0.034 kg d^{-1} (about 0.075 lb d^{-1} of homegrown below-ground vegetables) and a standard deviation of 0.061 kg d^{-1} (about one-third pound of homegrown below-ground vegetables per day at the 95th percentile of the distribution).

Distribution(s):

Adult female: Lognormal {arithmetic mean = 0.043 kg d^{-1}; standard deviation = 0.052 kg d^{-1}}

Child (6 mo - 3 yrs): Lognormal {arithmetic mean = 0.034 kg d^{-1}; standard deviation = 0.061 kg d^{-1}}

3.4 Ingestion of Soil

3.4.1 Ingestion Rate of Soil, kg d^{-1}

Parameter Symbol: U_{soil}

Assessment Endpoint(s): Wolf Valley farm family
Scarboro Community resident
East Fork Poplar Creek Floodplain farm family
Oak Ridge Community resident

Population Subgroup(s): Adult female (age 18 - 35 years)
Child (age 6 months - 3 years)
Child male (age 12 -15 years)

Period of Time Averaging: Annual average

Rationale: Several studies have been conducted to estimate the amount of soil children ingest, but little data are available on soil ingestion rates for adults. Earlier studies attempted to estimate the amount of soil ingested based on the amount of soil adhering to children's hands. In more recent studies, soil ingestion rates for children have been derived using a methodology that quantifies trace elements in feces and urine (Binder et al. 1986, Clausing et al. 1987, Calabrese et al. 1989, 1991, Davis et al. 1990).

Of these studies, the studies by Binder et al. (1986) and Clausing et al. (1987) did not account for the contribution of non-soil sources (e.g., food, water, etc.) to tracer element concentrations in the feces and urine. Calabrese et al. (1989) and Davis et al. (1990) used a mass balance approach to account for non-soil contributions; these studies are predicted to provide better estimates of soil ingestion rates for children (Finley et al. 1994). In a subsequent validation study, Calabrese and Stanek (1992) developed a model to measure the precision of the soil ingestion rates calculated using each of the tracers examined in the Calabrese et al. (1989) and Davis et al. (1990) studies. Calabrese and Stanek (1992) concluded that soil ingestion rates estimated by Calabrese et al. (1989) using Zr as the tracer were most accurate.

Child (6 mo - 3 yrs) and *Child male(10 - 14 yrs)*

Based on the data from Calabrese et al. (1989), the soil ingestion rate for preschool-aged children was defined as a lognormal distribution with an arithmetic mean of 75 mg d^{-1}, a standard deviation of 60 mg d^{-1} (Calabrese and Stanek 1992). These soil ingestion rates are based on data for very young children. It is plausible to assume that soil ingestion rates for older children would be less than those of very young children because of differences in behavioral patterns that would limit soil ingestion. The distribution for soil ingestion rate for older children (age 12 - 15 yrs) was assumed to be one-half of the soil ingestion rate for children age 6 mo - 3 yrs.

Adult Female

As stated above, little information is available on soil ingestion rates for adults. The distribution for adult soil ingestion rate was assumed to be one-third of the distribution for children age 6 mo - 3 yrs. The adult soil ingestion rate was defined as a lognormal distribution with an arithmetic mean of 25 mg d^{-1}, a standard deviation of 20 mg d^{-1}.

Distribution(s): Adult female: Lognormal {arithmetic mean = 0.000025 kg d^{-1}; standard deviation = 0.000020 kg d^{-1}}

Child (6 mo - 3 yrs): Lognormal {arithmetic mean = 0.000075 kg d^{-1}; standard deviation = 0.000060 kg d^{-1}}

Child male (12 - 15 yrs): Lognormal {arithmetic mean = 0.000037 kg d^{-1}; standard deviation = 0.000030 kg d^{-1}}

3.4.2 Fraction of Soil Ingested that was Contaminated

Parameter Symbol: f_{sc}

Assessment Endpoint(s): Wolf Valley farm family
Scarboro Community resident
East Fork Poplar Creek Floodplain farm family
Oak Ridge Community resident

Population Subgroup(s): Adult female (age 18 - 35 years)
Child (age 6 months - 3 years)
Child male (age 12 -15 years)

Period of Time Averaging: Annual average

Rationale: The fraction of soil ingested that was contaminated was estimated based on the time an individual was assumed to have spent at home. In this assessment, it was assumed that an individual may have ingested soil both at and away from home, and that the fraction of soil ingested that was contaminated could be estimated from the fraction of waking hours an individual spent at home. It is assumed that all soil consumed at home was potentially contaminated and that all soil consumed away from home was not contaminated.

Adult Female

As discussed in Section 3.2.2, it is assumed that an adult female between the ages of 18 and 35 spent an average of between 4 and 50 hours per week away from home. Thus, for an adult female awake 112 h wk^{-1} (i.e., 16 h d^{-1}), between about 55% and 96% of the waking hours were spent at home. It is likely that an adult female who was part of a rural farm family or who gardened in a suburban setting would have had greater contact with soil while at home than away from home. Therefore, it is assumed that the fraction of soil consumed by an adult female that was contaminated was larger than 70%. The PDF was characterized as a uniform distribution with a minimum of 0.7 and a maximum of 1.0.

Child (6 mo - 3 yrs)

The PDF for fraction of time that young children less than 3 years of age were exposed to contaminated soil was derived assuming that children of this age spent the majority of their time at home. As discussed in Section 3.2.2, it was assumed that young children spent between 0 and 20 hours per week away from home. For a young child awake 91 h wk^{-1} (i.e., 13 h d^{-1}), between approximately 80% and 100% of the waking hours were spent at home. It is likely that a child who was a member of a farm family or lived in a surburban home with a garden would have had greater contact with soil while at home than away from home. Therefore, it is assumed that the fraction of soil consumed by a farm family child that was contaminated was larger than 90% and less than 100%. The PDF was characterized as a uniform distribution with a minimum of 0.9 and a maximum of 1.0.

Child male (12 - 15 yrs)

As discussed in Section 3.2.2, it is assumed that a male child ages 12 to 15 years spent between approximately 1150 and 1600 h yr^{-1} at the Robertsville School yard, with a most likely value of approximately 1300 h yr^{-1}. Assuming a child was awake for approximately 5500 h yr^{-1} (i.e., 15 hr d^{-1}), between approximately 20% and 30% of the waking hours were spent at school. It was assumed that if a child engaged in recess activities or athletics at school, the fraction of soil ingested per day that was ingested at school on an annualized basis would be slightly higher. The PDF for the fraction of soil consumed by a male Robertsville School student that was contaminated was characterized as a uniform distribution with a minimum of 0.2 and a maximum of 0.5.

Distribution(s): Adult female: Uniform {minimum = 0.7; maximum = 1.0}

Child (6 mo - 3 yrs): Uniform {minimum =0.9; maximum = 1.0}

Child male (12 - 15 yrs): Uniform {minimum =0.2; maximum = 0.5}

3.5 Dermal Contact with Soil

3.5.1 Surface Area of Exposed Skin, Dermal Contact with Soil, cm^2 d^{-1}

Parameter Symbol: SA_{soil}

Assessment Endpoint(s): Scarboro Community resident
Robertsville School student
East Fork Poplar Creek Floodplain farm family

Population Subgroup(s): Adult female (age 18 - 35 years)
Child (age 6 months - 3 years)
Child male (12 - 15 yrs)

Period of Time Averaging: Annual average

Rationale: In most instances, only a portion of the body is likely to come in contact with soil. It was assumed that the skin surface area that may have come in contact with soil was largest during the warm summer months. The USEPA Exposure Factors Handbook (1995) presents percentile estimates of the total body surface area for different body parts for males and females. Separate distributions are presented for adults and children. Based on these data, distributions of surface area exposed for adult females and children were derived.

Adult Female

Adult females who were members of farm families were assumed to spend a portion of their time engaged in labor-intensive activities at or near their homes that likely involved soil contact. In this assessment, it was assumed that for four months of the year (i.e., summer), the skin surface area exposed included forearms, hands, lower legs, and feet, and for eight months of the year, the skin surface exposed included forearms and hands. Based on data presented in the USEPA Exposure Factors Handbook (1995) for females of all ethnicities between 18 and 35 years of age, annual average surface areas of exposed skin (based on the above exposure assumptions) can be described by a lognormal distribution with an arithmetic mean of 3100 cm^2 d^{-1} and a standard deviation of 300 cm^2 d^{-1}.

Child (6 mo - 3 yrs)

Young children from rural households in the 1950s and 1960s were assumed to have spent a significant period of time playing in their yards or near their homes, and may have had the opportunity to come in contact with contaminated soils. In this assessment, it was assumed that for four months of the year (i.e., summer), the skin surface area exposed included arms, hands, legs, feet, and face, for four months of the year (i.e., spring, fall), the skin surface area exposed included forearms, hands, lower legs, feet, and face, and for four months of the year (i.e., winter), only the forearms and hands were exposed. The USEPA Exposure Factors Handbook (1995) presents body surface areas for children in terms of surface area-to-body weight ratios. These data show that annual average surface area-to-body weight ratios for children less than three years old (based on the above seasonal exposure assumptions) can be described by a lognormal distribution with an arithmetic mean of 220 cm^2 kg^{-1} d^{-1} and a standard deviation of 33 cm^2 kg^{-1} d^{-1}.

Child male (12 - 15 yrs)

School-aged children attending Robertsville School in the 1950s and 1960s were assumed to have come in contact with contaminated soils on the ball fields or other locations at their school. It was assumed that the majority of times these children came in contact with soil at school they were wearing shoes and long pants, although during the summer and after school activities they may have worn short pants and occasionally gone shoeless. In this assessment, it was assumed that during the summer, the skin surface area exposed to soil included forearms, hands, lower legs, and feet, during the spring and fall the skin surface area exposed included forearms, hands, and lower legs, and during the winter only the forearms and hands were exposed. Based on data presented in the USEPA Exposure Factors Handbook (1995) for male children between 10 and 15 years of age, annual average surface areas of exposed skin (based on the above exposure assumptions) can be described by a lognormal distribution with an arithmetic mean of 3100 cm^2 d^{-1} and a standard deviation of 400 cm^2 d^{-1}.

Distribution(s):

Adult female: Lognormal {arithmetic mean = 3,100 cm^2 d^{-1}; standard deviation = 300 cm^2 d^{-1}}

Child (6 mo - 3 yrs): Lognormal (surface area-to-body weight ratio) {arithmetic mean = 220 cm^2 kg^{-1} d^{-1}; standard deviation = 33 cm^2 kg^{-1} d^{-1}}

Child male (12 - 15 yrs): Lognormal {arithmetic mean = 3,100 cm^2 d^{-1}; standard deviation = 400 cm^2 d^{-1}}

3.5.2 Soil Loading on Skin, mg cm^{-2}

Parameter Symbol: SL_{soil}

Assessment Endpoint(s): Scarboro Community resident
Robertsville School student
East Fork Poplar Creek Floodplain farm family

Population Subgroup(s): Adult female (age 18 - 35 years)
Child (age 6 months - 3 years)
Child male (age 12 - 15 years)

Period of Time Averaging: Annual average

Rationale: The degree to which soil adheres to the skin is referred to as soil adherence or soil loading. As described by Finley et al. (1994), many studies have been conducted to estimate the amount of soil that adheres to the hands of children (Chaney et al. 1980; Roels et al. 1980; Gallacher et al. 1984; Duggan et al. 1985; Duggan and Williams 1977; Que Hee et al. 1985; Driver et al. 1989), using a variety of different methods. Chaney et al. (1980), Roels et al. (1980), Gallacher et al. (1984), and Duggan et al. (1985) estimated soil adherance using the wipe technique (i.e., mass of soil adhering to the wipe). Duggan and Williams (1977), Que Hee et al. (1985), and Driver et al. (1989) measured adherence directly by placing the hands or fingertips of the subjects in a preweighed amount of soil and calculating the difference in soil mass remaining.

Based on the data obtained from the direct adherence studies, the soil loading factor PDF was defined as a lognormal distribution with a mean of 0.52 mg-soil/cm^2-skin and standard deviation of 0.99 mg-soil/cm^2-skin (Finley et al., 1994). Soil adherence was determined to be very similar for adults and children (Finley et al., (1994); therefore, age-specific values were not derived.

Distribution(s): Adult female, child (6 mo - 3 yrs), and child male (12 - 15 yrs): Lognormal {arithmetic mean = 0.52 mg cm^{-2}; standard deviation = 0.99 mg cm^{-2}}

3.5.3 Fraction of Soil Dermally Contacted that was Contaminated, unitless

Parameter Symbol: f_{sc}

Assessment Endpoint(s): Scarboro Community resident
Robertsville School student
East Fork Poplar Creek Floodplain farm family

Oak Ridge Community resident

Population Subgroup(s): Adult female (age 18 - 35 years)
Child (age 6 months - 3 years)
Child male (age 12 -15 years)

Period of Time Averaging: Annual average

Rationale: The fraction of soil dermally contacted that was contaminated was estimated based on the time an individual was assumed to have spent at and away from home. In this assessment, it was assumed that an individual may have contacted soil both at and away from home, and that the fraction of soil contacted that was contaminated can be estimated from the fraction of waking hours an individual spent at home (i.e., it is assumed that all soil contacted at home was potentially contaminated and that all soil contacted away from home was not contaminated).

The PDFs derived to describe the fraction of soil ingested that was contaminated (Section 3.4.2) were assumed to apply to the parameter describing the fraction of soil dermally contacted that was contaminated.

Distribution(s): Adult: Uniform {minimum = 0.7; maximum = 1.0}

Child (6 mo - 3 yrs): Uniform {minimum = 0.9; maximum = 1.0}

Child male (12 - 15 yrs): Uniform {minimum = 0.2; maximum = 0.5}

3.6 Consumption of Milk

3.6.1 Consumption Rate of Milk, L d^{-1}

Parameter Symbol: U_{milk}

Assessment Endpoint(s): Wolf Valley farm family
East Fork Poplar Creek Floodplain farm family

Population Subgroup(s): Adult female (age 18 - 35 years)
Child (age 6 months - 3 years)

Period of Time Averaging: Annual average

Rationale: Data from the NFCS for 1955 and 1965-66 were used to define PDFs for daily ingestion of milk (USDA 1955a; 1955b; 1966). Comparisons of the 1955 data for the US and the South show that averages for the two are approximately equal. Comparisons of seasonal averages presented in the 1965-66 survey show that milk ingestion rates do not vary significantly between seasons. Based on sex- and age-specific consumption rates presented in the 1965-66 survey, it was assumed that children and adult males consumed 2.5 times as much and 1.5 times as much milk, respectively, as adult females.

Adults

Based on the 1955 and 1965-66 NFCSs, average fresh milk consumption rates for adult females (ages 18-35) on rural farms in the South of 0.33 L d^{-1} and 0.24 L d^{-1}, respectively, were calculated. The average of the two values is about 0.28 L d^{-1}, or about 9.3 ounces of milk. Although neither the 1955 nor 1965-66 surveys present minimum and maximum milk consumption rates, data from more recent milk consumption studies presented in the USEPA Exposure Factors Handbook (1995) suggest that the 95th percentile milk consumption rate for adults is typically 3 times higher than the mean consumption rate. Based on this information, the maximum milk consumption rate for an adult female was assumed to be 0.85 L d^{-1} (about three and one-half 8-ounce glasses per day). The minimum milk consumption rate was assumed to be 0.12 L d^{-1} (about one-half of an 8-ounce glass per day).

Child (6 mo - 3 yrs)

Studies have shown that, in general, younger children consume more milk than adults (Rupp 1980). Based on the 1955 and 1965-66 NFCSs, average fresh milk consumption rates for young children on rural farms in the South of 0.83 L d^{-1} and 0.59 L d^{-1}, respectively, were calculated. The average of the two values is 0.71 L d^{-1}, or about three 8-ounce glasses of milk. The minimum and maximum milk consumption rates were assumed to be 0.24 and 1.2 L d^{-1}, respectively, or about one 8-ounce glass and five 8-ounce glasses of milk, respectively. These estimates are consistent with milk consumption rates reported for children under the age of 3 in the 1965-66 NFCS (USDA 1966), and child milk ingestion rates reported by other authors for the same time period (Dreicer et al. 1990; Durbin et al. 1970; Rupp 1980).

Distribution(s):

Adult: Triangular {minimum = 0.12 L d^{-1}; mode =0.28 L d^{-1}; maximum = 0.85 L d^{-1}}

Child (6 mo - 3 yrs): Triangular {minimum = 0.24 L d^{-1}; mode =0.71 L d^{-1}; maximum = 1.2 L d^{-1}}

3.6.2 Fraction of Milk Consumed that was Home-Produced, unitless

Parameter Symbol: f_{mh}

Assessment Endpoint(s): Wolf Valley farm family
East Fork Poplar Creek Floodplain farm family

Population Subgroup(s): Adult female (age 18 - 35 years)
Child (age 6 months - 3 years)

Period of Time Averaging: Annual average

Rationale: As part of the 1955 and 1965 NFCSs, participants provided information regarding the fraction of milk consumed that was home-produced. Comparison of national average vs. region-specific and annual average vs. seasonal average data show that the percentage of milk consumed by rural households that was home-produced during the two surveys did not vary significantly on a regional or seasonal basis. Data from the surveys suggest that the average fraction of fresh milk consumed on rural farms in the South that was home-produced in 1955 and 1965-66 was 78% and 57%, respectively. These data suggest that home-produced milk consumption decreased significantly during this time period, due largely to improved milk distribution methods.

Interviews with individuals living on farms adjacent to the EFPC floodplain or living in Wolf Valley during the 1950s and 1960s indicate that a number of the families living in these areas owned dairy cows that produced milk for consumption by the family. It is likely that these families received a majority of their milk from these "backyard" cows. Although it is possible that some of the "farm" families living near the floodplain did not have backyard dairy cows and so received their milk from other sources, in this assessment it was assumed that the farm family populations had backyard dairy cows.

Based on data from the USDA surveys and the results of interviews with area residents, it was assumed that the fraction of home-produced milk consumed by rural households with backyard cows living near Oak Ridge in the 1950s and 1960s was larger than 0.7 (70%). The maximum was assumed to be 1.0 (100%).

Distribution(s): Adult female and child (6 mo - 3 yrs): Uniform {minimum = 0.7; maximum = 1.0}

3.7 Consumption of Beef

3.7.1 Consumption Rate of Beef, kg d^{-1}

Parameter Symbol: U_{beef}

Assessment Endpoint(s): Wolf Valley farm family
East Fork Poplar Creek Floodplain farm family

Population Subgroup(s): Adult female (age 18 - 35 years)
Child (age 6 months - 3 years)

Period of Time Averaging: Annual average

Rationale: Data from the NFCS for 1955 and 1965-66 were used to define PDFs for daily ingestion of beef (USDA 1955a, 1955b, 1966). Comparison of the 1955 data for the US and the South shows that beef consumption by rural households in the South was less than the national average for rural households (or about 80% of the national average). Comparisons of seasonal averages presented in the 1965-66 survey show that beef ingestion rates do not vary significantly between seasons. Based on sex- and age-specific consumption rates presented in the 1965-66 survey, it was assumed that adult females and adult males consume about 2.5 times and 3.5 times as much beef, respectively, as young children.

Adult Female

Based on USDA figures, average beef consumption rates by adult females from rural farm family households in the South during 1955 and 1965-66 of 0.079 and 0.116 kg d^{-1}, respectively, were calculated. The average of these two values is about 0.10 kg d^{-1}, or about 0.22 pounds of beef per day.

Neither the 1955 nor the 1965-66 surveys present minimum and maximum beef consumption rates. However, data from the 1987-88 NFCS suggest that the 95th percentile consumption rate is approximately 2.5 times higher than the mean ingestion rate (USEPA 1995). Therefore, it was assumed that the maximum beef consumption rates for adult females from farm families was 0.25 kg d^{-1}, or about 0.55 pounds of beef per day. The minimum was assumed to be 0.032 kg d^{-1}, or about 0.5 pounds of beef per week.

Child (6 mo - 3 yrs)

Based on USDA figures, average beef consumption rates by young children belonging to rural households in the South during 1955 and 1965-66 of 0.031 and 0.046 kg d^{-1}, respectively, were estimated. The average of these two values is 0.039 kg d-1, or about 0.08 pounds of beef per day. The maximum beef consumption rate was assumed to be 0.11 kg d^{-1}, or about 0.25 pounds per day. The minimum was assumed to be 0.010 kg d^{-1}, or about 0.15 pounds per week.

Distribution(s): Adult female: Triangular {minimum = 0.032 kg d^{-1}; mode = 0.10 kg d^{-1}; maximum = 0.25 kg d^{-1}}

Child (6 mo - 3 yrs): Triangular {minimum = 0.010 kg d^{-1}; mode = 0.039 kg d^{-1}; maximum = 0.11 kg d^{-1}}

3.7.2 Fraction of Beef Consumed that was Home-Produced

Parameter Symbol: f_{bh}

Assessment Endpoint(s): Wolf Valley farm family
East Fork Poplar Creek Floodplain farm family

Population Subgroup(s): Adult female (age 18 - 35 years)
Child (age 6 months - 3 years)

Period of Time Averaging: Annual average

Rationale: As part of the 1955 and 1965 NFCSs, participants provided information regarding the fraction of beef consumed that was home- produced (USDA 1955a, 1955b, 1966). Comparison of national average vs. region-specific and annual average vs. seasonal average data show that the percentage of beef consumed by rural households that was home-produced during the two surveys did not vary significantly on a regional or seasonal basis. The average fraction of beef consumed by rural households in the South that was home-produced in 1955 and 1965-66 was 50% and 57%, respectively.

Interviews with individuals living on farms adjacent to the EFPC floodplain or living down Wolf Valley from the Y-12 Plant during the 1950s and 1960s indicate that for those families that raised beef cattle for household consumption, the majority of the beef consumed by these families came from their own cattle. Thus, for individuals who were members of farm families that raised beef cattle, the majority of beef consumed while at home was assumed to be home-produced. Although it is possible that some of the "farm" families living near the floodplain did not raise beef cattle and so received their beef from other sources, in this assessment it was assumed that the farm family populations had beef cattle.

Based on data from the USDA surveys and the results of interviews with area residents, it was assumed that the fraction of home-produced milk consumed by rural households with backyard beef cattle living near Oak Ridge in the 1950s and 1960s was larger than 70%. The maximum was assumed to be 1.0 (100%).

Distribution : Adult female and child (6 mo - 3 yrs): Uniform {minimum = 0.70; maximum = 1.0}

3.8 Contact with Sediment and Surface Water

3.8.1 Ingestion Rate of Sediment, kg d^{-1}

Parameter Symbol: U_{sed}

Assessment Endpoint(s): Scarboro Community resident
Robertsville School student
East Fork Poplar Creek Floodplain farm family

Population Subgroup(s): Adult female (age 18 - 35 years)
Child (age 6 months - 3 years)
Child male (age 12 -15 years)

Period of Time Averaging: Annual average

Rationale: It was assumed that the ingestion rate of sediment was the same as the soil ingestion rate (Section 3.4.1).

Distribution(s): Adult female: Lognormal {mean = 0.000025 kg d^{-1}; standard deviation = 0.000020 kg d^{-1}}

Child (6 mo - 3 yrs): Lognormal {mean = 0.000075 kg d^{-1}; standard deviation = 0.000060 kg d^{-1}}

Child male (12 - 15 yrs): Lognormal {mean = 0.000037 kg d^{-1}; standard deviation = 0.000030 kg d^{-1}}

3.8.2 Fraction of Sediment Ingested that was Contaminated, unitless

Parameter Symbol: f_{sc}

Assessment Endpoint(s): Scarboro Community resident
Robertsville School student
East Fork Poplar Creek Floodplain farm family

Population Subgroup(s): Adult female (age 18 - 35 years)
Child (age 6 months - 3 years)
Child male (age 12 -15 years)

Period of Time Averaging: Annual average

Rationale: It was assumed that the majority of contact with sediments in surface water bodies in and near the EFPC floodplain was in EFPC. However, small streams feed into EFPC, and interviews with Oak Ridge- area residents who played in streams in and near the EFPC floodplain indicate that children did occasionally play in these tributaries. It is assumed that the sediment in these tributaries was not contaminated.

Therefore, the fraction of sediment ingested that was contaminated was assumed to be larger than 80%. The maximum was assumed to be 100%.

Distribution(s): Adult female, child (6 mo - 3 yrs), and child male (12 - 15 yrs): Uniform {minimum = 0.8; maximum = 1.0}

3.8.3 Surface Area of Exposed Skin, Dermal Contact with Sediment, $cm^2\ d^{-1}$

Parameter Symbol: SA_{sed}

Assessment Endpoint(s): Scarboro Community resident
Robertsville School student
East Fork Poplar Creek Floodplain farm family

Population Subgroup(s): Adult female (age 18 - 35 years)
Child (age 6 months - 3 years)
Child male (age 12 -15 years)

Period of Time Averaging: Annual average

Rationale: It was assumed that the surface area of skin exposed to sediment was the same as the surface area of skin exposed to soil (Section 3.5.1).

Distribution(s): Adult female: Lognormal {arithmetic mean = 3,100 $cm^2\ d^{-1}$; standard deviation = 300 $cm^2\ d^{-1}$}

Child (6 mo - 3 yrs): Lognormal (surface area-to-body weight ratio) {arithmetic mean = 220 $cm^2 kg^{-1} d^{-1}$; standard deviation = 33 $cm^2 kg^{-1} d^{-1}$}

Child male (12 - 15 yrs): Lognormal {arithmetic mean = 3,100 $cm^2 d^{-1}$; standard deviation = 400 $cm^2 d^{-1}$}

3.8.4 Sediment Loading on Skin, mg cm^{-2}

Parameter Symbol: SL_{sed}

Assessment Endpoint(s): Scarboro Community resident
Robertsville School student
East Fork Poplar Creek Floodplain farm family

Population Subgroup(s): Adult female (age 18 - 35 years)
Child (age 6 months - 3 years)
Child male (age 12 -15 years)

Period of Time Averaging: Annual average

Rationale: It was assumed that the PDF for sediment loading on skin was the same as that for soil loading on skin (Section 3.5.2).

Distribution(s): Adult female, child (6 mo - 3 yrs), and child male (12 - 15 yrs): Lognormal {arithmetic mean = 0.52 mg cm^{-2}; standard deviation = 0.99 mg cm^{-2}}

3.8.5 Fraction of Sediment Dermally Contacted that was Contaminated, unitless

Parameter Symbol: f_{sc}

Assessment Endpoint(s): Scarboro Community resident
Robertsville School student
East Fork Poplar Creek Floodplain farm family

Population Subgroup(s): Adult female (age 18 - 35 years)
Child (age 6 mo - 3 years)
Child male (age 12 -15 years)

Period of Time Averaging: Annual average

Rationale: It was assumed that the PDF for fraction of sediment dermally contacted that was contaminated was the same as that for fraction of sediment ingested that was contaminated (Section 3.8.2)

Distribution(s): Adult female, child (6 mo - 3 yrs), and child (12 - 15 yrs): Uniform {minimum = 0.8; maximum = 1.0}

3.8.6 Incidental Ingestion of Surface Water, L h^{-1}

Parameter Symbol: $U_{water\text{-}inc}$

Assessment Endpoint(s): Scarboro Community resident
Robertsville School student
East Fork Poplar Creek Floodplain farm family

Population Subgroup(s): Adult female (age 18 - 35 years)
Child (age 6 months - 3 years)
Child male (age 12 -15 years)

Period of Time Averaging: Annual average

Rationale: Little information is available describing the incidental ingestion of surface water during recreational activities or other surface water contact activities. The USEPA has established a conservative upper bound estimate of the amount of water an individual may ingest while swimming of 0.05 L h^{-1} (about three and one-half tablespoons of water) (USEPA 1989). Based on this value, the PDF for incidental ingestion of surface water from surface water bodies in and near the EFPC floodplain by children was assumed to be a uniform distribution with a maximum value of 0.05 L h^{-1}. The maximum value for adult females was assumed to be one-half that for children, due to differences in behavioral patterns. A minimum value of 0 L h^{-1} was assumed since it is likely that not all contact with surface water involved swimming or hand-to-mouth contact that would have resulted in a significant volume of water being ingested.

Distribution(s): Adult female: Uniform {minimum = 0 L h^{-1}; maximum = 0.025 L h^{-1}}

Child (6 mo - 3 yrs), and child male (12 - 15 yrs): Uniform {minimum = 0 L h^{-1}; maximum = 0.05 L h^{-1}}

3.8.7 Fraction of Surface Water Incidentally Ingested that was Contaminated, unitless

Parameter Symbol: f_{wc}

Assessment Endpoint(s): Scarboro Community resident
Robertsville School student
East Fork Poplar Creek Floodplain farm family

Population Subgroup(s): Adult female (age 18 - 35 years)

Child (age 6 months - 3 years)
Child male (age 12 -15 years)

Period of Time Averaging: Annual average

Rationale: It was assumed that the PDF for fraction of surface water incidentally ingested that was contaminated was the same as that for fraction of sediment ingested that was contaminated (Section 3.8.2).

Distribution(s): Adult female, child (6 mo - 3 yrs), and child male (12 - 15 yrs): Uniform {minimum = 0.8; maximum = 1.0}

3.8.8 Surface Area of Exposed Skin, Dermal Contact with Surface Water, cm^2

Parameter Symbol: SA_w

Assessment Endpoint(s): Scarboro Community resident
Robertsville School student
East Fork Poplar Creek Floodplain farm family

Population Subgroup(s): Adult female (age 18 - 35 years)
Child (age 6 months - 3 years)
Child male (age 12 -15 years)

Period of Time Averaging: Annual average

Rationale: The PDF for surface area of skin exposed during dermal contact with surface water from surface water bodies in and near the EFPC floodplain was derived assuming that for a fraction of the episodes, the entire body was submerged (e.g., during swimming) and for the remaining episodes, only a portion of the body surface was contacted (e.g., during splashing, etc.)

As described in Section 3.5.1, the USEPA Exposure Factors Handbook (1995) presents percentile estimates of the total body surface area for different body parts for males and females. Separate distributions are presented for adults and children. Based on these data, distributions of body surface area exposed to surface water for adult females and children were derived.

Adult Female

For adult females, it was assumed that for one-third of the exposure episodes, the entire body surface was contacted; for one-third of the episodes, the feet, lower legs, hands, and forearms were contacted; and for one-third of the episodes, the hands and forearms only were contacted. Based on data presented in the USEPA Exposure Factors Handbook (1995) for females of all ethnicities between 18 and 35 years of age, average surface areas of skin exposed to surface water (based on the above exposure assumptions) can be described by a lognormal distribution with an arithmetic mean of 8,000 cm^2 and a standard deviation of 800 cm^2.

Child (6 mo - 3 yrs)

For young children, it was assumed that for one-third of the exposure episodes, the entire body surface was contacted; for one-third of the episodes, the feet, legs, hands, arms, and face were contacted; and for one-third of the episodes, the hands and forearms only were contacted. The USEPA Exposure Factors Handbook (1995) presents body surface areas for children in terms of surface area-to-body weight ratios. These data show that annual average surface area-to-body weight ratios for children less than three years old (based on the above exposure assumptions) can be described by a lognormal distribution with an arithmetic mean of 40 cm^2 kg^{-1} and a standard deviation of 10 cm^2 kg^{-1}.

Child male (12 - 15 yrs)

For a male child ages 12 to 15 years, it was assumed that for one-third of the exposure episodes, the entire body surface was contacted; for one-third of the episodes, the feet, legs, hands, arms, and face were contacted; and for one-third of the episodes, the hands and forearms only were contacted. Based on data presented in the USEPA Exposure Factors Handbook (1995) for male children ages 10 to 15 years, average surface areas of skin exposed to surface water (based on the above exposure assumptions) can be described by a lognormal distribution with an arithmetic mean of 7,800 cm^2 and a standard deviation of 1,100 cm^2.

Distribution(s): Adult female: Lognormal {mean = 8,000 cm^2; standard deviation = 800 cm^2}

Child (6 mo - 3 yrs): Lognormal (surface area-to-body weight ratio) {mean = 400 cm^2 kg^{-1}; standard deviation = 100 cm^2 kg^{-1}}

Child Male (12 - 15 yrs): Lognormal {mean = 7,800 cm^2; standard deviation = 1,100 cm^2}

3.8.9 Fraction of Surface Water Dermally Contacted that was Contaminated, unitless

Parameter Symbol: f_{wc}

Assessment Endpoint(s):	Scarboro Community resident Robertsville School student East Fork Poplar Creek Floodplain farm family
Population Subgroup(s):	Adult female (age 18 - 35 years) Child (age 6 months - 3 years) Child male (age 12 - 15 years)
Period of Time Averaging:	Annual average
Rationale:	It was assumed that the PDF for fraction of surface water dermally contacted that was contaminated was the same as that for fraction of sediment ingested that was contaminated (Section 3.8.2).
Distribution(s):	Adult female, child (6 mo - 3 yrs), and child (12 - 15 yrs): Uniform {minimum = 0.8; maximum = 1.0}

3.8.10 Exposure Time to Surface Water in or near the EFPC Floodplain, h d^{-1}

Parameter Symbol:	ET_{sw}
Assessment Endpoint(s):	Scarboro Community resident Robertsville School student East Fork Poplar Creek Floodplain farm family
Population Subgroup(s):	Adult female (age 18 - 35 years) Child (age 6 months - 3 years) Child male (age 12 -15 years)
Period of Time Averaging:	Annual average
Rationale:	PDFs for characterizing the length of time adult females and young children were exposed to surface water bodies in and near the EFPC floodplain were derived assuming that the exposure time of a child would likely be longer than that of an adult. While former residents of the City of Oak Ridge report having played in EFPC and nearby creeks as children for periods of up to eight hours per day during the summer, it is likely that preschool-aged children would have been exposed for significantly shorter periods of time. *Adult Female*

Based on the size of the surface water bodies in and near the EFPC floodplain and the vicinity of the City of Oak Ridge to more desirable water bodies (e.g., Melton Hill Lake), it was assumed that the average exposure time of adults to surface water and sediments in and near the EFPC floodplain would have been very brief. Based on this assumption, the exposure time of adult females was characterized by a triangular distribution with a most likely value of 0.25 h d^{-1} (i.e., 15 minutes) and a maximum value of 2 h d^{-1}. The minimum value was assumed to be 0.08 h d^{-1} (i.e., approximately five minutes).

Child (6 mo - 3 yrs)

It was assumed that the average exposure time of preschool-aged children to surface water and sediments in and near the EFPC floodplain would have been brief, due to the availability of other activities, the short attention span of children of this age, and the likelihood that children of this age would not play in surface water unsupervised. Based on this assumption, the exposure time of young children was characterized by a triangular distribution with a most likely value of 0.33 h d^{-1} (i.e., 20 minutes) and a maximum value of 3 h d^{-1}. The minimum value was assumed to be 0.08 h d^{-1} (i.e., approximately five minutes).

Child male (12 - 15 yrs)

School-aged children attending Robertsville School in the 1950s and 1960s were assumed to have most likely come in contact with surface water in and near the EFPC floodplain for brief periods due to the availability of other activities. However, interviews with individuals who played in EFPC as young teenagers indicate that some boys would occasionally play in the creek for most of the day. Based on this assumption, the exposure time of a male child ages 12 to 15 years was characterized by a triangular distribution with a most likely value of 0.5 h d^{-1} (i.e., 30 minutes) and a maximum value of 6 h d^{-1}. The minimum value was assumed to be 0.08 h d^{-1} (i.e., approximately five minutes).

Distribution(s):

Adult female: Triangular {minimum = 0.08 h d^{-1}; maximum = 2 h d^{-1}; mode = 0.25 h d^{-1}}

Child (6 mo - 3 yrs): Triangular {minimum = 0.08 h d^{-1}; maximum = 3 h d^{-1}; mode = 0.33 h d^{-1}}

Child male (12 - 15 yrs): Triangular {minimum = 0.08 h d^{-1}; maximum = 6 h d^{-1}; mode = 0.5 h d^{-1}}

3.8.11 Exposure Frequency to Surface Water Bodies or Sediment in or near the EFPC Floodplain, d d^{-1}

Parameter Symbol: EF_{EF}

Assessment Endpoint(s): Scarboro Community resident
Robertsville School student
East Fork Poplar Creek Floodplain farm family

Population Subgroup(s): Adult female (age 18 - 35 years)
Child (age 6 months - 3 years)
Child male (age 12 -15 years)

Period of Time Averaging: Annual average

Rationale: PDFs for characterizing the frequency of exposure to surface water or sediments in and near the EFPC floodplain during recreational activities were derived based upon assumptions about the behavior of children and adults living in the vicinity of the creek. Former residents of the City of Oak Ridge report playing in the creek as children at frequencies up to two days per week at "all times of the year," while individuals who were members of farm families report the children learned to swim in the creek. For both adults and children, it was assumed that the frequency of coming into contact with EFPC and other surface water bodies in and near the floodplain would be greater during the warmer summer months; however, the PDFs for this parameter are presented on an annualized basis (days per 365 days, or d d^{-1}).

Based on reports by current and former residents of the Scarboro Community, it was assumed that members of the community traveled the short distance to EFPC to play or recreate in the creek, particularly during the 1950s when the City of Oak Ridge was segregated and access to public recreation facilities was restricted.

Adult Female

In general, accounts of individuals playing in surface water bodies in and near the EFPC floodplain are of children. It is assumed that adults would have had limited time for recreational activities, and that because of the size of EFPC and the availability of more desirable water bodies nearby for recreational activities, their contact with surface water bodies in and near the EFPC floodplain during recreational activities would have been limited. However, because of the lack of air conditioning during the 1950s and 1960s, and the proximity of EFPC, as well as the potential for incidental contact during farm management activities, etc., it is assumed that some contact with EFPC floodplain did occur. The exposure frequency of an adult farm family female to surface water and sediments in and near the EFPC floodplain was thus characterized as a triangular distribution with a most likely value of 16 d yr^{-1} (i.e., two times per month for eight months per year) and a maximum value of 24 d yr^{-1} (i.e., four times per month for four months per year plus two times per month for four months per year). The minimum was assumed to be 4 d yr^{-1}. Values for the an adult female who is a member of the Scarboro Community were assumed to be the same with the exception that the minimum value was assumed to be 0 d yr^{-1}.

Child (6 mo - 3 yrs)

For children who played in EFPC creek and nearby surface water bodies, the reported frequency ranged from occasionally during the warmer months to three times per week at all times of the year. However, preschool-aged children are likely to have played in the surface water bodies in and near the EFPC floodplain much less frequently. The exposure frequency of children to surface water and sediments in and near the EFPC floodplain was thus characterized as a triangular distribution with a most likely value of 16 d yr^{-1} (i.e., approximately three times per month for four months per year plus one time per month for four months per year) and a maximum of 32 d yr^{-1} (i.e., approximately six times per month for four months per year plus two times per month for four months per year). The minimum was assumed to be 2 d yr^{-1}. Values for the a child who is a member of the Scarboro Community were assumed to be the same with the exception that the minimum value was assumed to be 0 d yr^{-1}.

Child male (12 - 15 yrs)

Former residents of the City of Oak Ridge report playing in the creek as children at frequencies up to two days per week at "all times of the year" in the 1950s and 1960s. However, it is assumed that while a child was attending school, he was usually engaged in other activities. The exposure frequency of school-aged children attending Robertsville School to surface water and sediments in and near the EFPC floodplain was thus characterized as a triangular distribution with a most likely value of 4 d yr^{-1} and a maximum of 18 d yr^{-1} (i.e., approximately four times per month for three months per year plus six times over the remainder of the year). The minimum was assumed to be 0 d yr^{-1}.

Distribution(s): Adult female: Triangular {minimum = 0.011 d d^{-1} (farm family), 0 d d^{-1} (Scarboro); maximum = 0.066 d d^{-1}; mode = 0.044 d d^{-1}}

Child (6 mo - 3 yrs): Triangular {minimum = 0.0055 d d^{-1} (farm family), 0 d d^{-1} (Scarboro); maximum = 0.088 d d^{-1}; mode = 0.044 d d^{-1}}

Child male (12 - 15 yrs): Triangular {minimum = 0 d d^{-1}; maximum = 0.050 d d^{-1}; mode = 0.011 d d^{-1}}

3.9 Consumption of Fish, kg d^{-1}

Parameter Symbol: U_{fish}

Assessment Endpoint(s): Scarboro Community resident
East Fork Poplar Creek Floodplain farm family
Poplar Creek/ Clinch River Recreational Angler
Poplar Creek/ Clinch River Commercial Angler
Watts Bar Recreational Angler
Watts Bar Commercial Angler

Population Subgroup(s): Adult female (age 18 - 35 years)
Child (age 6 months - 3 years)

Period of Time Averaging: Annual average

Rationale: The basis for these distributions is described in Appendix K.

Distribution(s): The following are truncated lognormal distributions for fish consumption rates for the populations of interest near the ORR:

Population	Mean Consumption (kg d^{-1})	St. Dev.	Minimum Consumption (kg d^{-1})	Maximum Consumption (kg d^{-1})
Watts Bar Reservoir Commercial Angler	0.024	0.057	0.00016	0.18
Clinch River/ Poplar Creek Commercial Angler	0.0022	0.0052	0.00016	0.18
Watts Bar Reservoir Recreational Angler	0.030	0.071	0.00016	0.18
Clinch River/ Poplar Creek Recreational Angler	0.018	0.043	0.00016	0.12
East Fork Poplar Creek Angler	0.0012	0.0029	0.00016	0.007
Scarboro Community Angler	0.0012	0.0029	0.00016	0.18

4.0 REFERENCES

Baes et al. 1984. C.R. Baes, R.D. Sharp, A.L. Sjoreen, and R.W. Shor. *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture*. Oak Ridge National Laboratory, Health and Safety Research Division. ORNL-5786.

Binder et al. 1986. S. Binder, D. Sokal, and D. Maughan. Estimating soil ingestion: The use of tracer elements in estimating the amount of soil ingested by children. *Arch. Environ. Health*. 41(6): 341-345.

Boone et al. 1981. F.W. Boone, Y.C. Ng, and J.M. Palms. Terrestrial pathways of radionuclide particulates. *Health Phys*. 41(5): 735-747.

Calabrese et al. 1989. E.J. Calabrese, R. Barnes, E.J. Stanek, H. Pastides, C.E. Gilbert, P. Veneman, X. Wang, A. Laszitiy, and P.T. Kostecki. How much soil do young children ingest: An epidemiological study. *Regul. Toxicol. Pharmacol.* 10:123-137.

Calabrese et al. 1991. E.J. Calabrese, E.S. Stanek, and C.E. Gilbert. A preliminary decision framework for deriving soil ingestion rates. *Hydrocarbon Contaminated Soils*. 1(19).

Calabrese and Stanek 1992. E.J. Calabrese and E.S. Stanek. A guide to interpreting soil ingestion studies. II. Qualitative and quantitative evidence of soil ingestion. *Regul. Toxicol. Pharmacol*. 13: 278-292.

Chaney et al. 1980. Chaney, E., J. Sayre, and M. Coulter. Increased lead absorption in inner city children: Where does the lead come from? *Pediatrics*. 65: 226-231.

Clausing et al. 1987. P. Clausing, B. Brunekreef, and J.H,. Van Wijnen. A method for estimating soil ingestion by children. *Int. Arch. Occup. Environ. Health*. 59:73-82.

Davis et al. 1990. S. Davis, P. Walker, R. Buschbom, J. Ballou, and P. White. Quantitative estimates of soil ingestion in normal children between the ages of 2 and 7 yeasts: Population-based estimates using aluminum, silicon, and titanium as soil tracer elements. *Arch. Environ. Health*. 45(2):112-122.

Dreicer et al. 1990. M. Dreicer, A. Bouville, B.W. Wachholz. Pasture practices, milk distribution, and consumption in the continental U.S. in the 1950s. *Health Phys*. 59(5): 627-636.

Driver et al. 1989. Driver, J.H., J.J. Konz, and G.K. Whitmyre. Soil adherence to human skin. *Bull. Environ. Contam. Toxicol*. 43: 814-820.

Duggan et al. 1985. Duggan, M.J., M.J. Inskip, S.A. Rundle, and J.S. Moorcroft. Lead in playground dust and on the hands of school children. *Total Environ*. 44: 65-79.

Duggan and Williams 1977. Duggan, M.J. and S. Williams. Lead-in-dust in city streets. *Sci. Total Environ*. 7: 91-97.

Durbin et al. 1970. P.W. Durbin, J. Lynch, and S. Murray. Average milk and mineral intakes (calcium, phosphorous, sodium, and potassium) of infants in the United States from 1954 to 1968; Implications for estimating annual intakes of radionuclides. *Health Phys.* 19: 187-222.

Finley et al. 1994. B. Finley, D. Proctor, P. Scott, N. Harrington, D. Paustenbach, and P. Price. Recommended distributions for exposure factors frequently used in health risk assessment. *Risk Anal*. 14(4)533-553.

Fries et al. 1982. G.F. Fries, G.S. Marrow, and P.A. Snow. Soil Ingestion by Dairy Cattle. *Journ. Dairy Sci*. 65: 611-618.

Gallacher et al. 1984. Gallacher, J.E., P.C. Elwood, K.M. Phillips, B.E. Davis, and D.T. Jones. Relations between pica and blood lead in areas of differing lead exposure. *Arch. Dis. child*. 58: 40-44.

Healy 1968. W.B. Healy. Ingestion of soil by dairy cows. *N.Z. J. Agric. Res*. 11: 487-499.

IAEA 1992. *Modelling of Resuspension, Seasonality, and Losses during Food Processing*. First report of the VAMP Terrestrial Working Group. IAEA-TECDOC-647. Vienna, Austria. May 1992.

IAEA 1994. *Handbook of Parameter Values for the Prediction of Radionuclide Transfer in Temperate Environments*. Technical Report Series No. 364. Vienna, Austria. 1994.

Kirby and Stuth 1980. D.R. Kirby and J.W. Stuth. Soil ingestion rates of steers following brush management in Central Texas, USA. *J. Range Manage*. 33: 207-209.

Koranda 1965. J.J. Koranda. *Agricultural Factors Affecting the Daily Intake of Fresh Fallout by Dairy Cows*. Lawrence Radiation Laboratory, Livermore, CA. March 19.

Layton, 1993. D.W. Layton. Metabolically consistent breathing rates for use in dose assessment. *Health Phys*. 64(1): 23-26.

Mayland et al. 1977. H.F. Mayland, G.E. Shewmaker, and R.C. Bull. Soil ingestion by cattle grazing crested wheatgrass. *J. Range Mgmt*. 30(4): 264-265.

McKone 1988. T.E. McKone. *Conventional Weapons Demilitarization: A Health and Environmental Effects Data Base Assessment. Methods for Estimating Multi-Pathway Exposures to Environmental Contaminants. Final Report, Phase II*. Environmental Science Division, Lawrence Livermore National Laboratory, Livermore, CA. UCRL-21064.

Miller and Hoffman 1979. C.W. Miller and F.O. Hoffman. "The Environmental Loss Constant for Radionuclides Deposited on the Surfaces of Vegetation, ë$_{w}$." In: *A Statistical Analysis of Selected Parameters for Predicting Food Chain Transport and Internal Dose of Radionuclides*. F.O Hoffman and C.F. Baes, ed. U.S. Nuclear Regulatory Commission. Office of Standards and Development. NUREG/CR-1004. pp. 43-50.

NCRP 1985. National Council on Radiation Protection and Measurements. *Radiological Assessment: Predicting the Transport, Bioaccumulation, and Uptake by Man of Radionuclides Released to the Environment*. Bethesda, MD. NCRP Report No. 76.

Ng et al. 1978. Y.C Ng, W.A. Phillips, Y.E. Ricker, R.K. Tandy, and S.E. Thompson. *Methodology for Assessing Dose Commitment to Individuals and to the Population from Ingestion of Terrestrial Foods Contaminated by Emissions from a Nuclear Fuel Reprocessing Plant at the Savannah River Plant*. Lawrence Livermore Laboratory. UCID-17743.

Que Hee et al. 1985. Que Hee, S.S., B. Peace, C.S. Scott, J.R. Boyle, R.L. Bornschein, and P.B. Hammond. Evolution of efficient methods to sample lead sources, such as house dust and hand dust, in the homes of children. *Environ. Res*. 38: 77-95.

Roels et al. 1980. Roels, H.A., J.P. Buchett, R.R. Lauwerys, P. Bruaux, F. Claeys-Thoreau, A. Lafontaine, and G. Verduyn. Exposure to lead in the oral and the pulmonary routes of children living in the vicinity of a primary lead smelter. *Environ. Res*. 22: 81-99.

Rupp 1980. E.M. Rupp. Age dependent values of dietary intake for assessing human exposures to environmental pollutants. *Health Phys*. 39: 151-163.

Shor and Fields 1979. R.W. Shor and D.E. Fields. "The Fraction of Total Feed Composed of Fresh Forage, f_s, and the Fraction of the Year Fresh Forage is Utilized, f_p." In: *A Statistical Analysis of Selected Parameters for Predicting Food Chain Transport and Internal Dose of Radionuclides*. F.O

Hoffman and C.F. Baes, ed. U.S. Nuclear Regulatory Commission. Office of Standards and Development. NUREG/CR-1004. pp. 59-63.

Shor and Fields 1980. R.W. Shor and D.E. Fields. Agricultural factors affecting the radionuclide foodchain pathway: Green forage consumption by dairy cows. *Health Phys*. 39: 325-332.

Sumerling et al. 1984. T.J. Sumerling, N.J. Dodd, and N. Green. The transfer of strontium-90 and caesium-137 to milk in a dairy herd grazing near a major nuclear installation. *Sci. Total Environ*. 34: 57-72.

Thornton and Abrahams 1983. I. Thornton and P. Abrahams. Soil ingestion**S** A major pathway of heavy metals into livestock grazing contaminated land. *Science Total Environ*. 28: 287-294.

USDA 1955a. U.S. Department of Agriculture. *Dietary Levels of Households in the South, Household Food Consumption Survey 1955, Report No. 9*. Washington, D.C.

USDA 1955b. U.S. Department of Agriculture. *Dietary Levels of Households in the United States, Household Food Consumption Survey 1955, Report No. 6*. Washington, D.C.

USDA 1966. U.S. Department of Agriculture. *Food Consumption of Households in the United States, Seasons and Year 1965-1966, Report No. 12*. Washington, D.C.

USEPA 1989. United States Environmental Protection Agency. *Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual (Part A)– Interim Final*. Office of Emergency and Remedial Response, Washington, D.C. USEPA/540/1-89/002. December.

USEPA 1995. United States Environmental Protection Agency. *Exposure Factors Handbook: Update to Exposure Factors Handbook, May 1989– Draft*. Office of Health and Environmental Assessment, Washington, D.C. EPA/600/P-95/002A. June.

Whicker and Kirchner 1987. F.W. Whicker and T.B. Kirchner. Pathway: A dynamic food-chain model to predict radionuclide after fallout deposition. *Health Phys*. 52(6): 717-737.

Zach and Mayoh 1983. R. Zach and K. Mayoh. Soil ingestion by cattle: A neglected pathway. *Health Phys*. 46(2): 426-431.

APPENDIX W

DOSE RECONSTRUCTION RESULTS

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Table W-1: Estimated Annual Mercury Doses, Wolf Valley Resident Population ($mg\ kg^{-1}\ d^{-1}$) [a]

	1953			1954			1955			1956		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Adult: inhalation [elemental]	8.1E-09	7.7E-08	6.7E-07	1.7E-08	1.8E-07	1.7E-06	1.3E-07	1.2E-06	1.0E-05	8.3E-08	8.1E-07	7.6E-06
Adult: beef (from air, pasture) [inorganic]	1.9E-10	3.2E-09	6.2E-08	4.7E-10	8.2E-09	1.5E-07	3.1E-09	5.7E-08	9.2E-07	2.1E-09	3.6E-08	6.8E-07
Adult: milk (from air, pasture) [inorganic]	2.2E-12	4.5E-11	1.2E-09	8.4E-12	1.0E-10	1.8E-09	4.1E-11	8.2E-10	1.6E-08	2.7E-11	5.0E-10	6.9E-09
Adult: vegetables (from air) [inorganic]	3.1E-08	6.6E-07	1.6E-05	7.9E-08	1.5E-06	5.5E-05	5.3E-07	1.1E-05	1.7E-04	2.5E-07	7.4E-06	1.4E-04
Adult: *Total* inorganic dose	3.4E-08	6.6E-07	1.6E-05	8.1E-08	1.6E-06	5.5E-05	5.9E-07	1.1E-05	1.7E-04	2.6E-07	7.5E-06	1.5E-04
Child: inhalation [elemental]	1.4E-08	1.5E-07	1.2E-06	3.9E-08	3.5E-07	3.1E-06	2.3E-07	2.3E-06	1.9E-05	1.4E-07	1.4E-06	1.4E-05
Child: beef (from air, pasture) [inorganic]	3.4E-10	6.8E-09	1.9E-07	1.1E-09	1.8E-08	3.8E-07	5.6E-09	1.2E-07	2.1E-06	4.9E-09	6.9E-08	1.5E-06
Child: milk (from air, pasture) [inorganic]	2.4E-10	6.3E-09	1.1E-07	8.9E-10	1.4E-08	2.9E-07	5.6E-09	1.0E-07	2.0E-06	3.9E-09	6.4E-08	1.1E-06
Child: vegetables (from air) [inorganic]	3.5E-08	1.2E-06	3.9E-05	1.2E-07	3.0E-06	9.5E-05	7.0E-07	1.9E-05	8.0E-04	5.0E-07	1.3E-05	2.9E-04
Child: *Total* inorganic dose	4.4E-08	1.2E-06	3.9E-05	1.2E-07	3.0E-06	9.6E-05	9.2E-07	1.9E-05	8.0E-04	5.2E-07	1.3E-05	2.9E-04

	1957			1958			1959			1960		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Adult: inhalation [elemental]	3.3E-08	3.3E-07	2.6E-06	5.1E-08	4.9E-07	4.6E-06	5.4E-08	4.1E-07	4.0E-06	2.2E-08	2.0E-07	1.8E-06
Adult: beef (from air, pasture) [inorganic]	7.6E-10	1.5E-08	3.0E-07	8.9E-10	2.4E-08	4.1E-07	1.1E-09	2.0E-08	3.4E-07	4.2E-10	9.3E-09	1.7E-07
Adult: milk (from air, pasture) [inorganic]	1.2E-11	2.2E-10	3.8E-09	1.6E-11	3.0E-10	4.6E-09	1.3E-11	2.6E-10	4.5E-09	6.4E-12	1.3E-10	2.5E-09
Adult: vegetables (from air) [inorganic]	8.2E-08	3.0E-06	6.9E-05	1.6E-07	4.2E-06	1.0E-04	1.7E-07	3.6E-06	6.8E-05	6.5E-08	1.8E-06	3.2E-05
Adult: *Total* inorganic dose	9.0E-08	3.0E-06	6.9E-05	1.7E-07	4.2E-06	1.0E-04	1.7E-07	3.6E-06	6.8E-05	6.7E-08	1.8E-06	3.2E-05
Child: inhalation [elemental]	6.9E-08	6.0E-07	5.1E-06	1.1E-07	9.8E-07	8.8E-06	9.0E-08	7.7E-07	8.2E-06	4.8E-08	3.8E-07	2.9E-06
Child: beef (from air, pasture) [inorganic]	1.6E-09	3.2E-08	5.1E-07	2.6E-09	4.7E-08	8.8E-07	2.2E-09	4.4E-08	7.7E-07	1.1E-09	2.1E-08	4.5E-07
Child: milk (from air, pasture) [inorganic]	1.4E-09	3.0E-08	3.8E-07	2.0E-09	4.3E-08	7.5E-07	2.0E-09	3.5E-08	6.8E-07	1.0E-09	1.5E-08	3.2E-07
Child: vegetables (from air) [inorganic]	2.3E-07	5.5E-06	1.2E-04	2.9E-07	8.5E-06	2.3E-04	2.7E-07	6.9E-06	2.0E-04	1.3E-07	3.2E-06	8.1E-05
Child: *Total* inorganic dose	2.4E-07	5.6E-06	1.2E-04	3.2E-07	8.6E-06	2.3E-04	2.9E-07	7.0E-06	2.0E-04	1.4E-07	3.4E-06	8.1E-05

	1961			1962		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Adult: inhalation [elemental]	1.5E-08	1.4E-07	1.2E-06	1.3E-08	1.4E-07	1.3E-06
Adult: beef (from air, pasture) [inorganic]	3.3E-10	6.2E-09	9.1E-08	3.8E-10	6.2E-09	1.1E-07
Adult: milk (from air, pasture) [inorganic]	3.7E-12	9.7E-11	1.5E-09	4.8E-12	9.1E-11	1.4E-09
Adult: vegetables (from air) [inorganic]	4.5E-08	1.3E-06	2.3E-05	5.3E-08	1.1E-06	3.0E-05
Adult: *Total* inorganic dose	4.9E-08	1.3E-06	2.3E-05	5.4E-08	1.2E-06	3.0E-05
Child: inhalation [elemental]	2.6E-08	2.7E-07	2.3E-06	2.3E-08	2.7E-07	2.4E-06
Child: beef (from air, pasture) [inorganic]	9.1E-10	1.4E-08	2.1E-07	5.8E-10	1.5E-08	2.6E-07
Child: milk (from air, pasture) [inorganic]	5.7E-10	1.1E-08	2.1E-07	7.9E-10	1.2E-08	1.9E-07
Child: vegetables (from air) [inorganic]	7.7E-08	2.2E-06	8.7E-05	9.2E-08	2.4E-06	5.2E-05
Child: *Total* inorganic dose	8.6E-08	2.3E-06	8.7E-05	1.1E-07	2.5E-06	5.2E-05

a Underlined doses exceed the USEPA Reference Dose (RfD)

Table W-2: Estimated Annual Mercury Doses, Scarboro Community Resident Population ($mg\ kg^{-1}\ d^{-1}$) [a]

	1950			1951			1952			1953		
	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile
Adult: fish consumption [methyl]	1.2E-06	2.0E-05	2.9E-04	1.2E-06	2.0E-05	2.8E-04	1.4E-06	2.0E-05	2.9E-04	1.4E-06	2.0E-05	2.7E-04
Adult: inhalation [elemental]	4.7E-09	2.3E-08	1.3E-07	9.5E-09	4.4E-08	2.5E-07	4.7E-08	2.3E-07	1.4E-06	3.9E-07	1.9E-06	8.0E-06
Adult: sediment ingestion [inorganic]	2.7E-10	1.1E-08	5.4E-07	2.2E-10	1.2E-08	8.6E-07	1.9E-10	1.1E-08	7.5E-07	1.9E-10	1.4E-08	6.0E-07
Adult: skin contact (sediment) [inorganic]	5.1E-09	4.6E-07	2.6E-05	6.5E-09	4.8E-07	3.5E-05	6.0E-09	4.7E-07	3.7E-05	8.1E-09	4.3E-07	2.9E-05
Adult: soil ingestion [inorganic]	3.8E-11	1.0E-09	4.2E-08	3.2E-11	1.1E-09	4.9E-08	2.4E-11	1.1E-09	3.4E-08	2.8E-11	1.1E-09	3.9E-08
Adult: skin contact (soil) [inorganic]	1.0E-09	4.1E-08	1.8E-06	1.3E-09	4.3E-08	1.7E-06	7.7E-10	4.6E-08	1.5E-06	1.2E-09	4.4E-08	1.7E-06
Adult: water ingestion [inorganic]	1.0E-09	2.4E-08	1.6E-07	1.4E-09	4.6E-08	3.2E-07	6.5E-09	2.3E-07	1.6E-06	3.5E-08	9.9E-07	6.2E-06
Adult: skin contact (water) [inorganic]	6.0E-09	4.9E-08	4.7E-07	8.3E-09	1.1E-07	1.0E-06	4.0E-08	5.4E-07	5.3E-06	1.8E-07	2.4E-06	1.7E-05
Adult: vegetables (from air) [inorganic]	1.5E-08	2.2E-07	3.6E-06	2.0E-08	4.4E-07	7.5E-06	1.2E-07	2.1E-06	5.2E-05	1.1E-06	1.9E-05	1.8E-04
Adult: vegetables (from soil) [inorganic]	2.8E-09	7.3E-08	1.7E-06	2.6E-09	8.4E-08	1.7E-06	4.2E-09	7.9E-08	1.4E-06	4.5E-09	7.7E-08	1.5E-06
Adult: Total inorganic dose	3.1E-07	1.8E-06	2.7E-05	3.9E-07	2.3E-06	3.7E-05	9.9E-07	5.9E-06	7.2E-05	4.5E-06	2.9E-05	2.1E-04
Child: fish consumption [methyl]	1.3E-06	2.3E-05	3.5E-04	1.4E-06	2.3E-05	3.0E-04	1.4E-06	2.3E-05	3.3E-04	1.6E-06	2.4E-05	3.5E-04
Child: inhalation [elemental]	8.9E-09	4.4E-08	2.4E-07	1.7E-08	9.5E-08	5.6E-07	9.3E-08	4.7E-07	3.0E-06	7.4E-07	3.6E-06	1.8E-05
Child: sediment ingestion [inorganic]	5.1E-09	2.2E-07	1.1E-05	3.2E-09	2.1E-07	1.6E-05	3.6E-09	2.1E-07	1.5E-05	3.2E-09	2.0E-07	1.5E-05
Child: skin contact (sediment) [inorganic]	4.2E-08	2.1E-06	1.8E-04	2.3E-08	2.8E-06	2.0E-04	4.5E-08	2.2E-06	1.2E-04	2.4E-08	2.5E-06	1.7E-04
Child: soil ingestion [inorganic]	5.8E-10	1.7E-08	8.0E-07	5.5E-10	2.2E-08	7.2E-07	4.8E-10	1.9E-08	7.7E-07	4.8E-10	2.0E-08	6.5E-07
Child: skin contact (soil) [inorganic]	6.1E-09	2.1E-07	6.8E-06	6.4E-09	2.0E-07	6.8E-06	5.2E-09	2.3E-07	4.9E-06	5.6E-09	2.2E-07	5.8E-06
Child: water ingestion [inorganic]	1.1E-08	3.5E-07	2.5E-06	1.9E-08	7.4E-07	5.5E-06	1.5E-07	3.7E-06	2.7E-05	4.7E-07	1.6E-05	1.2E-04
Child: skin contact (water) [inorganic]	1.8E-08	2.9E-07	2.6E-06	4.0E-08	5.5E-07	5.0E-06	1.9E-07	2.8E-06	3.2E-05	6.3E-07	1.4E-05	1.1E-04
Child: vegetables (from air) [inorganic]	2.0E-08	4.3E-07	9.9E-06	3.6E-08	8.5E-07	1.5E-05	1.7E-07	3.7E-06	8.7E-05	1.6E-06	3.1E-05	6.3E-04
Child: vegetables (from soil) [inorganic]	8.4E-09	2.1E-07	7.8E-06	8.0E-09	2.6E-07	6.4E-06	9.9E-09	2.4E-07	8.1E-06	7.1E-09	2.5E-07	7.3E-06
Child: Total inorganic dose	1.3E-06	7.8E-06	2.1E-04	1.9E-06	1.1E-05	2.7E-04	4.2E-06	2.8E-05	2.2E-04	1.5E-05	1.1E-04	7.2E-04

a Underlined doses exceed the USEPA Reference Dose

Table W-2: Estimated Annual Mercury Doses, Scarboro Community Resident Population (mg kg^{-1} d^{-1}) [a]

	1954			1955			1956			1957	
	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central
Adult: fish consumption [methyl]	1.1E-06	2.0E-05	3.4E-04	1.2E-06	2.1E-05	3.4E-04	1.3E-06	2.0E-05	3.5E-04	1.3E-06	2.0E-05
Adult: inhalation [elemental]	4.5E-07	1.9E-06	1.0E-05	2.8E-06	1.1E-05	5.8E-05	2.0E-06	7.2E-06	4.1E-05	2.4E-06	9.4E-06
Adult: sediment ingestion [inorganic]	1.6E-10	1.1E-08	9.1E-07	3.5E-10	2.0E-08	1.4E-06	2.4E-10	1.9E-08	2.0E-06	3.0E-10	1.9E-08
Adult: skin contact (sediment) [inorganic]	8.3E-09	4.6E-07	2.8E-05	1.4E-08	6.9E-07	4.8E-05	1.1E-08	7.0E-07	4.2E-05	9.6E-09	6.9E-07
Adult: soil ingestion [inorganic]	3.1E-11	1.2E-09	6.8E-08	4.0E-11	1.1E-09	4.9E-08	3.2E-11	1.0E-09	5.2E-08	2.5E-11	1.0E-09
Adult: skin contact (soil) [inorganic]	1.2E-09	4.1E-08	1.6E-06	1.7E-09	4.2E-08	1.4E-06	9.0E-10	4.4E-08	1.5E-06	1.3E-09	3.9E-08
Adult: water ingestion [inorganic]	1.5E-08	6.0E-07	4.3E-06	1.1E-07	2.9E-06	2.0E-05	6.8E-08	2.4E-06	1.8E-05	2.8E-07	6.7E-06
Adult: skin contact (water) [inorganic]	1.1E-07	1.5E-06	1.2E-05	7.0E-07	6.8E-06	5.7E-05	3.5E-07	5.5E-06	4.4E-05	1.4E-06	1.5E-05
Adult: vegetables (from air) [inorganic]	1.2E-06	1.9E-05	3.1E-04	7.2E-06	1.1E-04	1.4E-03	5.0E-06	6.5E-05	1.4E-03	5.1E-06	9.3E-05
Adult: vegetables (from soil) [inorganic]	4.4E-09	7.6E-08	2.1E-06	3.8E-09	7.9E-08	2.1E-06	3.2E-09	8.3E-08	2.1E-06	3.2E-09	7.8E-08
Adult: Total inorganic dose	4.6E-06	2.8E-05	3.4E-04	1.9E-05	1.4E-04	1.4E-03	1.2E-05	9.1E-05	1.4E-03	2.0E-05	1.4E-04
Child: fish consumption [methyl]	1.4E-06	2.3E-05	3.6E-04	1.3E-06	2.3E-05	3.5E-04	1.4E-06	2.4E-05	3.9E-04	1.4E-06	2.4E-05
Child: inhalation [elemental]	9.0E-07	3.6E-06	2.0E-05	5.0E-06	2.2E-05	1.2E-04	3.2E-06	1.4E-05	8.1E-05	4.3E-06	2.0E-05
Child: sediment ingestion [inorganic]	3.3E-09	2.4E-07	1.2E-05	6.2E-09	3.6E-07	2.7E-05	3.8E-09	3.6E-07	2.6E-05	5.9E-09	3.7E-07
Child: skin contact (sediment) [inorganic]	3.5E-08	2.4E-06	1.5E-04	6.6E-08	3.2E-06	2.2E-04	5.8E-08	3.9E-06	2.3E-04	7.7E-08	4.1E-06
Child: soil ingestion [inorganic]	6.8E-10	2.0E-08	9.1E-07	5.0E-10	2.0E-08	7.8E-07	4.4E-10	2.1E-08	6.9E-07	4.6E-10	1.9E-08
Child: skin contact (soil) [inorganic]	4.4E-09	2.1E-07	7.3E-06	1.1E-08	1.8E-07	7.1E-06	4.2E-09	2.1E-07	8.2E-06	6.9E-09	2.1E-07
Child: water ingestion [inorganic]	3.0E-07	9.5E-06	7.4E-05	1.7E-06	4.8E-05	3.6E-04	1.7E-06	3.4E-05	3.1E-04	3.1E-06	1.0E-04
Child: skin contact (water) [inorganic]	4.6E-07	7.9E-06	7.5E-05	2.4E-06	3.5E-05	3.8E-04	1.4E-06	2.8E-05	2.7E-04	6.3E-06	8.1E-05
Child: vegetables (from air) [inorganic]	1.7E-06	3.6E-05	7.5E-04	1.0E-05	2.0E-04	4.2E-03	7.2E-06	1.4E-04	2.3E-03	7.6E-06	1.6E-04
Child: vegetables (from soil) [inorganic]	7.8E-09	2.4E-07	8.3E-06	6.2E-09	2.3E-07	7.9E-06	8.2E-09	2.8E-07	7.3E-06	1.1E-08	2.3E-07
Child: Total inorganic dose	1.5E-05	9.1E-05	8.8E-04	6.4E-05	4.1E-04	4.4E-03	4.4E-05	3.2E-04	2.4E-03	7.9E-05	5.4E-04

a Underlined doses exceed the USEPA Reference Dose

Table W-2: Estimated Annual Mercury Doses, Scarboro Community Resident Population (mg kg^{-1} d^{-1}) [a]

		1958			1959			1960			
	97.5%-ile	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile	2.5%-ile
Adult: fish consumption [methyl]	3.6E-04	1.1E-06	2.0E-05	3.2E-04	1.3E-06	2.0E-05	3.1E-04	1.2E-06	2.0E-05	3.0E-04	1.2E-06
Adult: inhalation [elemental]	4.0E-05	2.2E-06	1.0E-05	3.9E-05	1.1E-06	4.6E-06	2.2E-05	4.7E-07	2.1E-06	1.1E-05	3.9E-07
Adult: sediment ingestion [inorganic]	1.2E-06	1.9E-10	2.0E-08	1.1E-06	8.7E-11	7.8E-09	5.0E-07	1.4E-10	7.1E-09	4.6E-07	1.0E-10
Adult: skin contact (sediment) [inorganic]	7.4E-05	1.0E-08	8.3E-07	3.8E-05	3.9E-09	2.6E-07	1.8E-05	3.4E-09	2.7E-07	1.8E-05	3.0E-09
Adult: soil ingestion [inorganic]	3.9E-08	2.8E-11	1.1E-09	4.2E-08	2.3E-11	1.2E-09	5.3E-08	2.6E-11	1.2E-09	3.8E-08	2.3E-11
Adult: skin contact (soil) [inorganic]	1.4E-06	1.0E-09	4.5E-08	1.1E-06	1.3E-09	4.1E-08	2.1E-06	1.3E-09	4.3E-08	1.8E-06	7.3E-10
Adult: water ingestion [inorganic]	3.7E-05	2.3E-07	7.4E-06	3.9E-05	9.7E-08	2.2E-06	1.1E-05	4.0E-08	6.9E-07	4.0E-06	2.4E-08
Adult: skin contact (water) [inorganic]	1.1E-04	1.2E-06	1.7E-05	1.2E-04	5.2E-07	4.9E-06	3.5E-05	2.1E-07	1.6E-06	1.3E-05	1.1E-07
Adult: vegetables (from air) [inorganic]	9.8E-04	6.4E-06	9.3E-05	1.0E-03	2.6E-06	4.5E-05	6.0E-04	1.2E-06	2.0E-05	2.4E-04	9.3E-07
Adult: vegetables (from soil) [inorganic]	1.5E-06	3.3E-09	8.5E-08	2.4E-06	4.4E-09	7.9E-08	1.7E-06	4.4E-09	7.6E-08	1.9E-06	3.2E-09
Adult: Total inorganic dose	1.0E-03	2.2E-05	1.4E-04	1.1E-03	8.9E-06	6.1E-05	6.1E-04	4.3E-06	2.7E-05	2.4E-04	2.9E-06
Child: fish consumption [methyl]	3.8E-04	1.4E-06	2.2E-05	3.8E-04	1.7E-06	2.2E-05	3.4E-04	1.4E-06	2.2E-05	3.4E-04	1.5E-06
Child: inhalation [elemental]	9.2E-05	4.0E-06	1.9E-05	9.3E-05	2.1E-06	8.9E-06	4.9E-05	9.3E-07	3.9E-06	2.1E-05	7.3E-07
Child: sediment ingestion [inorganic]	1.8E-05	3.5E-09	2.9E-07	2.6E-05	1.6E-09	1.3E-07	1.4E-05	2.8E-09	1.3E-07	9.2E-06	2.0E-09
Child: skin contact (sediment) [inorganic]	1.5E-04	9.3E-08	3.2E-06	2.6E-04	2.3E-08	1.5E-06	1.0E-04	2.8E-08	1.4E-06	1.3E-04	1.4E-08
Child: soil ingestion [inorganic]	7.7E-07	8.2E-10	2.0E-08	6.0E-07	4.7E-10	1.9E-08	1.2E-06	4.5E-10	2.1E-08	6.8E-07	5.2E-10
Child: skin contact (soil) [inorganic]	6.4E-06	4.7E-09	2.3E-07	5.6E-06	4.5E-09	2.1E-07	5.0E-06	6.2E-09	2.1E-07	1.0E-05	6.8E-09
Child: water ingestion [inorganic]	6.8E-04	3.5E-06	1.1E-04	7.3E-04	1.1E-06	3.6E-05	2.2E-04	3.2E-07	1.3E-05	7.5E-05	3.9E-07
Child: skin contact (water) [inorganic]	6.3E-04	7.6E-06	8.6E-05	7.3E-04	1.9E-06	2.4E-05	2.2E-04	6.9E-07	9.0E-06	6.7E-05	6.0E-07
Child: vegetables (from air) [inorganic]	2.7E-03	8.3E-06	1.6E-04	3.6E-03	2.9E-06	8.5E-05	1.9E-03	1.7E-06	3.6E-05	8.5E-04	1.4E-06
Child: vegetables (from soil) [inorganic]	8.5E-06	6.1E-09	2.5E-07	8.5E-06	1.1E-08	2.8E-07	5.5E-06	6.2E-09	2.3E-07	1.3E-05	7.7E-09
Child: Total inorganic dose	3.1E-03	8.0E-05	5.8E-04	4.1E-03	3.2E-05	2.1E-04	2.1E-03	1.6E-05	8.5E-05	9.8E-04	1.3E-05

a Underlined doses exceed the USEPA Reference Dose

Table W-2: Estimated Annual Mercury Doses, Scarboro Community Resident Population (mg kg^{-1} d^{-1}) [a]

	1961		1962			1963			1964		
	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile
Adult: fish consumption [methyl]	2.0E-05	3.4E-04	1.2E-06	2.0E-05	3.0E-04	1.3E-06	1.9E-05	3.3E-04	1.4E-06	1.9E-05	3.3E-04
Adult: inhalation [elemental]	1.6E-06	8.2E-06	3.3E-07	1.2E-06	7.0E-06	5.7E-08	2.6E-07	1.6E-06	2.0E-08	1.0E-07	5.2E-07
Adult: sediment ingestion [inorganic]	7.6E-09	4.5E-07	7.0E-11	7.9E-09	4.6E-07	8.5E-11	7.9E-09	5.2E-07	7.0E-11	8.1E-09	4.3E-07
Adult: skin contact (sediment) [inorganic]	2.7E-07	2.1E-05	3.2E-09	2.8E-07	2.3E-05	2.1E-09	2.9E-07	1.6E-05	5.1E-09	3.1E-07	1.9E-05
Adult: soil ingestion [inorganic]	1.2E-09	6.2E-08	2.5E-11	1.2E-09	5.2E-08	3.4E-11	1.2E-09	3.9E-08	3.3E-11	1.2E-09	3.6E-08
Adult: skin contact (soil) [inorganic]	4.5E-08	1.9E-06	1.2E-09	4.5E-08	2.2E-06	1.5E-09	4.0E-08	1.9E-06	1.0E-09	4.3E-08	1.0E-06
Adult: water ingestion [inorganic]	5.6E-07	4.2E-06	9.7E-09	3.3E-07	2.5E-06	7.5E-09	2.5E-07	1.7E-06	3.9E-09	1.2E-07	9.3E-07
Adult: skin contact (water) [inorganic]	1.5E-06	1.0E-05	6.4E-08	8.8E-07	5.9E-06	5.5E-08	6.1E-07	5.0E-06	2.7E-08	3.1E-07	2.7E-06
Adult: vegetables (from air) [inorganic]	1.6E-05	2.5E-04	6.9E-07	1.3E-05	2.2E-04	1.4E-07	2.8E-06	3.7E-05	5.2E-08	9.5E-07	1.2E-05
Adult: vegetables (from soil) [inorganic]	7.6E-08	1.5E-06	3.3E-09	8.0E-08	1.3E-06	4.0E-09	7.5E-08	1.8E-06	4.3E-09	8.3E-08	1.5E-06
Adult: Total inorganic dose	2.1E-05	2.7E-04	2.5E-06	1.7E-05	2.4E-04	1.1E-06	6.3E-06	5.3E-05	6.3E-07	3.3E-06	2.4E-05
Child: fish consumption [methyl]	2.3E-05	4.1E-04	1.4E-06	2.4E-05	3.5E-04	1.4E-06	2.2E-05	3.4E-04	1.6E-06	2.3E-05	3.7E-04
Child: inhalation [elemental]	3.1E-06	1.7E-05	6.2E-07	2.5E-06	1.4E-05	9.9E-08	5.2E-07	3.1E-06	3.7E-08	2.0E-07	1.2E-06
Child: sediment ingestion [inorganic]	1.3E-07	7.0E-06	1.6E-09	1.3E-07	1.1E-05	1.6E-09	1.4E-07	1.1E-05	1.3E-09	1.5E-07	8.7E-06
Child: skin contact (sediment) [inorganic]	1.4E-06	1.1E-04	1.6E-08	1.4E-06	1.1E-04	2.2E-08	1.4E-06	8.0E-05	1.5E-08	1.5E-06	9.7E-05
Child: soil ingestion [inorganic]	2.0E-08	1.1E-06	4.4E-10	2.1E-08	6.2E-07	4.3E-10	2.0E-08	9.2E-07	4.9E-10	2.0E-08	9.5E-07
Child: skin contact (soil) [inorganic]	2.1E-07	8.5E-06	5.3E-09	2.4E-07	1.0E-05	5.5E-09	2.0E-07	8.5E-06	6.2E-09	2.4E-07	6.7E-06
Child: water ingestion [inorganic]	9.6E-06	5.8E-05	1.5E-07	5.4E-06	3.8E-05	9.5E-08	4.5E-06	3.0E-05	5.9E-08	2.0E-06	1.7E-05
Child: skin contact (water) [inorganic]	6.9E-06	7.1E-05	3.2E-07	4.2E-06	4.3E-05	2.3E-07	3.1E-06	3.1E-05	1.5E-07	1.5E-06	1.6E-05
Child: vegetables (from air) [inorganic]	3.0E-05	4.4E-04	1.2E-06	2.2E-05	5.5E-04	1.6E-07	4.8E-06	8.3E-05	5.9E-08	1.8E-06	3.3E-05
Child: vegetables (from soil) [inorganic]	2.6E-07	6.5E-06	6.7E-09	2.5E-07	1.2E-05	9.0E-09	2.3E-07	7.5E-06	6.6E-09	2.4E-07	1.0E-05
Child: Total inorganic dose	7.4E-05	6.2E-04	8.2E-06	5.6E-05	6.5E-04	4.7E-06	2.7E-05	2.3E-04	2.7E-06	1.5E-05	1.3E-04

a Underlined doses exceed the USEPA Reference Dose

Table W-2: Estimated Annual Mercury Doses, Scarboro Community Resident Population (mg kg^{-1} d^{-1}) [a]

	1965			1966			1967			1968		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Adult: fish consumption [methyl]	1.4E-06	2.0E-05	3.2E-04	1.1E-06	1.8E-05	3.3E-04	1.2E-06	2.0E-05	3.0E-04	1.1E-06	1.9E-05	2.7E-04
Adult: inhalation [elemental]	4.2E-08	2.3E-07	1.2E-06	2.0E-08	1.2E-07	7.0E-07	1.3E-08	7.4E-08	4.1E-07	2.5E-09	1.2E-08	8.1E-08
Adult: sediment ingestion [inorganic]	9.0E-11	6.8E-09	5.0E-07	7.7E-11	7.3E-09	6.9E-07	6.5E-11	5.6E-09	2.8E-07	4.7E-11	5.7E-09	3.1E-07
Adult: skin contact (sediment) [inorganic]	4.5E-09	2.7E-07	3.1E-05	4.4E-09	2.9E-07	2.9E-05	3.7E-09	2.1E-07	1.1E-05	2.8E-09	1.9E-07	2.2E-05
Adult: soil ingestion [inorganic]	3.3E-11	1.0E-09	4.3E-08	2.4E-11	1.2E-09	4.8E-08	3.1E-11	1.1E-09	6.1E-08	3.2E-11	1.1E-09	4.9E-08
Adult: skin contact (soil) [inorganic]	1.6E-09	4.1E-08	1.4E-06	1.4E-09	4.4E-08	1.5E-06	1.3E-09	4.3E-08	1.7E-06	1.3E-09	4.1E-08	2.1E-06
Adult: water ingestion [inorganic]	6.3E-09	2.9E-07	1.9E-06	6.5E-09	1.3E-07	8.7E-07	3.6E-09	8.1E-08	5.4E-07	6.1E-10	1.5E-08	9.5E-08
Adult: skin contact (water) [inorganic]	4.3E-08	6.9E-07	5.6E-06	2.3E-08	3.1E-07	2.8E-06	1.5E-08	2.1E-07	1.4E-06	4.2E-09	3.8E-08	2.5E-07
Adult: vegetables (from air) [inorganic]	1.0E-07	2.0E-06	4.3E-05	7.5E-08	1.1E-06	1.8E-05	4.8E-08	7.1E-07	1.1E-05	6.1E-09	1.1E-07	2.1E-06
Adult: vegetables (from soil) [inorganic]	3.8E-09	7.9E-08	2.1E-06	3.0E-09	7.9E-08	1.6E-06	4.2E-09	7.8E-08	1.8E-06	3.9E-09	7.5E-08	2.0E-06
Adult: Total inorganic dose	9.5E-07	5.8E-06	5.2E-05	6.8E-07	3.2E-06	3.6E-05	5.7E-07	2.5E-06	2.0E-05	1.8E-07	1.0E-06	2.4E-05
Child: fish consumption [methyl]	1.6E-06	2.3E-05	3.4E-04	1.3E-06	2.2E-05	3.5E-04	1.3E-06	2.2E-05	3.3E-04	1.4E-06	2.2E-05	3.2E-04
Child: inhalation [elemental]	8.0E-08	4.5E-07	2.5E-06	3.9E-08	2.4E-07	1.2E-06	2.6E-08	1.5E-07	7.9E-07	4.3E-09	2.4E-08	1.4E-07
Child: sediment ingestion [inorganic]	1.6E-09	1.5E-07	1.1E-05	1.7E-09	1.4E-07	1.1E-05	9.4E-10	1.0E-07	5.8E-06	1.7E-09	1.0E-07	7.1E-06
Child: skin contact (sediment) [inorganic]	2.0E-08	1.4E-06	7.6E-05	1.5E-08	1.5E-06	8.0E-05	1.9E-08	1.1E-06	5.5E-05	1.3E-08	1.1E-06	6.2E-05
Child: soil ingestion [inorganic]	5.0E-10	1.8E-08	5.7E-07	5.6E-10	2.1E-08	5.5E-07	4.8E-10	1.9E-08	1.1E-06	7.0E-10	1.8E-08	1.0E-06
Child: skin contact (soil) [inorganic]	5.5E-09	1.9E-07	1.3E-05	8.3E-09	1.9E-07	6.7E-06	7.7E-09	1.7E-07	9.2E-06	7.5E-09	2.0E-07	7.9E-06
Child: water ingestion [inorganic]	1.7E-07	4.3E-06	3.0E-05	7.8E-08	1.9E-06	1.5E-05	3.5E-08	1.5E-06	9.6E-06	9.6E-09	2.5E-07	1.5E-06
Child: skin contact (water) [inorganic]	2.5E-07	3.3E-06	3.7E-05	1.1E-07	1.5E-06	1.6E-05	6.7E-08	1.1E-06	1.1E-05	1.4E-08	1.9E-07	1.4E-06
Child: vegetables (from air) [inorganic]	2.0E-07	3.5E-06	9.4E-05	7.2E-08	1.9E-06	5.0E-05	6.1E-08	1.3E-06	2.7E-05	9.7E-09	2.1E-07	4.2E-06
Child: vegetables (from soil) [inorganic]	8.4E-09	2.4E-07	8.3E-06	8.4E-09	2.3E-07	7.8E-06	8.5E-09	2.4E-07	1.1E-05	7.1E-09	2.5E-07	7.6E-06
Child: Total inorganic dose	4.5E-06	2.6E-05	2.0E-04	3.0E-06	1.5E-05	1.4E-04	2.1E-06	1.3E-05	8.3E-05	7.8E-07	4.9E-06	8.6E-05

a Underlined doses exceed the USEPA Reference Dose

Table W-2: Estimated Annual Mercury Doses, Scarboro Community Resident Population (mg kg^{-1} d^{-1}) [a]

	1969			1970			1971			1972	
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**
Adult: fish consumption [methyl]	1.4E-06	1.9E-05	3.3E-04	1.3E-06	1.9E-05	3.0E-04	1.3E-06	1.8E-05	2.6E-04	1.0E-06	1.8E-05
Adult: inhalation [elemental]	3.5E-09	1.6E-08	8.7E-08	1.1E-08	6.2E-08	3.6E-07	2.9E-09	1.6E-08	8.2E-08	3.3E-10	1.7E-09
Adult: sediment ingestion [inorganic]	5.9E-11	5.4E-09	4.6E-07	5.1E-11	5.4E-09	3.5E-07	2.1E-11	2.0E-09	1.6E-07	2.5E-11	2.0E-09
Adult: skin contact (sediment) [inorganic]	2.8E-09	2.0E-07	1.1E-05	2.9E-09	2.0E-07	1.6E-05	7.3E-10	7.8E-08	5.9E-06	7.5E-10	6.5E-08
Adult: soil ingestion [inorganic]	3.6E-11	1.2E-09	4.0E-08	3.2E-11	1.2E-09	4.9E-08	3.1E-11	1.1E-09	5.4E-08	4.5E-11	1.1E-09
Adult: skin contact (soil) [inorganic]	1.5E-09	4.2E-08	1.5E-06	1.5E-09	4.2E-08	1.6E-06	1.3E-09	4.5E-08	1.4E-06	1.0E-09	4.4E-08
Adult: water ingestion [inorganic]	8.0E-10	1.7E-08	1.1E-07	1.8E-09	8.0E-08	4.4E-07	7.2E-10	1.8E-08	1.1E-07	8.7E-11	2.9E-09
Adult: skin contact (water) [inorganic]	5.0E-09	4.4E-08	3.6E-07	1.6E-08	1.9E-07	1.4E-06	3.8E-09	4.1E-08	2.9E-07	7.2E-10	6.7E-09
Adult: vegetables (from air) [inorganic]	8.6E-09	1.5E-07	2.6E-06	4.0E-08	5.5E-07	1.1E-05	6.8E-09	1.5E-07	2.2E-06	7.7E-10	1.6E-08
Adult: vegetables (from soil) [inorganic]	3.5E-09	7.8E-08	1.7E-06	3.5E-09	8.4E-08	1.7E-06	3.1E-09	7.8E-08	1.5E-06	4.1E-09	7.3E-08
Adult: Total inorganic dose	2.2E-07	1.1E-06	1.3E-05	4.3E-07	2.2E-06	2.5E-05	1.7E-07	8.8E-07	9.0E-06	7.7E-08	4.6E-07
Child: fish consumption [methyl]	1.4E-06	2.1E-05	3.5E-04	1.4E-06	2.2E-05	3.2E-04	1.4E-06	2.2E-05	3.5E-04	1.4E-06	2.0E-05
Child: inhalation [elemental]	5.7E-09	3.2E-08	1.9E-07	2.4E-08	1.2E-07	6.6E-07	6.1E-09	2.9E-08	1.5E-07	6.7E-10	3.4E-09
Child: sediment ingestion [inorganic]	2.0E-09	8.8E-08	8.1E-06	1.2E-09	9.6E-08	4.9E-06	4.5E-10	3.4E-08	4.7E-06	5.4E-10	3.9E-08
Child: skin contact (sediment) [inorganic]	1.3E-08	9.7E-07	9.8E-05	1.3E-08	1.0E-06	8.3E-05	5.8E-09	4.2E-07	2.9E-05	4.9E-09	3.7E-07
Child: soil ingestion [inorganic]	6.1E-10	2.1E-08	9.3E-07	4.2E-10	1.9E-08	8.3E-07	4.9E-10	1.9E-08	6.9E-07	7.0E-10	1.6E-08
Child: skin contact (soil) [inorganic]	4.8E-09	2.2E-07	5.8E-06	6.6E-09	2.1E-07	6.1E-06	4.1E-09	2.0E-07	6.6E-06	6.5E-09	2.0E-07
Child: water ingestion [inorganic]	6.2E-09	3.1E-07	1.8E-06	7.0E-08	1.3E-06	8.0E-06	8.7E-09	3.0E-07	2.1E-06	2.1E-09	4.6E-08
Child: skin contact (water) [inorganic]	1.5E-08	2.2E-07	1.9E-06	8.7E-08	9.5E-07	9.2E-06	2.1E-08	2.1E-07	1.9E-06	2.2E-09	3.5E-08
Child: vegetables (from air) [inorganic]	1.3E-08	2.8E-07	4.2E-06	4.3E-08	1.1E-06	2.3E-05	9.5E-09	2.5E-07	4.2E-06	1.7E-09	3.0E-08
Child: vegetables (from soil) [inorganic]	9.3E-09	2.4E-07	7.1E-06	7.2E-09	2.6E-07	7.3E-06	1.0E-08	2.3E-07	9.0E-06	5.7E-09	2.9E-07
Child: Total inorganic dose	7.6E-07	5.2E-06	1.3E-04	1.9E-06	1.1E-05	1.3E-04	6.4E-07	4.0E-06	4.8E-05	3.3E-07	2.4E-06

a Underlined doses exceed the USEPA Reference Dose

Table W-2: Estimated Annual Mercury Doses, Scarboro Community Resident Population (mg kg^{-1} d^{-1}) [a]

		1973			1974			1975			
	97.5%-ile	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile	2.5%-ile
Adult: fish consumption [methyl]	2.8E-04	1.1E-06	1.8E-05	3.3E-04	1.2E-06	1.9E-05	2.7E-04	1.0E-06	1.6E-05	2.5E-04	9.8E-07
Adult: inhalation [elemental]	9.4E-09	2.8E-08	1.6E-07	8.3E-07	6.0E-09	3.0E-08	1.6E-07	4.2E-10	1.7E-09	1.1E-08	4.8E-10
Adult: sediment ingestion [inorganic]	1.4E-07	1.4E-11	2.0E-09	1.7E-07	3.5E-11	1.9E-09	1.4E-07	1.5E-11	1.3E-09	1.1E-07	1.5E-11
Adult: skin contact (sediment) [inorganic]	5.2E-06	5.1E-10	7.3E-08	4.5E-06	1.3E-09	7.1E-08	8.2E-06	4.9E-10	4.6E-08	4.4E-06	6.9E-10
Adult: soil ingestion [inorganic]	3.4E-08	2.0E-11	1.2E-09	3.2E-08	2.6E-11	1.3E-09	3.6E-08	2.6E-11	1.1E-09	5.3E-08	2.5E-11
Adult: skin contact (soil) [inorganic]	1.8E-06	9.9E-10	4.8E-08	1.3E-06	1.1E-09	4.0E-08	1.4E-06	1.2E-09	4.4E-08	1.3E-06	1.3E-09
Adult: water ingestion [inorganic]	1.7E-08	6.0E-09	1.7E-07	1.1E-06	1.6E-09	4.3E-08	2.2E-07	9.9E-11	3.0E-09	1.7E-08	1.2E-10
Adult: skin contact (water) [inorganic]	4.5E-08	4.8E-08	4.4E-07	3.5E-06	9.1E-09	1.0E-07	7.2E-07	5.9E-10	6.9E-09	4.7E-08	6.5E-10
Adult: vegetables (from air) [inorganic]	2.3E-07	8.3E-08	1.4E-06	2.4E-05	1.4E-08	2.6E-07	5.0E-06	9.1E-10	1.7E-08	3.4E-07	1.0E-09
Adult: vegetables (from soil) [inorganic]	1.7E-06	3.6E-09	8.0E-08	1.6E-06	4.3E-09	7.7E-08	1.4E-06	3.1E-09	8.3E-08	1.5E-06	2.6E-09
Adult: Total inorganic dose	8.1E-06	6.9E-07	3.6E-06	2.9E-05	2.4E-07	1.2E-06	1.0E-05	7.2E-08	4.3E-07	6.1E-06	7.0E-08
Child: fish consumption [methyl]	3.7E-04	1.3E-06	2.0E-05	3.6E-04	1.4E-06	2.2E-05	3.2E-04	1.2E-06	1.8E-05	2.7E-04	1.2E-06
Child: inhalation [elemental]	1.7E-08	4.5E-08	3.1E-07	1.9E-06	1.0E-08	5.9E-08	3.0E-07	7.6E-10	3.6E-09	2.2E-08	9.0E-10
Child: sediment ingestion [inorganic]	3.5E-06	4.0E-10	3.4E-08	2.6E-06	5.6E-10	3.5E-08	2.9E-06	3.3E-10	2.3E-08	2.4E-06	2.6E-10
Child: skin contact (sediment) [inorganic]	2.5E-05	4.0E-09	3.9E-07	3.1E-05	5.3E-09	3.5E-07	1.8E-05	3.6E-09	2.4E-07	2.5E-05	2.2E-09
Child: soil ingestion [inorganic]	9.1E-07	4.2E-10	2.3E-08	6.5E-07	4.4E-10	2.2E-08	5.5E-07	5.2E-10	2.0E-08	8.3E-07	6.6E-10
Child: skin contact (soil) [inorganic]	6.9E-06	5.5E-09	2.2E-07	7.1E-06	5.8E-09	2.2E-07	5.9E-06	5.0E-09	2.1E-07	8.5E-06	5.8E-09
Child: water ingestion [inorganic]	2.7E-07	1.1E-07	2.9E-06	1.8E-05	3.0E-08	6.8E-07	4.8E-06	2.1E-09	4.9E-08	2.7E-07	1.1E-09
Child: skin contact (water) [inorganic]	2.8E-07	2.0E-07	2.2E-06	1.9E-05	3.6E-08	5.1E-07	5.3E-06	3.0E-09	3.4E-08	2.8E-07	2.7E-09
Child: vegetables (from air) [inorganic]	4.9E-07	1.3E-07	2.6E-06	4.4E-05	1.9E-08	5.4E-07	8.9E-06	1.4E-09	3.2E-08	7.0E-07	2.3E-09
Child: vegetables (from soil) [inorganic]	5.8E-06	8.0E-09	2.3E-07	9.4E-06	8.4E-09	2.4E-07	6.0E-06	8.9E-09	2.4E-07	7.4E-06	6.8E-09
Child: Total inorganic dose	2.8E-05	3.0E-06	1.5E-05	8.6E-05	1.1E-06	5.8E-06	3.7E-05	2.9E-07	2.1E-06	3.5E-05	3.3E-07

a Underlined doses exceed the USEPA Reference Dose

Table W-2: Estimated Annual Mercury Doses, Scarboro Community Resident Population (mg kg^{-1} d^{-1}) [a]

	1976		1977			1978			1979		
	Central	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Adult: fish consumption [methyl]	1.6E-05	2.3E-04	8.7E-07	1.5E-05	2.8E-04	8.9E-07	1.5E-05	2.2E-04	9.4E-07	1.5E-05	2.4E-04
Adult: inhalation [elemental]	2.2E-09	1.2E-08	9.2E-10	4.2E-09	2.5E-08	3.9E-10	1.9E-09	1.1E-08	7.3E-10	3.7E-09	1.8E-08
Adult: sediment ingestion [inorganic]	1.2E-09	1.7E-07	1.4E-11	1.4E-09	1.1E-07	1.4E-11	1.5E-09	1.7E-07	8.6E-12	7.2E-10	4.5E-08
Adult: skin contact (sediment) [inorganic]	5.4E-08	3.3E-06	7.6E-10	5.4E-08	4.8E-06	3.3E-10	4.9E-08	5.6E-06	2.4E-10	2.9E-08	3.1E-06
Adult: soil ingestion [inorganic]	1.2E-09	3.7E-08	4.4E-11	1.1E-09	4.5E-08	2.3E-11	1.1E-09	5.3E-08	3.4E-11	1.1E-09	4.4E-08
Adult: skin contact (soil) [inorganic]	4.4E-08	1.4E-06	1.2E-09	4.6E-08	1.7E-06	1.1E-09	4.3E-08	1.5E-06	9.4E-10	4.6E-08	1.6E-06
Adult: water ingestion [inorganic]	3.0E-09	1.8E-08	1.9E-10	5.8E-09	3.4E-08	8.7E-11	3.0E-09	1.7E-08	2.7E-10	5.3E-09	3.6E-08
Adult: skin contact (water) [inorganic]	7.2E-09	5.0E-08	1.1E-09	1.3E-08	1.2E-07	6.6E-10	6.3E-09	6.1E-08	1.4E-09	1.3E-08	1.2E-07
Adult: vegetables (from air) [inorganic]	2.0E-08	3.2E-07	2.7E-09	4.1E-08	6.2E-07	1.1E-09	1.8E-08	2.4E-07	1.8E-09	3.8E-08	4.7E-07
Adult: vegetables (from soil) [inorganic]	7.5E-08	1.8E-06	4.5E-09	7.7E-08	1.3E-06	3.5E-09	8.1E-08	1.3E-06	4.2E-09	7.9E-08	1.5E-06
Adult: Total inorganic dose	4.6E-07	4.7E-06	7.9E-08	4.7E-07	5.9E-06	6.6E-08	4.9E-07	8.7E-06	7.7E-08	4.6E-07	4.4E-06
Child: fish consumption [methyl]	1.8E-05	2.6E-04	1.1E-06	1.6E-05	2.6E-04	1.1E-06	1.7E-05	2.5E-04	1.0E-06	1.6E-05	2.4E-04
Child: inhalation [elemental]	4.4E-09	2.5E-08	1.7E-09	8.6E-09	5.3E-08	7.4E-10	3.7E-09	2.3E-08	1.3E-09	7.8E-09	3.9E-08
Child: sediment ingestion [inorganic]	2.8E-08	2.3E-06	2.3E-10	2.3E-08	2.1E-06	1.9E-10	2.7E-08	2.5E-06	1.9E-10	1.4E-08	1.4E-06
Child: skin contact (sediment) [inorganic]	2.8E-07	1.4E-05	2.6E-09	2.7E-07	2.0E-05	2.7E-09	2.7E-07	3.4E-05	1.4E-09	1.3E-07	1.4E-05
Child: soil ingestion [inorganic]	2.1E-08	6.3E-07	8.1E-10	1.7E-08	7.8E-07	4.5E-10	2.0E-08	8.5E-07	6.2E-10	1.8E-08	6.6E-07
Child: skin contact (soil) [inorganic]	2.2E-07	6.5E-06	5.4E-09	2.4E-07	1.1E-05	7.1E-09	2.2E-07	6.2E-06	4.5E-09	2.0E-07	6.6E-06
Child: water ingestion [inorganic]	4.7E-08	2.9E-07	3.0E-09	9.8E-08	5.2E-07	2.4E-09	4.5E-08	3.0E-07	3.8E-09	8.7E-08	5.6E-07
Child: skin contact (water) [inorganic]	3.7E-08	3.2E-07	5.3E-09	7.6E-08	6.2E-07	2.3E-09	3.7E-08	3.0E-07	4.4E-09	6.8E-08	6.5E-07
Child: vegetables (from air) [inorganic]	3.6E-08	9.5E-07	3.7E-09	7.8E-08	1.3E-06	1.4E-09	3.4E-08	8.3E-07	3.3E-09	6.6E-08	1.4E-06
Child: vegetables (from soil) [inorganic]	2.4E-07	6.0E-06	7.8E-09	2.5E-07	7.0E-06	1.2E-08	2.5E-07	7.9E-06	8.5E-09	2.5E-07	4.9E-06
Child: Total inorganic dose	2.2E-06	2.7E-05	4.2E-07	2.5E-06	3.2E-05	2.9E-07	2.1E-06	4.5E-05	3.5E-07	2.0E-06	3.1E-05

a Underlined doses exceed the USEPA Reference Dose

Table W-2: Estimated Annual Mercury Doses, Scarboro Community Resident Population ($mg\ kg^{-1}\ d^{-1}$) [a]

	1980			1981			1982			1983		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Adult: fish consumption [methyl]	9.8E-07	1.4E-05	<u>2.3E-04</u>	8.5E-07	1.3E-05	<u>2.1E-04</u>	7.8E-07	1.2E-05	<u>2.1E-04</u>	7.3E-07	1.1E-05	<u>1.7E-04</u>
Adult: inhalation [elemental]	9.6E-10	4.5E-09	2.4E-08	6.2E-10	3.1E-09	1.5E-08	1.2E-09	5.7E-09	3.7E-08	9.2E-10	5.1E-09	2.6E-08
Adult: sediment ingestion [inorganic]	8.3E-12	7.4E-10	6.8E-08	8.2E-12	7.0E-10	5.2E-08	7.4E-12	7.1E-10	5.8E-08	3.0E-12	4.5E-10	4.6E-08
Adult: skin contact (sediment) [inorganic]	3.8E-10	2.8E-08	2.1E-06	2.9E-10	2.9E-08	2.1E-06	3.9E-10	2.7E-08	2.5E-06	7.7E-11	1.8E-08	2.3E-06
Adult: soil ingestion [inorganic]	2.7E-11	1.2E-09	3.9E-08	2.9E-11	1.2E-09	4.6E-08	2.7E-11	1.2E-09	3.8E-08	2.9E-11	1.2E-09	6.0E-08
Adult: skin contact (soil) [inorganic]	1.0E-09	4.2E-08	2.0E-06	1.2E-09	4.6E-08	2.0E-06	1.5E-09	4.4E-08	1.5E-06	1.3E-09	4.2E-08	1.6E-06
Adult: water ingestion [inorganic]	2.6E-10	6.1E-09	3.5E-08	2.3E-10	6.0E-09	3.4E-08	2.5E-10	9.0E-09	4.8E-08	2.2E-10	6.7E-09	3.6E-08
Adult: skin contact (water) [inorganic]	1.3E-09	1.5E-08	1.1E-07	1.5E-09	1.4E-08	1.0E-07	1.8E-09	2.3E-08	1.4E-07	1.3E-09	1.5E-08	9.4E-08
Adult: vegetables (from air) [inorganic]	1.8E-09	4.9E-08	6.8E-07	1.5E-09	2.7E-08	3.7E-07	3.1E-09	5.0E-08	8.2E-07	2.7E-09	4.3E-08	6.8E-07
Adult: vegetables (from soil) [inorganic]	4.6E-09	7.2E-08	1.8E-06	3.0E-09	8.5E-08	1.4E-06	3.0E-09	7.9E-08	2.0E-06	3.3E-09	7.4E-08	1.6E-06
Adult: Total inorganic dose	1.0E-07	4.9E-07	4.9E-06	7.9E-08	4.4E-07	4.9E-06	9.4E-08	5.3E-07	5.1E-06	8.6E-08	4.7E-07	5.5E-06
Child: fish consumption [methyl]	1.1E-06	1.6E-05	<u>2.3E-04</u>	9.3E-07	1.6E-05	<u>2.4E-04</u>	9.4E-07	1.5E-05	<u>2.5E-04</u>	8.7E-07	1.3E-05	<u>2.0E-04</u>
Child: inhalation [elemental]	1.9E-09	9.5E-09	5.5E-08	1.3E-09	5.9E-09	3.4E-08	2.1E-09	1.1E-08	6.2E-08	1.6E-09	1.0E-08	5.7E-08
Child: sediment ingestion [inorganic]	1.4E-10	1.3E-08	1.1E-06	1.3E-10	1.2E-08	1.1E-06	1.4E-10	1.4E-08	1.1E-06	7.3E-11	8.1E-09	6.1E-07
Child: skin contact (sediment) [inorganic]	1.2E-09	1.5E-07	1.3E-05	1.4E-09	1.5E-07	1.2E-05	2.2E-09	1.4E-07	1.5E-05	8.1E-10	9.0E-08	8.1E-06
Child: soil ingestion [inorganic]	3.5E-10	2.3E-08	7.7E-07	6.0E-10	2.0E-08	8.3E-07	5.1E-10	2.2E-08	5.7E-07	6.2E-10	1.9E-08	8.4E-07
Child: skin contact (soil) [inorganic]	6.1E-09	2.1E-07	7.3E-06	6.3E-09	2.0E-07	6.3E-06	3.9E-09	2.0E-07	1.1E-05	5.6E-09	1.9E-07	8.5E-06
Child: water ingestion [inorganic]	3.0E-09	9.4E-08	6.6E-07	2.4E-09	9.7E-08	6.4E-07	5.5E-09	1.4E-07	7.6E-07	4.4E-09	9.6E-08	5.4E-07
Child: skin contact (water) [inorganic]	4.4E-09	7.4E-08	6.5E-07	4.9E-09	7.5E-08	5.8E-07	8.8E-09	1.1E-07	1.0E-06	4.3E-09	7.5E-08	7.1E-07
Child: vegetables (from air) [inorganic]	3.5E-09	8.5E-08	1.6E-06	2.1E-09	4.8E-08	9.3E-07	5.4E-09	1.1E-07	1.2E-06	4.2E-09	8.4E-08	1.3E-06
Child: vegetables (from soil) [inorganic]	8.4E-09	2.6E-07	9.2E-06	8.1E-09	2.2E-07	7.3E-06	6.4E-09	2.6E-07	6.2E-06	9.6E-09	2.3E-07	8.8E-06
Child: Total inorganic dose	3.4E-07	2.3E-06	2.6E-05	3.4E-07	2.0E-06	2.1E-05	4.0E-07	2.4E-06	3.1E-05	3.6E-07	2.0E-06	2.7E-05

a Underlined doses exceed the USEPA Reference Dose

Table W-2: Estimated Annual Mercury Doses, Scarboro Community Resident Population (mg kg^{-1} d^{-1}) [a]

	1984			1985			1986			1987	
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**
Adult: fish consumption [methyl]	6.2E-07	9.9E-06	1.5E-04	5.2E-07	7.7E-06	1.2E-04	4.7E-07	7.9E-06	1.2E-04	5.0E-07	7.5E-06
Adult: inhalation [elemental]	8.5E-10	4.1E-09	2.1E-08	1.0E-09	4.8E-09	2.5E-08	1.1E-09	5.9E-09	3.2E-08	1.3E-09	6.5E-09
Adult: sediment ingestion [inorganic]	4.1E-12	4.4E-10	3.7E-08	3.5E-12	3.8E-10	5.9E-08	3.5E-12	4.3E-10	5.6E-08	4.7E-12	3.9E-10
Adult: skin contact (sediment) [inorganic]	1.7E-10	1.5E-08	1.3E-06	1.7E-10	1.6E-08	1.6E-06	1.9E-10	1.5E-08	2.3E-06	1.6E-10	1.7E-08
Adult: soil ingestion [inorganic]	2.8E-11	1.2E-09	4.1E-08	3.1E-11	1.2E-09	5.0E-08	2.5E-11	1.1E-09	6.6E-08	3.2E-11	1.1E-09
Adult: skin contact (soil) [inorganic]	1.2E-09	4.9E-08	1.8E-06	1.7E-09	4.1E-08	1.5E-06	1.7E-09	3.8E-08	1.8E-06	1.2E-09	3.9E-08
Adult: water ingestion [inorganic]	1.8E-10	5.0E-09	2.5E-08	2.4E-10	5.3E-09	3.2E-08	2.3E-10	6.8E-09	3.8E-08	3.0E-10	8.4E-09
Adult: skin contact (water) [inorganic]	1.2E-09	1.1E-08	7.8E-08	1.3E-09	1.4E-08	1.0E-07	1.6E-09	1.6E-08	1.2E-07	1.9E-09	2.0E-08
Adult: vegetables (from air) [inorganic]	2.5E-09	3.6E-08	5.5E-07	2.8E-09	4.5E-08	5.9E-07	3.6E-09	4.4E-08	9.5E-07	3.9E-09	6.2E-08
Adult: vegetables (from soil) [inorganic]	3.0E-09	8.3E-08	1.7E-06	2.9E-09	8.0E-08	2.8E-06	2.7E-09	8.3E-08	1.7E-06	3.1E-09	7.2E-08
Adult: Total inorganic dose	7.7E-08	4.2E-07	5.6E-06	9.6E-08	4.3E-07	5.0E-06	9.1E-08	4.6E-07	5.2E-06	9.6E-08	5.0E-07
Child: fish consumption [methyl]	7.3E-07	1.2E-05	1.7E-04	5.8E-07	8.9E-06	1.3E-04	5.9E-07	8.7E-06	1.3E-04	5.6E-07	8.4E-06
Child: inhalation [elemental]	1.6E-09	7.7E-09	4.7E-08	1.8E-09	9.4E-09	5.6E-08	2.0E-09	1.1E-08	6.7E-08	2.7E-09	1.3E-08
Child: sediment ingestion [inorganic]	8.3E-11	7.6E-09	6.4E-07	4.5E-11	7.4E-09	9.7E-07	6.7E-11	6.5E-09	7.7E-07	7.4E-11	8.6E-09
Child: skin contact (sediment) [inorganic]	7.6E-10	7.6E-08	8.5E-06	6.1E-10	7.0E-08	9.2E-06	8.2E-10	8.1E-08	8.6E-06	5.2E-10	8.0E-08
Child: soil ingestion [inorganic]	5.3E-10	2.1E-08	6.2E-07	5.3E-10	1.9E-08	6.1E-07	4.5E-10	1.8E-08	1.2E-06	4.4E-10	2.0E-08
Child: skin contact (soil) [inorganic]	7.1E-09	1.9E-07	1.0E-05	6.5E-09	2.1E-07	9.4E-06	7.6E-09	1.9E-07	8.8E-06	7.2E-09	1.9E-07
Child: water ingestion [inorganic]	2.4E-09	7.8E-08	5.7E-07	2.3E-09	9.2E-08	5.2E-07	3.8E-09	1.1E-07	6.5E-07	3.7E-09	1.4E-07
Child: skin contact (water) [inorganic]	4.5E-09	6.2E-08	5.0E-07	5.3E-09	6.9E-08	6.1E-07	6.8E-09	8.4E-08	6.9E-07	6.6E-09	1.1E-07
Child: vegetables (from air) [inorganic]	3.2E-09	7.8E-08	1.2E-06	4.0E-09	8.9E-08	1.3E-06	4.6E-09	9.6E-08	2.7E-06	5.3E-09	1.1E-07
Child: vegetables (from soil) [inorganic]	8.4E-09	2.3E-07	9.4E-06	6.3E-09	2.7E-07	1.0E-05	8.3E-09	2.5E-07	8.4E-06	8.7E-09	2.5E-07
Child: Total inorganic dose	3.3E-07	1.7E-06	1.8E-05	4.0E-07	1.9E-06	2.4E-05	3.5E-07	2.3E-06	2.1E-05	3.8E-07	2.2E-06

a Underlined doses exceed the USEPA Reference Dose

Table W-2: Estimated Annual Mercury Doses, Scarboro Community Resident Population ($mg\ kg^{-1}\ d^{-1}$) [a]

		1988			1989			1990		
	97.5%-ile	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Adult: fish consumption [methyl]	1.2E-04	4.9E-07	7.7E-06	1.1E-04	4.8E-07	7.7E-06	1.2E-04	4.8E-07	7.8E-06	1.3E-04
Adult: inhalation [elemental]	2.9E-08	7.9E-10	3.5E-09	2.0E-08	7.1E-10	3.4E-09	1.8E-08	6.4E-10	3.2E-09	2.0E-08
Adult: sediment ingestion [inorganic]	4.7E-08	3.5E-12	4.3E-10	4.7E-08	3.8E-12	4.5E-10	3.5E-08	3.2E-12	4.6E-10	3.0E-08
Adult: skin contact (sediment) [inorganic]	1.8E-06	2.1E-10	1.7E-08	1.1E-06	1.3E-10	1.6E-08	2.2E-06	1.7E-10	1.7E-08	1.1E-06
Adult: soil ingestion [inorganic]	6.9E-08	3.0E-11	1.1E-09	5.6E-08	2.9E-11	1.1E-09	4.9E-08	2.6E-11	1.2E-09	4.5E-08
Adult: skin contact (soil) [inorganic]	1.8E-06	1.4E-09	4.4E-08	1.2E-06	1.0E-09	4.1E-08	1.4E-06	1.1E-09	4.2E-08	1.5E-06
Adult: water ingestion [inorganic]	4.8E-08	1.9E-10	5.7E-09	3.3E-08	1.8E-10	4.7E-09	3.0E-08	2.5E-10	4.9E-09	2.9E-08
Adult: skin contact (water) [inorganic]	1.5E-07	1.2E-09	1.3E-08	9.9E-08	1.2E-09	1.1E-08	7.7E-08	1.2E-09	1.3E-08	8.9E-08
Adult: vegetables (from air) [inorganic]	8.9E-07	1.6E-09	3.0E-08	6.1E-07	2.1E-09	3.5E-08	4.4E-07	1.5E-09	2.8E-08	4.8E-07
Adult: vegetables (from soil) [inorganic]	1.7E-06	4.0E-09	7.9E-08	1.7E-06	3.3E-09	7.8E-08	1.5E-06	3.3E-09	7.4E-08	1.8E-06
Adult: Total inorganic dose	4.0E-06	6.6E-08	4.3E-07	4.0E-06	6.7E-08	3.9E-07	4.4E-06	6.5E-08	4.2E-07	3.8E-06
Child: fish consumption [methyl]	1.2E-04	5.7E-07	8.5E-06	1.3E-04	5.8E-07	8.7E-06	1.3E-04	5.9E-07	8.7E-06	1.4E-04
Child: inhalation [elemental]	6.4E-08	1.4E-09	6.4E-09	4.1E-08	1.2E-09	6.9E-09	3.6E-08	1.3E-09	6.2E-09	3.9E-08
Child: sediment ingestion [inorganic]	8.5E-07	6.3E-11	6.9E-09	9.7E-07	8.8E-11	7.0E-09	1.1E-06	7.3E-11	8.3E-09	5.4E-07
Child: skin contact (sediment) [inorganic]	9.0E-06	7.0E-10	8.6E-08	7.5E-06	6.1E-10	8.0E-08	9.9E-06	5.6E-10	9.5E-08	5.2E-06
Child: soil ingestion [inorganic]	8.7E-07	5.2E-10	1.9E-08	1.2E-06	4.2E-10	1.8E-08	8.5E-07	4.6E-10	1.9E-08	6.5E-07
Child: skin contact (soil) [inorganic]	7.3E-06	6.3E-09	2.2E-07	7.8E-06	4.9E-09	1.9E-07	7.3E-06	5.7E-09	2.2E-07	6.2E-06
Child: water ingestion [inorganic]	9.3E-07	2.7E-09	9.3E-08	5.5E-07	4.4E-09	7.1E-08	4.8E-07	3.0E-09	8.1E-08	4.8E-07
Child: skin contact (water) [inorganic]	9.8E-07	4.5E-09	6.9E-08	6.5E-07	4.7E-09	5.8E-08	5.6E-07	6.2E-09	6.3E-08	5.1E-07
Child: vegetables (from air) [inorganic]	2.5E-06	3.2E-09	5.8E-08	1.2E-06	2.9E-09	6.6E-08	1.3E-06	1.9E-09	6.0E-08	9.5E-07
Child: vegetables (from soil) [inorganic]	6.3E-06	9.4E-09	2.5E-07	6.7E-06	6.0E-09	2.3E-07	9.4E-06	8.7E-09	2.3E-07	6.9E-06
Child: Total inorganic dose	2.1E-05	3.0E-07	1.9E-06	2.0E-05	3.2E-07	1.7E-06	2.5E-05	3.3E-07	1.9E-06	2.0E-05

a Underlined doses exceed the USEPA Reference Dose

Table W-3: Estimated Annual Mercury Doses, Robertsville School Children (mg kg^{-1} d^{-1}) [a]

	1950			1951			1952			1953		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Child: inhalation [elemental]	7.1E-10	3.9E-09	2.2E-08	1.4E-09	7.7E-09	4.5E-08	7.2E-09	3.9E-08	2.2E-07	3.4E-08	1.8E-07	1.0E-06
Child: sediment ingestion [inorganic]	7.1E-10	2.8E-08	9.1E-07	7.0E-10	2.7E-08	8.6E-07	7.8E-10	2.7E-08	8.7E-07	6.5E-10	2.8E-08	9.1E-07
Child: skin contact (sediment) [inorganic]	2.1E-08	7.0E-07	2.2E-05	2.1E-08	7.2E-07	2.0E-05	2.3E-08	6.9E-07	2.1E-05	2.2E-08	7.1E-07	2.0E-05
Child: skin contact (soil) [inorganic]	2.2E-08	2.1E-06	2.0E-04	2.1E-08	2.0E-06	2.0E-04	2.1E-08	2.1E-06	1.9E-04	2.4E-08	2.0E-06	2.1E-04
Child: skin contact (water) [inorganic]	4.2E-09	6.9E-08	7.2E-07	9.1E-09	1.4E-07	1.4E-06	4.9E-08	7.6E-07	7.7E-06	2.2E-07	3.3E-06	3.2E-05
Child: soil ingestion [inorganic]	7.8E-10	7.8E-08	7.7E-06	7.8E-10	8.2E-08	7.7E-06	8.2E-10	7.8E-08	8.3E-06	7.4E-10	8.4E-08	7.2E-06
Child: water ingestion [inorganic]	6.7E-10	2.6E-08	2.5E-07	1.6E-09	5.3E-08	4.9E-07	7.9E-09	2.9E-07	2.7E-06	3.5E-08	1.2E-06	1.1E-05
Child: Total inorganic dose ('typical' student)	3.0E-08	2.4E-06	2.1E-04	3.0E-08	2.3E-06	2.0E-04	3.0E-08	2.4E-06	1.9E-04	3.4E-08	2.3E-06	2.1E-04
Child: Total inorganic dose (student-recreator)	3.0E-07	5.3E-06	2.1E-04	3.8E-07	5.2E-06	2.1E-04	7.4E-07	7.3E-06	2.1E-04	1.5E-06	1.4E-05	2.3E-04

	1954			1955			1956			1957		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Child: inhalation [elemental]	1.9E-08	1.1E-07	5.9E-07	9.7E-08	5.4E-07	3.0E-06	8.2E-08	4.4E-07	2.5E-06	2.0E-07	1.1E-06	6.2E-06
Child: sediment ingestion [inorganic]	7.6E-10	2.7E-08	8.8E-07	1.3E-09	4.4E-08	1.4E-06	1.4E-09	4.3E-08	1.3E-06	1.3E-09	4.3E-08	1.4E-06
Child: skin contact (sediment) [inorganic]	2.3E-08	6.9E-07	2.3E-05	3.6E-08	1.1E-06	3.1E-05	3.7E-08	1.1E-06	3.3E-05	3.7E-08	1.1E-06	3.0E-05
Child: skin contact (soil) [inorganic]	1.9E-08	2.1E-06	1.9E-04	3.1E-08	3.3E-06	3.1E-04	3.7E-08	3.3E-06	2.9E-04	3.3E-08	3.4E-06	2.7E-04
Child: skin contact (water) [inorganic]	1.3E-07	1.9E-06	1.9E-05	6.0E-07	9.4E-06	9.6E-05	4.7E-07	7.1E-06	7.4E-05	1.5E-06	2.0E-05	1.7E-04
Child: soil ingestion [inorganic]	7.9E-10	8.0E-08	9.0E-06	1.3E-09	1.2E-07	1.3E-05	1.4E-09	1.3E-07	1.1E-05	1.2E-09	1.3E-07	1.4E-05
Child: water ingestion [inorganic]	2.1E-08	7.1E-07	6.8E-06	1.2E-07	3.5E-06	3.4E-05	8.6E-08	2.8E-06	2.5E-05	2.3E-07	7.7E-06	6.4E-05
Child: Total inorganic dose ('typical' student)	2.8E-08	2.3E-06	1.9E-04	4.5E-08	3.8E-06	3.2E-04	5.0E-08	3.8E-06	3.0E-04	4.6E-08	4.0E-06	2.8E-04
Child: Total inorganic dose (student-recreator)	1.1E-06	1.0E-05	2.0E-04	3.4E-06	3.1E-05	3.8E-04	2.9E-06	2.6E-05	3.4E-04	5.6E-06	5.1E-05	4.1E-04

	1958			1959			1960			1961		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Child: inhalation [elemental]	1.8E-07	9.7E-07	5.5E-06	5.3E-08	2.9E-07	1.6E-06	2.0E-08	1.1E-07	6.1E-07	1.9E-08	9.8E-08	5.6E-07
Child: sediment ingestion [inorganic]	1.3E-09	4.4E-08	1.3E-06	4.4E-10	1.7E-08	5.6E-07	4.2E-10	1.7E-08	6.1E-07	4.5E-10	1.6E-08	6.5E-07
Child: skin contact (sediment) [inorganic]	3.4E-08	1.1E-06	3.0E-05	1.2E-08	4.4E-07	1.5E-05	1.3E-08	4.3E-07	1.5E-05	1.2E-08	4.3E-07	1.4E-05
Child: skin contact (soil) [inorganic]	3.9E-08	3.2E-06	3.3E-04	1.2E-08	1.3E-06	1.3E-04	1.2E-08	1.3E-06	1.2E-04	1.1E-08	1.3E-06	1.1E-04
Child: skin contact (water) [inorganic]	1.7E-06	2.3E-05	2.1E-04	4.8E-07	6.1E-06	6.0E-05	1.5E-07	2.2E-06	1.9E-05	1.3E-07	1.8E-06	1.7E-05
Child: soil ingestion [inorganic]	1.2E-09	1.3E-07	1.3E-05	4.8E-10	5.0E-08	4.8E-06	4.3E-10	5.1E-08	4.9E-06	4.6E-10	4.9E-08	5.1E-06
Child: water ingestion [inorganic]	2.6E-07	8.8E-06	7.2E-05	7.1E-08	2.5E-06	2.0E-05	2.6E-08	8.3E-07	7.0E-06	1.9E-08	7.0E-07	5.7E-06
Child: Total inorganic dose ('typical' student)	5.1E-08	3.7E-06	3.3E-04	1.7E-08	1.5E-06	1.3E-04	1.7E-08	1.5E-06	1.2E-04	1.4E-08	1.5E-06	1.1E-04
Child: Total inorganic dose (student-recreator)	6.2E-06	5.7E-05	4.8E-04	2.0E-06	1.7E-05	1.6E-04	1.0E-06	8.7E-06	1.4E-04	8.9E-07	8.1E-06	1.2E-04

a Underlined doses exceed the USEPA Reference Dose (RfD)

Table W-3: Estimated Annual Mercury Doses, Robertsville School Children (mg kg^{-1} d^{-1}) [a]

	1962			1963			1964			1965		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Child: inhalation [elemental]	1.3E-08	6.8E-08	3.7E-07	8.5E-09	4.6E-08	2.6E-07	3.2E-09	1.7E-08	9.6E-08	6.6E-09	3.6E-08	2.1E-07
Child: sediment ingestion [inorganic]	4.4E-10	1.7E-08	5.9E-07	4.6E-10	1.7E-08	6.1E-07	4.5E-10	1.6E-08	6.1E-07	4.2E-10	1.7E-08	5.2E-07
Child: skin contact (sediment) [inorganic]	1.3E-08	4.2E-07	1.5E-05	1.2E-08	4.4E-07	1.3E-05	1.1E-08	4.3E-07	1.4E-05	1.2E-08	4.4E-07	1.4E-05
Child: skin contact (soil) [inorganic]	1.4E-08	1.3E-06	1.2E-04	1.2E-08	1.3E-06	1.2E-04	1.3E-08	1.2E-06	1.4E-04	1.5E-08	1.3E-06	1.3E-04
Child: skin contact (water) [inorganic]	6.9E-08	1.1E-06	1.0E-05	5.9E-08	8.5E-07	7.6E-06	2.4E-08	3.9E-07	3.8E-06	5.2E-08	8.7E-07	7.7E-06
Child: soil ingestion [inorganic]	4.4E-10	4.8E-08	5.9E-06	4.9E-10	4.8E-08	5.3E-06	4.8E-10	4.9E-08	5.1E-06	5.1E-10	4.8E-08	5.6E-06
Child: water ingestion [inorganic]	1.1E-08	4.1E-07	3.9E-06	9.6E-09	3.2E-07	2.8E-06	4.3E-09	1.5E-07	1.3E-06	8.7E-09	3.3E-07	2.8E-06
Child: Total inorganic dose ('typical' student)	1.8E-08	1.4E-06	1.3E-04	1.7E-08	1.5E-06	1.3E-04	1.8E-08	1.4E-06	1.5E-04	1.9E-08	1.5E-06	1.4E-04
Child: Total inorganic dose (student-recreator)	6.9E-07	6.4E-06	1.4E-04	6.0E-07	5.5E-06	1.4E-04	4.3E-07	4.3E-06	1.5E-04	5.6E-07	5.6E-06	1.4E-04

	1966			1967			1968			1969		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Child: inhalation [elemental]	3.3E-09	2.0E-08	1.2E-07	2.6E-09	1.2E-08	6.8E-08	3.6E-10	2.1E-09	1.1E-08	4.3E-10	2.7E-09	1.6E-08
Child: sediment ingestion [inorganic]	5.5E-10	1.6E-08	4.4E-07	2.8E-10	1.2E-08	4.9E-07	4.0E-10	1.2E-08	4.2E-07	4.4E-10	1.2E-08	3.5E-07
Child: skin contact (sediment) [inorganic]	1.3E-08	4.5E-07	1.2E-05	1.1E-08	3.4E-07	7.4E-06	8.8E-09	3.3E-07	8.3E-06	8.4E-09	3.1E-07	9.4E-06
Child: skin contact (soil) [inorganic]	2.0E-08	9.2E-07	1.5E-04	1.3E-08	8.9E-07	1.4E-04	1.1E-08	8.7E-07	8.1E-05	8.8E-09	9.7E-07	9.6E-05
Child: skin contact (water) [inorganic]	2.8E-08	4.1E-07	4.7E-06	2.1E-08	2.4E-07	3.0E-06	3.3E-09	5.3E-08	4.6E-07	4.3E-09	5.7E-08	5.0E-07
Child: soil ingestion [inorganic]	4.0E-10	5.2E-08	3.4E-06	5.9E-10	3.8E-08	3.0E-06	3.6E-10	3.8E-08	3.9E-06	4.0E-10	4.2E-08	3.0E-06
Child: water ingestion [inorganic]	4.2E-09	1.4E-07	1.3E-06	2.1E-09	8.8E-08	8.5E-07	5.8E-10	1.8E-08	1.3E-07	6.4E-10	2.0E-08	1.8E-07
Child: Total inorganic dose ('typical' student)	1.3E-08	1.4E-06	1.3E-04	1.4E-08	1.0E-06	9.2E-05	1.1E-08	1.0E-06	1.3E-04	1.4E-08	1.0E-06	7.0E-05
Child: Total inorganic dose (student-recreator)	4.5E-07	4.3E-06	1.5E-04	2.9E-07	2.8E-06	1.5E-04	1.8E-07	2.4E-06	8.5E-05	1.5E-07	2.3E-06	9.8E-05

	1970			1971			1972			1973		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Child: inhalation [elemental]	2.1E-09	1.0E-08	5.6E-08	4.5E-10	2.6E-09	1.4E-08	5.1E-11	2.8E-10	1.5E-09	4.5E-09	2.5E-08	1.3E-07
Child: sediment ingestion [inorganic]	4.7E-10	1.2E-08	4.2E-07	1.1E-10	4.5E-09	1.4E-07	1.2E-10	4.0E-09	1.7E-07	9.7E-11	4.7E-09	1.9E-07
Child: skin contact (sediment) [inorganic]	1.3E-08	3.1E-07	1.2E-05	2.3E-09	1.2E-07	3.1E-06	2.5E-09	1.2E-07	4.7E-06	3.1E-09	9.7E-08	4.3E-06
Child: skin contact (soil) [inorganic]	6.7E-09	9.5E-07	6.4E-05	2.5E-09	2.8E-07	5.9E-05	2.2E-09	3.4E-07	3.7E-05	3.6E-09	3.1E-07	2.8E-05
Child: skin contact (water) [inorganic]	1.9E-08	2.2E-07	2.0E-06	4.0E-09	5.7E-08	5.2E-07	4.0E-10	8.6E-09	7.7E-08	3.3E-08	5.5E-07	4.2E-06
Child: soil ingestion [inorganic]	3.1E-10	3.9E-08	5.0E-06	1.1E-10	1.3E-08	1.4E-06	6.9E-11	1.3E-08	1.7E-06	8.5E-11	1.4E-08	1.0E-06
Child: water ingestion [inorganic]	2.0E-09	8.7E-08	6.7E-07	5.4E-10	1.9E-08	1.8E-07	8.3E-11	2.9E-09	2.3E-08	6.3E-09	1.8E-07	1.3E-06
Child: Total inorganic dose ('typical' student)	1.1E-08	1.2E-06	8.1E-05	4.5E-09	4.3E-07	5.0E-05	2.8E-09	3.3E-07	4.4E-05	4.7E-09	3.8E-07	4.2E-05
Child: Total inorganic dose (student-recreator)	2.8E-07	2.8E-06	8.6E-05	7.1E-08	9.0E-07	5.9E-05	4.0E-08	9.1E-07	4.4E-05	2.5E-07	2.1E-06	3.4E-05

a Underlined doses exceed the USEPA Reference Dose (RfD)

Table W-3: Estimated Annual Mercury Doses, Robertsville School Children (mg kg^{-1} d^{-1}) [a]

	1974			1975			1976			1977		
	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile
Child: inhalation [elemental]	8.3E-10	4.9E-09	3.0E-08	6.6E-11	3.0E-10	1.8E-09	6.6E-11	3.8E-10	2.0E-09	1.3E-10	7.4E-10	4.1E-09
Child: sediment ingestion [inorganic]	1.2E-10	4.0E-09	1.7E-07	6.2E-11	3.2E-09	1.3E-07	4.6E-11	2.7E-09	1.4E-07	6.4E-11	3.3E-09	8.4E-08
Child: skin contact (sediment) [inorganic]	2.7E-09	1.1E-07	3.3E-06	2.6E-09	8.1E-08	2.4E-06	1.9E-09	8.8E-08	3.0E-06	2.5E-09	7.7E-08	2.1E-06
Child: skin contact (soil) [inorganic]	3.2E-09	3.7E-07	4.7E-05	2.2E-09	2.4E-07	2.2E-05	1.8E-09	2.4E-07	4.5E-05	2.4E-09	2.4E-07	2.5E-05
Child: skin contact (water) [inorganic]	7.4E-09	1.2E-07	1.0E-06	4.1E-10	7.6E-09	6.8E-08	5.9E-10	8.6E-09	7.7E-08	1.0E-09	1.6E-08	1.5E-07
Child: soil ingestion [inorganic]	1.3E-10	1.2E-08	1.7E-06	5.9E-11	9.7E-09	1.1E-06	5.3E-11	9.7E-09	1.3E-06	6.4E-11	8.3E-09	1.5E-06
Child: water ingestion [inorganic]	1.3E-09	3.9E-08	3.6E-07	9.1E-11	2.7E-09	2.6E-08	9.6E-11	3.3E-09	2.8E-08	1.2E-10	6.2E-09	5.0E-08
Child: Total inorganic dose ('typical' student)	3.3E-09	4.6E-07	4.0E-05	1.5E-09	2.7E-07	2.4E-05	1.8E-09	2.5E-07	3.1E-05	1.5E-09	2.8E-07	4.4E-05
Child: Total inorganic dose (student-recreator)	1.1E-07	1.1E-06	5.0E-05	3.9E-08	5.9E-07	2.3E-05	3.4E-08	5.8E-07	4.5E-05	3.8E-08	6.5E-07	2.6E-05

	1978			1979			1980			1981		
	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile
Child: inhalation [elemental]	6.8E-11	3.1E-10	1.8E-09	1.2E-10	5.9E-10	3.9E-09	1.5E-10	7.7E-10	4.3E-09	8.5E-11	5.1E-10	2.9E-09
Child: sediment ingestion [inorganic]	6.7E-11	2.8E-09	1.7E-07	3.8E-11	1.5E-09	7.7E-08	3.9E-11	1.6E-09	6.7E-08	4.2E-11	1.6E-09	6.6E-08
Child: skin contact (sediment) [inorganic]	1.7E-09	7.7E-08	3.6E-06	8.1E-10	4.5E-08	1.4E-06	1.1E-09	3.9E-08	1.8E-06	9.1E-10	4.0E-08	2.1E-06
Child: skin contact (soil) [inorganic]	2.6E-09	2.3E-07	1.9E-05	1.3E-09	1.1E-07	2.0E-05	1.2E-09	1.2E-07	1.7E-05	1.5E-09	1.1E-07	2.2E-05
Child: skin contact (water) [inorganic]	6.6E-10	8.2E-09	6.9E-08	1.1E-09	1.5E-08	1.5E-07	1.7E-09	2.0E-08	1.8E-07	1.3E-09	1.8E-08	1.7E-07
Child: soil ingestion [inorganic]	7.3E-11	8.2E-09	8.2E-07	4.8E-11	5.2E-09	4.7E-07	4.8E-11	4.7E-09	5.9E-07	4.2E-11	5.0E-09	5.2E-07
Child: water ingestion [inorganic]	9.9E-11	2.9E-09	2.4E-08	1.3E-10	5.7E-09	4.6E-08	2.2E-10	7.0E-09	6.8E-08	1.3E-10	6.8E-09	6.1E-08
Child: Total inorganic dose ('typical' student)	3.0E-09	2.8E-07	2.4E-05	1.8E-09	1.3E-07	1.4E-05	1.1E-09	1.4E-07	1.5E-05	1.4E-09	1.4E-07	2.0E-05
Child: Total inorganic dose (student-recreator)	4.4E-08	6.1E-07	2.0E-05	2.7E-08	3.5E-07	2.6E-05	3.0E-08	3.8E-07	2.0E-05	2.9E-08	3.9E-07	2.4E-05

	1982			1983			1984			1985		
	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile
Child: inhalation [elemental]	1.7E-10	9.5E-10	5.5E-09	1.4E-10	8.6E-10	4.5E-09	1.3E-10	6.7E-10	4.1E-09	1.5E-10	7.3E-10	5.3E-09
Child: sediment ingestion [inorganic]	2.5E-11	1.8E-09	8.0E-08	1.8E-11	1.0E-09	5.6E-08	2.0E-11	9.0E-10	5.3E-08	1.8E-11	9.6E-10	5.7E-08
Child: skin contact (sediment) [inorganic]	1.2E-09	4.5E-08	1.6E-06	3.8E-10	2.4E-08	1.7E-06	4.1E-10	2.4E-08	1.3E-06	4.4E-10	2.4E-08	1.2E-06
Child: skin contact (soil) [inorganic]	1.1E-09	1.3E-07	2.0E-05	4.6E-10	7.3E-08	1.2E-05	6.8E-10	7.6E-08	8.2E-06	4.4E-10	7.1E-08	1.8E-05
Child: skin contact (water) [inorganic]	1.5E-09	2.6E-08	2.3E-07	1.2E-09	1.9E-08	1.7E-07	9.1E-10	1.5E-08	1.2E-07	1.3E-09	1.6E-08	1.6E-07
Child: soil ingestion [inorganic]	3.2E-11	5.3E-09	5.6E-07	2.5E-11	2.5E-09	4.4E-07	1.8E-11	2.9E-09	4.3E-07	2.0E-11	2.8E-09	3.5E-07
Child: water ingestion [inorganic]	2.6E-10	9.4E-09	9.7E-08	2.0E-10	6.6E-09	5.2E-08	1.4E-10	5.5E-09	3.9E-08	1.7E-10	6.4E-09	4.7E-08
Child: Total inorganic dose ('typical' student)	1.3E-09	1.5E-07	1.4E-05	5.3E-10	9.2E-08	1.5E-05	7.4E-10	7.4E-08	1.0E-05	7.5E-10	8.8E-08	1.1E-05
Child: Total inorganic dose (student-recreator)	3.2E-08	3.9E-07	2.0E-05	1.9E-08	2.7E-07	1.4E-05	1.8E-08	2.3E-07	9.9E-06	1.7E-08	2.6E-07	1.9E-05

a Underlined doses exceed the USEPA Reference Dose (RfD)

Table W-3: Estimated Annual Mercury Doses, Robertsville School Children (mg kg^{-1} d^{-1}) [a]

	1986			1987		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Child: inhalation [elemental]	1.8E-10	9.6E-10	5.2E-09	2.1E-10	1.1E-09	5.6E-09
Child: sediment ingestion [inorganic]	2.3E-11	9.1E-10	5.1E-08	1.7E-11	1.0E-09	4.5E-08
Child: skin contact (sediment) [inorganic]	6.3E-10	2.3E-08	1.4E-06	4.9E-10	2.4E-08	1.6E-06
Child: skin contact (soil) [inorganic]	5.8E-10	7.1E-08	7.6E-06	5.0E-10	6.4E-08	1.0E-05
Child: skin contact (water) [inorganic]	1.5E-09	2.2E-08	1.9E-07	1.9E-09	2.7E-08	2.7E-07
Child: soil ingestion [inorganic]	1.9E-11	2.8E-09	4.2E-07	3.1E-11	2.7E-09	2.9E-07
Child: water ingestion [inorganic]	1.6E-10	7.7E-09	6.4E-08	4.4E-10	8.9E-09	1.0E-07
Child: Total inorganic dose ('typical' student)	7.5E-10	8.8E-08	8.5E-06	3.2E-10	9.6E-08	7.5E-06
Child: Total inorganic dose (student-recreator)	2.4E-08	2.9E-07	8.8E-06	1.8E-08	2.7E-07	1.4E-05

	1988			1989		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Child: inhalation [elemental]	1.2E-10	5.8E-10	3.3E-09	1.1E-10	6.0E-10	3.0E-09
Child: sediment ingestion [inorganic]	1.3E-11	9.6E-10	3.2E-08	1.9E-11	9.2E-10	7.2E-08
Child: skin contact (sediment) [inorganic]	4.0E-10	2.5E-08	1.3E-06	5.1E-10	2.9E-08	1.1E-06
Child: skin contact (soil) [inorganic]	5.4E-10	7.7E-08	1.3E-05	3.9E-10	7.5E-08	1.0E-05
Child: skin contact (water) [inorganic]	9.7E-10	1.7E-08	1.1E-07	1.0E-09	1.3E-08	1.3E-07
Child: soil ingestion [inorganic]	1.4E-11	2.4E-09	4.3E-07	1.5E-11	2.7E-09	3.7E-07
Child: water ingestion [inorganic]	1.6E-10	5.7E-09	4.1E-08	2.0E-10	4.6E-09	3.8E-08
Child: Total inorganic dose ('typical' student)	5.0E-10	7.9E-08	1.2E-05	7.4E-10	9.2E-08	1.1E-05
Child: Total inorganic dose (student-recreator)	2.5E-08	2.3E-07	1.3E-05	1.3E-08	2.4E-07	1.1E-05

	1990		
	2.5%-ile	**Central**	**97.5%-ile**
Child: inhalation [elemental]	9.2E-11	5.5E-10	3.0E-09
Child: sediment ingestion [inorganic]	1.7E-11	9.6E-10	4.7E-08
Child: skin contact (sediment) [inorganic]	3.4E-10	2.4E-08	1.9E-06
Child: skin contact (soil) [inorganic]	3.3E-10	7.6E-08	1.5E-05
Child: skin contact (water) [inorganic]	9.4E-10	1.6E-08	1.4E-07
Child: soil ingestion [inorganic]	1.9E-11	3.1E-09	5.0E-07
Child: water ingestion [inorganic]	1.1E-10	5.4E-09	3.9E-08
Child: Total inorganic dose ('typical' student)	6.6E-10	8.4E-08	1.2E-05
Child: Total inorganic dose (student-recreator)	1.2E-08	2.5E-07	1.7E-05

a Underlined doses exceed the USEPA Reference Dose (RfD)

Table W-4: Estimated Annual Mercury Doses, EFPC Farm Family Population (mg kg^{-1} d^{-1}) [a]

	1950			1951			1952			1953		
	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile
Adult: fish consumption [methyl]	1.2E-06	2.0E-05	3.0E-04	1.3E-06	1.9E-05	3.5E-04	1.4E-06	2.0E-05	3.5E-04	1.3E-06	1.9E-05	3.8E-04
Adult: inhalation [elemental]	4.1E-08	2.2E-07	1.5E-06	9.2E-08	4.7E-07	2.7E-06	4.1E-07	2.4E-06	1.3E-05	2.2E-06	1.1E-05	5.4E-05
Adult: beef (from air, pasture) [inorganic]	9.1E-10	1.3E-08	1.6E-07	2.3E-09	2.7E-08	3.0E-07	8.3E-09	1.2E-07	1.5E-06	4.4E-08	5.8E-07	6.1E-06
Adult: beef (from soil) [inorganic]	3.0E-10	2.0E-08	2.3E-06	2.3E-10	2.1E-08	2.1E-06	2.8E-10	2.0E-08	2.3E-06	2.0E-10	2.2E-08	2.8E-06
Adult: beef (from soil, pasture) [inorganic]	1.7E-10	6.6E-09	3.3E-07	1.3E-10	6.6E-09	2.7E-07	1.2E-10	7.2E-09	3.3E-07	1.3E-10	7.1E-09	3.9E-07
Adult: beef (from water) [inorganic]	8.8E-09	5.2E-08	2.3E-07	1.6E-08	9.8E-08	4.7E-07	1.0E-07	5.5E-07	2.9E-06	4.4E-07	2.4E-06	1.3E-05
Adult: beef (Total) [inorganic]	1.7E-08	1.3E-07	2.9E-06	3.8E-08	2.0E-07	2.7E-06	1.4E-07	8.9E-07	5.9E-06	6.4E-07	3.6E-06	1.7E-05
Adult: milk (from air, pasture) [inorganic]	1.0E-11	1.4E-10	1.7E-09	1.8E-11	3.0E-10	4.8E-09	1.0E-10	1.3E-09	1.8E-08	5.5E-10	6.2E-09	9.9E-08
Adult: milk (from soil) [inorganic]	5.7E-11	3.6E-09	3.5E-07	4.9E-11	3.6E-09	4.7E-07	4.1E-11	3.2E-09	6.2E-07	5.3E-11	3.3E-09	3.3E-07
Adult: milk (from soil, pasture) [inorganic]	2.8E-11	1.1E-09	5.7E-08	2.3E-11	1.2E-09	6.3E-08	2.1E-11	1.2E-09	6.1E-08	1.9E-11	1.1E-09	9.2E-08
Adult: milk (from water) [inorganic]	5.8E-08	3.3E-07	2.0E-06	1.1E-07	6.9E-07	4.5E-06	6.9E-07	4.0E-06	2.6E-05	2.7E-06	1.8E-05	1.0E-04
Adult: milk (Total) [inorganic]	6.6E-08	3.7E-07	2.2E-06	1.1E-07	7.2E-07	4.7E-06	7.0E-07	4.0E-06	2.6E-05	2.7E-06	1.8E-05	1.0E-04
Adult: soil ingestion [inorganic]	5.2E-10	4.1E-08	4.6E-06	4.5E-10	4.4E-08	3.2E-06	6.5E-10	3.8E-08	4.5E-06	5.2E-10	4.0E-08	2.9E-06
Adult: skin contact (soil) [inorganic]	4.1E-08	1.3E-06	1.3E-04	2.3E-08	1.7E-06	1.1E-04	2.6E-08	1.8E-06	9.6E-05	1.5E-08	1.5E-06	1.0E-04
Adult: sediment ingestion [inorganic]	2.3E-10	1.1E-08	5.7E-07	1.4E-10	1.1E-08	4.8E-07	2.2E-10	1.2E-08	6.7E-07	2.0E-10	1.2E-08	6.1E-07
Adult: skin contact (sediment) [inorganic]	7.5E-09	3.7E-07	3.3E-05	8.3E-09	4.6E-07	2.8E-05	9.7E-09	4.4E-07	1.5E-05	8.9E-09	4.1E-07	1.9E-05
Adult: water ingestion [inorganic]	5.2E-10	1.2E-08	8.7E-08	8.8E-10	2.6E-08	1.6E-07	7.5E-09	1.5E-07	9.1E-07	2.6E-08	6.2E-07	3.6E-06
Adult: skin contact (water) [inorganic]	3.1E-09	3.1E-08	2.1E-07	6.2E-09	6.1E-08	5.0E-07	4.2E-08	3.7E-07	2.6E-06	1.7E-07	1.4E-06	1.1E-05
Adult: vegetables (from air) [inorganic]	1.7E-07	2.1E-06	3.8E-05	3.3E-07	4.6E-06	6.0E-05	1.5E-06	2.2E-05	3.1E-04	5.9E-06	9.5E-05	1.3E-03
Adult: vegetables (from soil) [inorganic]	6.2E-08	2.2E-06	9.6E-05	5.7E-08	2.3E-06	8.1E-05	6.8E-08	2.0E-06	8.4E-05	8.3E-08	2.1E-06	6.9E-05
Adult: vegetables (Total) [inorganic]	7.1E-07	6.9E-06	1.0E-04	1.2E-06	9.8E-06	1.1E-04	2.8E-06	3.0E-05	3.1E-04	9.2E-06	1.1E-04	1.3E-03
Adult: *Total* inorganic dose	2.4E-06	1.7E-05	1.9E-04	3.7E-06	2.1E-05	2.5E-04	1.2E-05	5.2E-05	4.0E-04	3.4E-05	1.7E-04	1.4E-03
Child: fish consumption [methyl]	1.4E-06	2.2E-05	3.2E-04	1.5E-06	2.2E-05	3.9E-04	1.5E-06	2.2E-05	3.6E-04	1.5E-06	2.2E-05	3.4E-04
Child: inhalation [elemental]	1.4E-07	6.9E-07	3.8E-06	2.9E-07	1.4E-06	7.5E-06	1.4E-06	6.9E-06	3.5E-05	7.2E-06	3.1E-05	1.6E-04
Child: beef (from air, pasture) [inorganic]	1.6E-09	2.3E-08	2.9E-07	2.9E-09	4.9E-08	5.2E-07	2.3E-08	2.1E-07	3.1E-06	9.0E-08	1.0E-06	1.1E-05
Child: beef (from soil) [inorganic]	5.5E-10	3.9E-08	3.5E-06	4.9E-10	4.0E-08	3.3E-06	6.5E-10	3.5E-08	5.1E-06	4.2E-10	4.3E-08	4.4E-06
Child: beef (from soil, pasture) [inorganic]	3.2E-10	1.4E-08	6.0E-07	2.9E-10	1.3E-08	5.6E-07	2.6E-10	1.3E-08	6.7E-07	2.5E-10	1.3E-08	7.8E-07
Child: beef (from water) [inorganic]	1.5E-08	9.5E-08	5.7E-07	2.8E-08	1.9E-07	1.2E-06	2.1E-07	1.1E-06	5.8E-06	7.3E-07	4.7E-06	2.7E-05
Child: beef (Total) [inorganic]	3.6E-08	2.5E-07	4.2E-06	7.2E-08	4.0E-07	4.2E-06	3.1E-07	1.7E-06	1.2E-05	1.1E-06	6.5E-06	3.6E-05
Child: milk (from air, pasture) [inorganic]	1.6E-09	2.1E-08	2.4E-07	3.1E-09	4.3E-08	6.2E-07	1.6E-08	2.0E-07	2.3E-06	6.6E-08	9.3E-07	1.1E-05
Child: milk (from soil) [inorganic]	5.4E-10	3.3E-08	3.3E-06	4.1E-10	3.5E-08	3.3E-06	5.2E-10	3.0E-08	5.4E-06	5.2E-10	2.9E-08	3.4E-06
Child: milk (from soil, pasture) [inorganic]	2.6E-10	1.0E-08	6.1E-07	2.4E-10	9.9E-09	4.1E-07	1.8E-10	1.1E-08	5.4E-07	2.2E-10	1.0E-08	8.1E-07
Child: milk (from water) [inorganic]	2.0E-08	8.7E-08	4.5E-07	3.9E-08	1.8E-07	1.0E-06	2.2E-07	1.0E-06	5.3E-06	8.6E-07	4.3E-06	2.3E-05
Child: milk (Total) [inorganic]	3.8E-08	2.2E-07	4.2E-06	7.1E-08	3.6E-07	3.9E-06	3.1E-07	1.5E-06	1.1E-05	1.3E-06	5.8E-06	3.2E-05
Child: soil ingestion [inorganic]	1.1E-08	7.4E-07	7.5E-05	8.1E-09	7.5E-07	6.2E-05	1.1E-08	7.4E-07	7.1E-05	9.2E-09	7.5E-07	9.5E-05
Child: skin contact (soil) [inorganic]	1.2E-07	6.3E-06	8.8E-04	1.7E-07	8.2E-06	5.4E-04	1.0E-07	7.3E-06	5.1E-04	1.3E-07	7.4E-06	8.1E-04
Child: sediment ingestion [inorganic]	3.7E-09	1.8E-07	1.0E-05	3.2E-09	1.7E-07	9.3E-06	3.4E-09	2.0E-07	1.5E-05	3.1E-09	2.0E-07	1.0E-05
Child: skin contact (sediment) [inorganic]	3.5E-08	1.9E-06	1.2E-04	2.8E-08	2.0E-06	1.7E-04	2.9E-08	1.9E-06	1.5E-04	4.1E-08	1.8E-06	9.7E-05
Child: water ingestion [inorganic]	6.8E-09	2.0E-07	1.2E-06	1.7E-08	3.7E-07	2.5E-06	8.3E-08	2.2E-06	1.8E-05	3.1E-07	9.4E-06	6.2E-05
Child: skin contact (water) [inorganic]	1.4E-08	1.4E-07	1.4E-06	2.6E-08	2.9E-07	2.8E-06	1.2E-07	1.6E-06	1.7E-05	4.9E-07	7.0E-06	6.8E-05
Child: vegetables (from air) [inorganic]	2.0E-07	4.0E-06	7.0E-05	3.5E-07	7.5E-06	1.6E-04	1.8E-06	4.0E-05	7.3E-04	8.2E-06	1.9E-04	3.6E-03
Child: vegetables (from soil) [inorganic]	1.5E-07	6.0E-06	4.0E-04	1.1E-07	8.2E-06	3.0E-04	1.3E-07	6.5E-06	2.7E-04	1.4E-07	6.0E-06	3.7E-04
Child: vegetables (Total) [inorganic]	1.3E-06	1.9E-05	4.0E-04	2.2E-06	2.4E-05	3.9E-04	3.5E-06	6.3E-05	8.4E-04	1.3E-05	2.4E-04	3.6E-03
Child: *Total* inorganic dose	6.9E-06	6.2E-05	1.3E-03	9.7E-06	7.7E-05	9.1E-04	2.4E-05	1.4E-04	1.8E-03	5.7E-05	3.7E-04	4.8E-03

a Underlined doses exceed the USEPA Reference Dose (RfD)

Table W-4: Estimated Annual Mercury Doses, EFPC Farm Family Population (mg kg^{-1} d^{-1}) [a]

	1954			1955			1956			1957		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Adult: fish consumption [methyl]	1.2E-06	2.0E-05	2.6E-04	1.3E-06	2.0E-05	3.2E-04	1.4E-06	1.9E-05	2.9E-04	1.3E-06	2.0E-05	3.4E-04
Adult: inhalation [elemental]	1.4E-06	6.3E-06	3.9E-05	6.6E-06	3.3E-05	1.7E-04	4.9E-06	2.7E-05	1.3E-04	1.3E-05	6.5E-05	3.8E-04
Adult: beef (from air, pasture) [inorganic]	2.5E-08	3.4E-07	3.8E-06	1.3E-07	1.7E-06	1.8E-05	1.5E-07	1.4E-06	1.6E-05	2.7E-07	3.5E-06	3.4E-05
Adult: beef (from soil) [inorganic]	3.0E-10	2.2E-08	1.7E-06	5.0E-10	3.5E-08	2.3E-06	5.0E-10	3.1E-08	2.5E-06	3.5E-10	3.8E-08	1.6E-06
Adult: beef (from soil, pasture) [inorganic]	1.1E-10	7.0E-09	3.6E-07	1.8E-10	9.9E-09	6.5E-07	2.7E-10	1.0E-08	4.3E-07	2.2E-10	1.1E-08	5.1E-07
Adult: beef (from water) [inorganic]	2.2E-07	1.4E-06	7.1E-06	1.1E-06	6.8E-06	3.8E-05	8.9E-07	5.2E-06	2.5E-05	3.4E-06	1.4E-05	5.9E-05
Adult: beef (Total) [inorganic]	3.8E-07	2.1E-06	1.1E-05	1.7E-06	9.7E-06	4.9E-05	1.4E-06	7.4E-06	4.0E-05	4.4E-06	1.9E-05	9.3E-05
Adult: milk (from air, pasture) [inorganic]	2.8E-10	3.9E-09	4.8E-08	1.7E-09	1.9E-08	2.6E-07	1.4E-09	1.7E-08	2.3E-07	3.6E-09	4.2E-08	4.9E-07
Adult: milk (from soil) [inorganic]	4.6E-11	3.7E-09	4.1E-07	8.2E-11	5.3E-09	3.5E-07	8.1E-11	4.9E-09	5.0E-07	5.2E-11	6.5E-09	3.6E-07
Adult: milk (from soil, pasture) [inorganic]	1.8E-11	1.1E-09	4.6E-08	4.3E-11	1.7E-09	6.7E-08	4.5E-11	1.8E-09	1.1E-07	3.7E-11	1.9E-09	7.4E-08
Adult: milk (from water) [inorganic]	1.5E-06	9.5E-06	5.5E-05	8.0E-06	4.6E-05	2.6E-04	5.6E-06	3.6E-05	2.0E-04	1.7E-05	9.8E-05	4.5E-04
Adult: milk (Total) [inorganic]	1.6E-06	9.5E-06	5.5E-05	8.0E-06	4.6E-05	2.6E-04	5.7E-06	3.6E-05	2.0E-04	1.7E-05	9.8E-05	4.6E-04
Adult: soil ingestion [inorganic]	6.2E-10	3.9E-08	3.9E-06	1.1E-09	6.5E-08	4.1E-06	1.2E-09	6.5E-08	4.0E-06	7.0E-10	7.8E-08	4.9E-06
Adult: skin contact (soil) [inorganic]	2.5E-08	1.6E-06	1.1E-04	3.3E-08	2.6E-06	1.8E-04	4.2E-08	2.7E-06	1.9E-04	4.5E-08	2.2E-06	1.5E-04
Adult: sediment ingestion [inorganic]	1.5E-10	1.1E-08	7.5E-07	2.1E-10	1.9E-08	9.8E-07	3.1E-10	1.6E-08	1.2E-06	3.7E-10	1.9E-08	8.7E-07
Adult: skin contact (sediment) [inorganic]	8.6E-09	3.6E-07	2.4E-05	1.5E-08	6.5E-07	3.8E-05	1.0E-08	6.7E-07	4.9E-05	1.5E-08	6.3E-07	3.6E-05
Adult: water ingestion [inorganic]	1.3E-08	3.2E-07	2.4E-06	6.6E-08	1.7E-06	1.2E-05	5.0E-08	1.4E-06	1.0E-05	1.8E-07	3.6E-06	2.0E-05
Adult: skin contact (water) [inorganic]	9.4E-08	8.6E-07	7.2E-06	3.9E-07	4.0E-06	3.6E-05	3.3E-07	3.0E-06	2.6E-05	1.0E-06	8.7E-06	5.9E-05
Adult: vegetables (from air) [inorganic]	3.6E-06	5.6E-05	8.6E-04	1.2E-05	2.9E-04	5.4E-03	1.7E-05	2.5E-04	3.0E-03	3.2E-05	5.8E-04	9.0E-03
Adult: vegetables (from soil) [inorganic]	7.9E-08	2.2E-06	7.8E-05	9.7E-08	3.6E-06	1.2E-04	9.1E-08	3.7E-06	1.4E-04	9.5E-08	3.8E-06	1.0E-04
Adult: vegetables (Total) [inorganic]	6.6E-06	6.8E-05	9.1E-04	1.9E-05	3.1E-04	5.4E-03	2.5E-05	2.7E-04	3.3E-03	3.9E-05	6.2E-04	9.0E-03
Adult: *Total* inorganic dose	2.1E-05	1.0E-04	9.4E-04	8.5E-05	4.8E-04	5.5E-03	6.6E-05	3.7E-04	3.3E-03	1.6E-04	8.1E-04	9.4E-03
Child: fish consumption [methyl]	1.4E-06	2.3E-05	3.6E-04	1.4E-06	2.3E-05	3.7E-04	1.6E-06	2.3E-05	3.3E-04	1.4E-06	2.3E-05	3.5E-04
Child: inhalation [elemental]	4.2E-06	1.8E-05	1.1E-04	1.8E-05	9.8E-05	4.9E-04	1.7E-05	8.1E-05	4.1E-04	3.7E-05	1.9E-04	1.1E-03
Child: beef (from air, pasture) [inorganic]	5.7E-08	6.3E-07	6.7E-06	3.2E-07	3.5E-06	2.9E-05	2.3E-07	2.6E-06	4.1E-05	5.0E-07	6.8E-06	9.7E-05
Child: beef (from soil) [inorganic]	5.3E-10	3.7E-08	3.7E-06	8.7E-10	7.4E-08	5.5E-06	1.2E-09	6.6E-08	6.6E-06	7.0E-10	7.7E-08	3.1E-06
Child: beef (from soil, pasture) [inorganic]	2.4E-10	1.3E-08	7.0E-07	3.5E-10	2.0E-08	1.3E-06	4.6E-10	1.8E-08	1.2E-06	4.3E-10	2.1E-08	1.4E-06
Child: beef (from water) [inorganic]	4.1E-07	2.5E-06	1.6E-05	2.3E-06	1.3E-05	6.3E-05	1.5E-06	9.9E-06	6.5E-05	5.0E-06	2.8E-05	1.2E-04
Child: beef (Total) [inorganic]	6.8E-07	3.9E-06	2.1E-05	3.0E-06	1.9E-05	8.6E-05	2.0E-06	1.5E-05	9.4E-05	6.8E-06	3.7E-05	2.0E-04
Child: milk (from air, pasture) [inorganic]	4.5E-08	5.2E-07	7.0E-06	2.2E-07	3.0E-06	2.7E-05	1.8E-07	2.2E-06	2.3E-05	5.3E-07	5.7E-06	7.2E-05
Child: milk (from soil) [inorganic]	4.4E-10	3.5E-08	2.3E-06	9.4E-10	5.2E-08	2.9E-06	8.0E-10	5.1E-08	4.6E-06	5.4E-10	5.9E-08	2.6E-06
Child: milk (from soil, pasture) [inorganic]	2.2E-10	1.0E-08	5.3E-07	3.4E-10	1.6E-08	7.6E-07	5.1E-10	1.6E-08	8.7E-07	4.0E-10	1.6E-08	7.2E-07
Child: milk (from water) [inorganic]	4.7E-07	2.4E-06	1.2E-05	2.3E-06	1.2E-05	6.8E-05	1.8E-06	1.0E-05	4.7E-05	5.2E-06	2.7E-05	1.1E-04
Child: milk (Total) [inorganic]	7.4E-07	3.5E-06	1.8E-05	3.1E-06	1.7E-05	9.1E-05	2.5E-06	1.4E-05	6.4E-05	6.9E-06	3.4E-05	1.7E-04
Child: soil ingestion [inorganic]	9.7E-09	7.4E-07	5.7E-05	2.3E-08	1.0E-06	9.6E-05	2.0E-08	1.1E-06	8.3E-05	1.2E-08	1.3E-06	6.2E-05
Child: skin contact (soil) [inorganic]	1.3E-07	7.9E-06	4.8E-04	1.2E-07	1.2E-05	1.1E-03	1.3E-07	1.4E-05	1.1E-03	2.7E-07	1.2E-05	9.6E-04
Child: sediment ingestion [inorganic]	2.5E-09	1.7E-07	1.3E-05	5.9E-09	2.9E-07	2.2E-05	6.8E-09	2.9E-07	2.3E-05	4.9E-09	3.2E-07	1.1E-05
Child: skin contact (sediment) [inorganic]	3.9E-08	2.0E-06	1.0E-04	6.5E-08	3.5E-06	1.2E-04	6.6E-08	3.3E-06	1.5E-04	6.4E-08	3.4E-06	2.0E-04
Child: water ingestion [inorganic]	1.7E-07	5.3E-06	3.4E-05	7.9E-07	2.8E-05	1.8E-04	7.0E-07	2.0E-05	1.4E-04	2.2E-06	5.4E-05	3.1E-04
Child: skin contact (water) [inorganic]	2.6E-07	4.0E-06	4.1E-05	1.5E-06	2.1E-05	1.7E-04	1.1E-06	1.6E-05	1.4E-04	3.4E-06	4.3E-05	3.5E-04
Child: vegetables (from air) [inorganic]	5.5E-06	1.1E-04	2.1E-03	2.5E-05	5.5E-04	1.1E-02	2.3E-05	4.5E-04	9.9E-03	4.9E-05	1.0E-03	2.5E-02
Child: vegetables (from soil) [inorganic]	1.3E-07	7.8E-06	3.0E-04	2.8E-07	1.1E-05	7.4E-04	2.2E-07	1.1E-05	5.0E-04	2.6E-07	1.0E-05	6.9E-04
Child: vegetables (Total) [inorganic]	1.1E-05	1.4E-04	2.4E-03	3.9E-05	6.3E-04	1.1E-02	3.8E-05	5.1E-04	9.9E-03	6.8E-05	1.2E-03	2.5E-02
Child: *Total* inorganic dose	4.6E-05	2.4E-04	3.6E-03	1.7E-04	8.9E-04	1.2E-02	1.3E-04	8.0E-04	1.0E-02	2.7E-04	1.6E-03	2.6E-02

a Underlined doses exceed the USEPA Reference Dose (RfD)

Table W-4: Estimated Annual Mercury Doses, EFPC Farm Family Population ($mg\ kg^{-1}\ d^{-1}$) [a]

	1958			1959			1960			1961		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Adult: fish consumption [methyl]	1.2E-06	1.9E-05	3.5E-04	1.2E-06	2.0E-05	3.3E-04	1.1E-06	2.0E-05	3.3E-04	1.5E-06	1.9E-05	3.0E-04
Adult: inhalation [elemental]	1.2E-05	5.9E-05	3.2E-04	3.7E-06	1.7E-05	9.5E-05	1.2E-06	6.5E-06	3.4E-05	1.1E-06	6.1E-06	3.9E-05
Adult: beef (from air, pasture) [inorganic]	2.2E-07	3.2E-06	3.3E-05	7.9E-08	8.9E-07	1.3E-05	2.4E-08	3.6E-07	3.6E-06	2.2E-08	3.5E-07	4.4E-06
Adult: beef (from soil) [inorganic]	4.1E-10	3.6E-08	2.5E-06	1.6E-10	1.3E-08	1.1E-06	1.2E-10	1.2E-08	1.7E-06	1.9E-10	1.3E-08	9.4E-07
Adult: beef (from soil, pasture) [inorganic]	1.8E-10	1.0E-08	5.0E-07	8.2E-11	4.2E-09	2.0E-07	7.8E-11	4.3E-09	2.5E-07	7.1E-11	4.1E-09	2.9E-07
Adult: beef (from water) [inorganic]	3.3E-06	1.7E-05	6.9E-05	9.0E-07	4.6E-06	2.1E-05	3.2E-07	1.5E-06	7.4E-06	2.7E-07	1.2E-06	6.4E-06
Adult: beef (Total) [inorganic]	4.5E-06	2.1E-05	9.1E-05	1.1E-06	5.9E-06	2.7E-05	4.1E-07	2.2E-06	9.9E-06	3.8E-07	1.8E-06	9.9E-06
Adult: milk (from air, pasture) [inorganic]	2.2E-09	3.7E-08	3.2E-07	7.9E-10	1.1E-08	1.1E-07	3.5E-10	3.8E-09	5.5E-08	3.2E-10	3.8E-09	5.1E-08
Adult: milk (from soil) [inorganic]	9.2E-11	6.0E-09	4.3E-07	3.0E-11	2.4E-09	2.4E-07	2.6E-11	2.1E-09	2.4E-07	2.7E-11	2.3E-09	1.3E-07
Adult: milk (from soil, pasture) [inorganic]	3.9E-11	1.8E-09	6.4E-08	1.7E-11	7.7E-10	3.7E-08	1.6E-11	7.1E-10	3.2E-08	1.8E-11	7.5E-10	3.8E-08
Adult: milk (from water) [inorganic]	2.5E-05	1.2E-04	6.0E-04	5.2E-06	3.1E-05	1.8E-04	2.3E-06	1.1E-05	5.4E-05	1.6E-06	9.4E-06	4.6E-05
Adult: milk (Total) [inorganic]	2.5E-05	1.2E-04	6.0E-04	5.2E-06	3.1E-05	1.8E-04	2.3E-06	1.1E-05	5.4E-05	1.6E-06	9.5E-06	4.6E-05
Adult: soil ingestion [inorganic]	1.3E-09	5.7E-08	5.1E-06	4.7E-10	2.5E-08	2.3E-06	3.1E-10	2.3E-08	2.3E-06	3.7E-10	2.7E-08	3.3E-06
Adult: skin contact (soil) [inorganic]	5.2E-08	2.4E-06	2.3E-04	1.1E-08	1.0E-06	1.1E-04	1.0E-08	9.0E-07	8.8E-05	1.1E-08	1.1E-06	5.4E-05
Adult: sediment ingestion [inorganic]	3.0E-10	1.5E-08	1.5E-06	1.1E-10	6.4E-09	4.4E-07	8.6E-11	7.0E-09	5.4E-07	9.8E-11	6.8E-09	3.9E-07
Adult: skin contact (sediment) [inorganic]	1.2E-08	5.7E-07	4.3E-05	4.8E-09	2.6E-07	1.9E-05	3.8E-09	2.5E-07	2.3E-05	4.2E-09	2.9E-07	1.5E-05
Adult: water ingestion [inorganic]	1.8E-07	4.2E-06	2.4E-05	8.4E-08	1.2E-06	6.5E-06	1.7E-08	4.3E-07	2.3E-06	2.0E-08	3.4E-07	1.9E-06
Adult: skin contact (water) [inorganic]	1.1E-06	1.0E-05	7.4E-05	3.4E-07	3.1E-06	1.9E-05	9.9E-08	9.4E-07	6.4E-06	8.7E-08	8.5E-07	5.8E-06
Adult: vegetables (from air) [inorganic]	3.5E-05	5.2E-04	7.5E-03	1.1E-05	1.6E-04	2.4E-03	2.3E-06	5.8E-05	8.8E-04	2.9E-06	5.6E-05	8.9E-04
Adult: vegetables (from soil) [inorganic]	1.0E-07	3.7E-06	1.2E-04	3.0E-08	1.3E-06	7.0E-05	4.0E-08	1.2E-06	4.1E-05	4.3E-08	1.4E-06	4.7E-05
Adult: vegetables (Total) [inorganic]	4.5E-05	5.3E-04	7.5E-03	1.3E-05	1.7E-04	2.4E-03	5.3E-06	6.4E-05	9.2E-04	4.0E-06	6.1E-05	8.9E-04
Adult: *Total* inorganic dose	1.7E-04	8.4E-04	7.8E-03	4.9E-05	2.5E-04	2.6E-03	2.2E-05	9.8E-05	9.5E-04	1.7E-05	9.2E-05	1.1E-03
Child: fish consumption [methyl]	1.6E-06	2.1E-05	3.9E-04	1.5E-06	2.3E-05	4.0E-04	1.3E-06	2.3E-05	3.9E-04	1.6E-06	2.1E-05	3.6E-04
Child: inhalation [elemental]	3.2E-05	1.7E-04	8.9E-04	1.2E-05	5.0E-05	2.1E-04	4.1E-06	1.9E-05	9.6E-05	3.4E-06	1.7E-05	1.0E-04
Child: beef (from air, pasture) [inorganic]	3.3E-07	5.9E-06	7.1E-05	1.2E-07	1.8E-06	2.2E-05	4.8E-08	6.4E-07	7.2E-06	3.5E-08	6.8E-07	7.7E-06
Child: beef (from soil) [inorganic]	8.2E-10	6.3E-08	5.6E-06	2.7E-10	2.5E-08	2.2E-06	1.9E-10	2.4E-08	3.3E-06	3.3E-10	2.6E-08	1.7E-06
Child: beef (from soil, pasture) [inorganic]	4.2E-10	2.0E-08	1.0E-06	1.3E-10	8.0E-09	3.7E-07	1.6E-10	8.7E-09	4.0E-07	1.5E-10	8.1E-09	5.3E-07
Child: beef (from water) [inorganic]	5.9E-06	3.3E-05	1.6E-04	1.6E-06	9.0E-06	5.0E-05	5.2E-07	3.1E-06	1.6E-05	4.4E-07	2.5E-06	1.3E-05
Child: beef (Total) [inorganic]	7.9E-06	4.3E-05	2.0E-04	2.2E-06	1.2E-05	5.6E-05	7.4E-07	4.4E-06	2.3E-05	5.2E-07	3.7E-06	2.2E-05
Child: milk (from air, pasture) [inorganic]	3.4E-07	5.0E-06	5.2E-05	1.1E-07	1.5E-06	1.5E-05	5.2E-08	4.9E-07	8.2E-06	3.9E-08	5.2E-07	6.5E-06
Child: milk (from soil) [inorganic]	8.8E-10	5.0E-08	4.1E-06	2.9E-10	2.1E-08	1.6E-06	2.3E-10	1.8E-08	2.1E-06	3.4E-10	2.1E-08	1.7E-06
Child: milk (from soil, pasture) [inorganic]	3.8E-10	1.7E-08	5.7E-07	1.4E-10	7.0E-09	3.3E-07	1.8E-10	6.1E-09	2.7E-07	1.6E-10	7.4E-09	4.7E-07
Child: milk (from water) [inorganic]	6.3E-06	3.1E-05	1.3E-04	1.9E-06	8.2E-06	3.8E-05	6.0E-07	2.9E-06	1.4E-05	5.1E-07	2.5E-06	1.0E-05
Child: milk (Total) [inorganic]	8.1E-06	4.0E-05	1.8E-04	2.3E-06	1.1E-05	4.9E-05	8.1E-07	3.9E-06	2.0E-05	6.5E-07	3.3E-06	1.7E-05
Child: soil ingestion [inorganic]	2.5E-08	1.2E-06	1.0E-04	7.2E-09	4.4E-07	3.5E-05	5.5E-09	4.4E-07	3.7E-05	9.4E-09	5.1E-07	2.4E-05
Child: skin contact (soil) [inorganic]	2.0E-07	1.2E-05	1.2E-03	7.4E-08	4.9E-06	4.6E-04	7.4E-08	5.1E-06	4.0E-04	7.9E-08	4.9E-06	4.2E-04
Child: sediment ingestion [inorganic]	3.4E-09	3.0E-07	2.0E-05	1.7E-09	1.3E-07	5.7E-06	1.3E-09	1.3E-07	7.2E-06	1.8E-09	1.2E-07	6.6E-06
Child: skin contact (sediment) [inorganic]	4.7E-08	3.1E-06	1.8E-04	1.7E-08	1.2E-06	7.6E-05	2.1E-08	1.2E-06	5.9E-05	3.0E-08	1.2E-06	8.5E-05
Child: water ingestion [inorganic]	2.2E-06	6.8E-05	3.9E-04	6.9E-07	1.8E-05	1.2E-04	2.2E-07	5.9E-06	4.2E-05	1.7E-07	5.4E-06	3.3E-05
Child: skin contact (water) [inorganic]	4.4E-06	5.1E-05	5.2E-04	1.1E-06	1.4E-05	1.1E-04	4.0E-07	4.4E-06	3.7E-05	3.8E-07	3.7E-06	3.7E-05
Child: vegetables (from air) [inorganic]	5.4E-05	8.9E-04	2.7E-02	1.7E-05	2.7E-04	6.9E-03	4.5E-06	1.2E-04	2.2E-03	5.2E-06	1.0E-04	1.7E-03
Child: vegetables (from soil) [inorganic]	2.0E-07	1.1E-05	7.6E-04	7.5E-08	3.8E-06	2.1E-04	9.1E-08	4.6E-06	2.1E-04	1.1E-07	3.9E-06	2.2E-04
Child: vegetables (Total) [inorganic]	7.2E-05	1.0E-03	2.7E-02	2.2E-05	3.0E-04	6.9E-03	8.2E-06	1.3E-04	2.3E-03	9.1E-06	1.3E-04	1.7E-03
Child: *Total* inorganic dose	3.1E-04	1.5E-03	2.7E-02	9.3E-05	4.4E-04	7.1E-03	3.9E-05	2.1E-04	2.4E-03	3.7E-05	2.0E-04	2.3E-03

a Underlined doses exceed the USEPA Reference Dose (RfD)

Table W-4: Estimated Annual Mercury Doses, EFPC Farm Family Population ($mg\ kg^{-1}\ d^{-1}$) [a]

	1962			1963			1964			1965		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Adult: fish consumption [methyl]	1.3E-06	2.0E-05	2.5E-04	1.3E-06	1.9E-05	3.3E-04	1.2E-06	2.0E-05	3.4E-04	1.3E-06	1.8E-05	2.9E-04
Adult: inhalation [elemental]	8.0E-07	4.2E-06	2.1E-05	5.7E-07	2.8E-06	1.5E-05	2.2E-07	9.6E-07	5.8E-06	3.7E-07	2.3E-06	1.3E-05
Adult: beef (from air, pasture) [inorganic]	1.6E-08	2.2E-07	3.1E-06	1.1E-08	1.6E-07	1.5E-06	4.6E-09	5.6E-08	6.3E-07	9.8E-09	1.2E-07	1.5E-06
Adult: beef (from soil) [inorganic]	2.0E-10	1.3E-08	1.6E-06	1.4E-10	1.2E-08	8.9E-07	1.4E-10	1.3E-08	1.2E-06	1.2E-10	1.3E-08	1.2E-06
Adult: beef (from soil, pasture) [inorganic]	6.9E-11	4.0E-09	2.2E-07	7.6E-11	4.4E-09	3.0E-07	1.0E-10	4.1E-09	1.8E-07	5.8E-11	4.4E-09	3.1E-07
Adult: beef (from water) [inorganic]	1.6E-07	7.7E-07	3.9E-06	1.2E-07	6.1E-07	2.9E-06	4.6E-08	2.8E-07	1.3E-06	1.2E-07	6.0E-07	3.2E-06
Adult: beef (Total) [inorganic]	2.2E-07	1.2E-06	6.6E-06	1.9E-07	9.4E-07	4.5E-06	7.2E-08	4.3E-07	2.2E-06	1.6E-07	8.8E-07	4.9E-06
Adult: milk (from air, pasture) [inorganic]	2.1E-10	2.6E-09	3.6E-08	1.3E-10	1.7E-09	2.2E-08	5.0E-11	6.2E-10	8.8E-09	1.1E-10	1.4E-09	1.8E-08
Adult: milk (from soil) [inorganic]	2.2E-11	2.3E-09	2.1E-07	2.3E-11	2.3E-09	1.6E-07	3.1E-11	2.4E-09	3.8E-07	2.2E-11	2.1E-09	1.9E-07
Adult: milk (from soil, pasture) [inorganic]	1.2E-11	7.5E-10	3.9E-08	1.1E-11	7.6E-10	3.6E-08	1.3E-11	7.3E-10	3.9E-08	1.1E-11	7.8E-10	4.1E-08
Adult: milk (from water) [inorganic]	9.4E-07	5.6E-06	3.4E-05	7.1E-07	4.4E-06	2.7E-05	3.5E-07	1.9E-06	9.4E-06	7.2E-07	4.2E-06	2.4E-05
Adult: milk (Total) [inorganic]	9.6E-07	5.6E-06	3.4E-05	7.1E-07	4.5E-06	2.8E-05	3.6E-07	1.9E-06	1.0E-05	7.2E-07	4.2E-06	2.4E-05
Adult: soil ingestion [inorganic]	3.7E-10	2.6E-08	1.9E-06	1.6E-10	2.7E-08	2.4E-06	3.0E-10	2.6E-08	3.1E-06	2.7E-10	2.6E-08	2.0E-06
Adult: skin contact (soil) [inorganic]	1.1E-08	1.0E-06	6.9E-05	1.6E-08	9.7E-07	8.9E-05	1.1E-08	1.0E-06	1.1E-04	1.3E-08	9.2E-07	1.3E-04
Adult: sediment ingestion [inorganic]	8.9E-11	7.3E-09	2.8E-07	8.0E-11	7.7E-09	4.3E-07	1.0E-10	6.9E-09	4.3E-07	1.3E-10	7.3E-09	4.4E-07
Adult: skin contact (sediment) [inorganic]	5.6E-09	2.6E-07	1.4E-05	4.9E-09	2.4E-07	1.3E-05	5.8E-09	2.2E-07	1.7E-05	3.5E-09	2.7E-07	1.5E-05
Adult: water ingestion [inorganic]	7.6E-09	2.1E-07	1.1E-06	5.8E-09	1.7E-07	1.1E-06	2.7E-09	7.0E-08	3.7E-07	6.2E-09	1.6E-07	9.9E-07
Adult: skin contact (water) [inorganic]	4.5E-08	4.9E-07	3.3E-06	4.8E-08	4.0E-07	2.8E-06	2.1E-08	1.7E-07	1.4E-06	3.1E-08	4.2E-07	2.6E-06
Adult: vegetables (from air) [inorganic]	1.9E-06	3.8E-05	5.9E-04	9.8E-07	2.4E-05	4.9E-04	5.6E-07	8.8E-06	1.8E-04	1.1E-06	2.0E-05	3.5E-04
Adult: vegetables (from soil) [inorganic]	4.5E-08	1.3E-06	5.1E-05	3.3E-08	1.4E-06	4.5E-05	3.0E-08	1.3E-06	7.2E-05	3.9E-08	1.4E-06	6.2E-05
Adult: vegetables (Total) [inorganic]	2.7E-06	4.5E-05	5.9E-04	2.1E-06	3.1E-05	5.0E-04	1.1E-06	1.5E-05	2.4E-04	1.9E-06	2.6E-05	3.6E-04
Adult: *Total* inorganic dose	1.2E-05	7.0E-05	7.3E-04	1.1E-05	5.1E-05	5.4E-04	5.1E-06	2.6E-05	2.8E-04	8.4E-06	4.4E-05	4.8E-04
Child: fish consumption [methyl]	1.5E-06	2.3E-05	3.2E-04	1.6E-06	2.2E-05	3.4E-04	1.5E-06	2.3E-05	3.7E-04	1.6E-06	2.1E-05	3.3E-04
Child: inhalation [elemental]	2.4E-06	1.2E-05	5.9E-05	2.0E-06	8.1E-06	3.9E-05	6.3E-07	2.7E-06	1.5E-05	1.3E-06	6.7E-06	3.2E-05
Child: beef (from air, pasture) [inorganic]	3.6E-08	4.0E-07	6.1E-06	1.9E-08	3.0E-07	3.1E-06	8.1E-09	1.1E-07	1.4E-06	1.8E-08	2.2E-07	3.3E-06
Child: beef (from soil) [inorganic]	2.7E-10	2.6E-08	3.0E-06	2.9E-10	2.3E-08	2.3E-06	3.6E-10	2.4E-08	2.5E-06	2.9E-10	2.5E-08	2.1E-06
Child: beef (from soil, pasture) [inorganic]	1.3E-10	8.3E-09	4.0E-07	1.5E-10	8.1E-09	6.1E-07	1.7E-10	7.8E-09	4.3E-07	1.2E-10	8.0E-09	5.9E-07
Child: beef (from water) [inorganic]	2.4E-07	1.5E-06	8.9E-06	2.1E-07	1.2E-06	6.6E-06	8.6E-08	5.5E-07	2.7E-06	2.1E-07	1.1E-06	5.9E-06
Child: beef (Total) [inorganic]	3.8E-07	2.4E-06	1.5E-05	2.8E-07	1.8E-06	1.1E-05	1.4E-07	8.6E-07	5.2E-06	3.1E-07	1.7E-06	9.1E-06
Child: milk (from air, pasture) [inorganic]	2.5E-08	3.4E-07	4.3E-06	1.8E-08	2.2E-07	2.7E-06	6.0E-09	8.5E-08	1.2E-06	1.5E-08	1.7E-07	2.3E-06
Child: milk (from soil) [inorganic]	2.6E-10	2.1E-08	1.9E-06	1.8E-10	2.0E-08	1.9E-06	3.0E-10	2.2E-08	2.0E-06	2.5E-10	1.9E-08	2.3E-06
Child: milk (from soil, pasture) [inorganic]	1.2E-10	6.7E-09	3.6E-07	1.1E-10	5.9E-09	3.8E-07	1.5E-10	7.0E-09	3.3E-07	8.0E-11	6.2E-09	5.1E-07
Child: milk (from water) [inorganic]	2.9E-07	1.5E-06	7.7E-06	2.5E-07	1.1E-06	6.4E-06	9.9E-08	5.1E-07	2.3E-06	2.2E-07	1.1E-06	5.6E-06
Child: milk (Total) [inorganic]	4.1E-07	2.2E-06	1.1E-05	3.4E-07	1.6E-06	8.9E-06	1.6E-07	7.6E-07	5.0E-06	2.9E-07	1.4E-06	8.0E-06
Child: soil ingestion [inorganic]	7.0E-09	4.9E-07	4.5E-05	4.0E-09	4.7E-07	2.8E-05	5.8E-09	4.1E-07	5.4E-05	4.6E-09	4.6E-07	3.7E-05
Child: skin contact (soil) [inorganic]	4.8E-08	4.9E-06	2.4E-04	5.0E-08	5.9E-06	4.0E-04	5.2E-08	4.8E-06	3.5E-04	5.4E-08	5.3E-06	3.8E-04
Child: sediment ingestion [inorganic]	2.3E-09	1.2E-07	7.5E-06	1.7E-09	1.2E-07	8.9E-06	1.9E-09	1.2E-07	6.8E-06	2.3E-09	1.1E-07	7.5E-06
Child: skin contact (sediment) [inorganic]	3.1E-08	9.6E-07	7.6E-05	2.6E-08	1.1E-06	7.4E-05	2.7E-08	1.1E-06	8.0E-05	2.1E-08	1.2E-06	7.4E-05
Child: water ingestion [inorganic]	8.7E-08	3.0E-06	2.3E-05	1.1E-07	2.2E-06	1.8E-05	2.6E-08	1.0E-06	7.6E-06	6.0E-08	2.5E-06	1.8E-05
Child: skin contact (water) [inorganic]	2.1E-07	2.3E-06	2.5E-05	1.6E-07	1.8E-06	1.7E-05	6.2E-08	8.0E-07	8.1E-06	1.4E-07	1.8E-06	2.0E-05
Child: vegetables (from air) [inorganic]	3.4E-06	7.1E-05	1.7E-03	1.9E-06	5.0E-05	9.9E-04	7.4E-07	1.6E-05	2.7E-04	1.5E-06	3.9E-05	6.1E-04
Child: vegetables (from soil) [inorganic]	6.4E-08	4.4E-06	2.1E-04	1.0E-07	4.0E-06	2.2E-04	8.8E-08	4.1E-06	2.8E-04	9.1E-08	4.1E-06	2.0E-04
Child: vegetables (Total) [inorganic]	5.3E-06	9.1E-05	1.8E-03	4.4E-06	7.0E-05	9.9E-04	2.5E-06	3.2E-05	5.0E-04	4.4E-06	6.0E-05	1.1E-03
Child: *Total* inorganic dose	2.4E-05	1.5E-04	2.1E-03	2.1E-05	1.3E-04	1.2E-03	1.2E-05	7.5E-05	7.8E-04	2.0E-05	1.1E-04	1.4E-03

a Underlined doses exceed the USEPA Reference Dose (RfD)

Table W-4: Estimated Annual Mercury Doses, EFPC Farm Family Population (mg kg^{-1} d^{-1}) [a]

	1966			1967			1968			1969		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Adult: fish consumption [methyl]	1.2E-06	1.9E-05	2.9E-04	1.3E-06	2.0E-05	3.3E-04	1.1E-06	1.9E-05	2.7E-04	1.2E-06	1.9E-05	2.9E-04
Adult: inhalation [elemental]	2.4E-07	1.2E-06	6.2E-06	1.4E-07	8.0E-07	4.0E-06	2.6E-08	1.3E-07	6.2E-07	2.9E-08	1.7E-07	8.3E-07
Adult: beef (from air, pasture) [inorganic]	5.2E-09	6.9E-08	5.7E-07	3.4E-09	4.3E-08	4.2E-07	4.8E-10	6.5E-09	7.9E-08	6.7E-10	8.9E-09	9.6E-08
Adult: beef (from soil) [inorganic]	1.4E-10	1.4E-08	8.8E-07	1.2E-10	9.8E-09	9.4E-07	9.6E-11	1.0E-08	8.3E-07	1.2E-10	9.0E-09	1.1E-06
Adult: beef (from soil, pasture) [inorganic]	8.1E-11	4.4E-09	2.3E-07	1.1E-10	2.7E-09	1.8E-07	5.9E-11	3.1E-09	1.7E-07	5.5E-11	3.3E-09	1.5E-07
Adult: beef (from water) [inorganic]	5.6E-08	3.0E-07	1.3E-06	3.2E-08	1.7E-07	8.3E-07	8.5E-09	3.9E-08	1.5E-07	8.2E-09	4.0E-08	2.0E-07
Adult: beef (Total) [inorganic]	8.1E-08	4.8E-07	2.2E-06	4.8E-08	2.8E-07	1.7E-06	1.2E-08	7.8E-08	1.1E-06	1.3E-08	7.9E-08	1.4E-06
Adult: milk (from air, pasture) [inorganic]	7.1E-11	7.6E-10	8.2E-09	3.1E-11	4.9E-10	5.7E-09	5.4E-12	7.8E-11	9.6E-10	6.9E-12	1.0E-10	1.1E-09
Adult: milk (from soil) [inorganic]	2.5E-11	2.4E-09	1.8E-07	2.5E-11	1.8E-09	1.1E-07	1.7E-11	1.7E-09	1.7E-07	2.5E-11	1.5E-09	1.5E-07
Adult: milk (from soil, pasture) [inorganic]	9.2E-12	7.1E-10	3.7E-08	1.2E-11	5.0E-10	2.3E-08	9.8E-12	5.3E-10	1.8E-08	1.1E-11	5.3E-10	2.3E-08
Adult: milk (from water) [inorganic]	3.6E-07	2.1E-06	1.1E-05	1.7E-07	1.2E-06	7.5E-06	5.1E-08	2.6E-07	1.5E-06	5.9E-08	2.9E-07	1.5E-06
Adult: milk (Total) [inorganic]	3.7E-07	2.1E-06	1.1E-05	1.9E-07	1.2E-06	7.5E-06	5.5E-08	2.7E-07	1.5E-06	6.0E-08	3.0E-07	1.6E-06
Adult: soil ingestion [inorganic]	3.8E-10	2.4E-08	2.0E-06	1.6E-10	2.0E-08	1.6E-06	2.3E-10	2.1E-08	1.6E-06	3.0E-10	1.8E-08	2.1E-06
Adult: skin contact (soil) [inorganic]	1.0E-08	9.8E-07	1.0E-04	1.3E-08	6.7E-07	5.7E-05	1.2E-08	7.4E-07	4.4E-05	8.3E-09	7.5E-07	5.1E-05
Adult: sediment ingestion [inorganic]	1.1E-10	7.1E-09	2.7E-07	7.8E-11	4.9E-09	3.5E-07	7.9E-11	5.7E-09	3.4E-07	1.1E-10	5.2E-09	3.1E-07
Adult: skin contact (sediment) [inorganic]	6.1E-09	2.5E-07	1.9E-05	3.6E-09	2.0E-07	9.8E-06	3.6E-09	1.9E-07	1.1E-05	3.3E-09	1.7E-07	1.0E-05
Adult: water ingestion [inorganic]	3.6E-09	7.4E-08	4.3E-07	1.7E-09	4.4E-08	2.8E-07	3.8E-10	9.6E-09	5.6E-08	4.6E-10	1.1E-08	6.5E-08
Adult: skin contact (water) [inorganic]	1.6E-08	1.9E-07	1.4E-06	1.2E-08	1.0E-07	8.1E-07	3.3E-09	2.3E-08	1.6E-07	2.8E-09	2.7E-08	1.6E-07
Adult: vegetables (from air) [inorganic]	5.3E-07	1.1E-05	1.7E-04	3.6E-07	7.0E-06	1.0E-04	7.3E-08	1.0E-06	1.3E-05	7.5E-08	1.5E-06	2.4E-05
Adult: vegetables (from soil) [inorganic]	4.3E-08	1.3E-06	5.2E-05	3.2E-08	8.7E-07	3.1E-05	1.7E-08	1.1E-06	3.6E-05	2.7E-08	1.1E-06	3.0E-05
Adult: vegetables (Total) [inorganic]	1.5E-06	1.5E-05	1.9E-04	7.8E-07	9.8E-06	1.3E-04	3.2E-07	3.2E-06	3.8E-05	2.7E-07	3.9E-06	4.3E-05
Adult: *Total* inorganic dose	5.6E-06	2.7E-05	2.9E-04	2.8E-06	1.8E-05	1.4E-04	9.5E-07	7.3E-06	8.2E-05	1.5E-06	9.0E-06	1.1E-04
Child: fish consumption [methyl]	1.3E-06	2.1E-05	3.4E-04	1.5E-06	2.2E-05	3.2E-04	1.3E-06	2.1E-05	3.3E-04	1.4E-06	2.1E-05	3.1E-04
Child: inhalation [elemental]	7.5E-07	3.6E-06	1.6E-05	4.5E-07	2.3E-06	1.1E-05	8.4E-08	3.7E-07	1.7E-06	1.0E-07	4.7E-07	2.3E-06
Child: beef (from air, pasture) [inorganic]	8.3E-09	1.2E-07	1.6E-06	6.2E-09	7.8E-08	9.6E-07	8.1E-10	1.3E-08	1.7E-07	1.6E-09	1.7E-08	2.2E-07
Child: beef (from soil) [inorganic]	2.4E-10	2.8E-08	1.8E-06	1.7E-10	1.8E-08	1.5E-06	2.0E-10	1.9E-08	1.5E-06	2.0E-10	1.9E-08	2.0E-06
Child: beef (from soil, pasture) [inorganic]	1.3E-10	7.3E-09	4.8E-07	1.4E-10	5.4E-09	3.8E-07	1.2E-10	6.2E-09	2.5E-07	9.0E-11	6.6E-09	2.4E-07
Child: beef (from water) [inorganic]	1.1E-07	5.4E-07	2.8E-06	5.8E-08	3.3E-07	1.8E-06	1.3E-08	7.2E-08	3.6E-07	1.6E-08	7.4E-08	4.4E-07
Child: beef (Total) [inorganic]	1.7E-07	8.6E-07	5.9E-06	8.0E-08	5.6E-07	3.9E-06	2.1E-08	1.6E-07	1.8E-06	2.5E-08	1.6E-07	2.5E-06
Child: milk (from air, pasture) [inorganic]	9.4E-09	1.1E-07	1.0E-06	4.5E-09	6.9E-08	8.1E-07	8.0E-10	1.0E-08	1.0E-07	9.5E-10	1.3E-08	1.7E-07
Child: milk (from soil) [inorganic]	4.2E-10	2.0E-08	1.8E-06	1.7E-10	1.6E-08	1.1E-06	2.0E-10	1.6E-08	1.3E-06	1.9E-10	1.5E-08	1.3E-06
Child: milk (from soil, pasture) [inorganic]	1.1E-10	6.3E-09	3.5E-07	1.0E-10	4.8E-09	2.5E-07	7.9E-11	5.1E-09	2.2E-07	9.3E-11	5.3E-09	2.2E-07
Child: milk (from water) [inorganic]	1.1E-07	5.7E-07	2.5E-06	5.1E-08	3.2E-07	1.4E-06	1.4E-08	7.3E-08	3.4E-07	1.6E-08	7.4E-08	3.1E-07
Child: milk (Total) [inorganic]	1.4E-07	8.3E-07	4.2E-06	8.8E-08	5.3E-07	2.9E-06	2.4E-08	1.4E-07	1.6E-06	2.5E-08	1.5E-07	1.6E-06
Child: soil ingestion [inorganic]	4.4E-09	5.1E-07	2.9E-05	4.5E-09	3.2E-07	2.8E-05	3.7E-09	3.2E-07	2.9E-05	6.0E-09	2.9E-07	3.7E-05
Child: skin contact (soil) [inorganic]	6.0E-08	4.4E-06	4.0E-04	6.4E-08	3.4E-06	2.3E-04	5.3E-08	3.4E-06	2.6E-04	3.6E-08	3.8E-06	2.8E-04
Child: sediment ingestion [inorganic]	2.0E-09	1.3E-07	5.0E-06	1.4E-09	8.2E-08	6.6E-06	1.4E-09	8.7E-08	8.5E-06	1.7E-09	8.4E-08	7.1E-06
Child: skin contact (sediment) [inorganic]	2.2E-08	1.1E-06	6.7E-05	1.7E-08	8.8E-07	5.7E-05	1.6E-08	9.1E-07	3.8E-05	1.4E-08	9.1E-07	3.7E-05
Child: water ingestion [inorganic]	5.0E-08	1.2E-06	8.2E-06	2.3E-08	6.2E-07	4.6E-06	6.9E-09	1.4E-07	8.4E-07	6.4E-09	1.5E-07	1.0E-06
Child: skin contact (water) [inorganic]	5.7E-08	8.9E-07	7.8E-06	3.4E-08	5.1E-07	4.3E-06	9.3E-09	1.1E-07	1.0E-06	1.1E-08	1.2E-07	9.6E-07
Child: vegetables (from air) [inorganic]	1.0E-06	2.1E-05	2.7E-04	5.7E-07	1.3E-05	2.5E-04	1.1E-07	2.1E-06	4.0E-05	1.6E-07	2.7E-06	7.7E-05
Child: vegetables (from soil) [inorganic]	7.8E-08	4.5E-06	2.1E-04	6.4E-08	3.0E-06	1.8E-04	5.3E-08	3.3E-06	2.0E-04	8.8E-08	2.9E-06	1.3E-04
Child: vegetables (Total) [inorganic]	3.4E-06	3.6E-05	4.7E-04	1.7E-06	2.4E-05	3.5E-04	4.8E-07	8.5E-06	2.2E-04	6.6E-07	9.4E-06	2.1E-04
Child: *Total* inorganic dose	1.3E-05	7.8E-05	8.5E-04	8.8E-06	5.5E-05	5.2E-04	3.4E-06	2.8E-05	5.3E-04	3.9E-06	2.9E-05	5.3E-04

a Underlined doses exceed the USEPA Reference Dose (RfD)

Table W-4: Estimated Annual Mercury Doses, EFPC Farm Family Population (mg kg^{-1} d^{-1}) [a]

	1970			1971			1972			1973		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Adult: fish consumption [methyl]	1.1E-06	1.9E-05	2.9E-04	1.2E-06	1.9E-05	3.0E-04	9.7E-07	1.8E-05	2.9E-04	1.2E-06	1.8E-05	2.5E-04
Adult: inhalation [elemental]	1.3E-07	6.1E-07	3.7E-06	2.8E-08	1.5E-07	8.6E-07	3.1E-09	1.8E-08	8.5E-08	2.8E-07	1.6E-06	9.3E-06
Adult: beef (from air, pasture) [inorganic]	2.5E-09	3.2E-08	3.8E-07	4.8E-10	8.5E-09	9.5E-08	8.5E-11	9.3E-10	1.0E-08	7.3E-09	8.6E-08	9.7E-07
Adult: beef (from soil) [inorganic]	1.1E-10	1.1E-08	8.5E-07	3.7E-11	3.5E-09	4.6E-07	3.8E-11	3.7E-09	2.9E-07	4.1E-11	3.6E-09	2.4E-07
Adult: beef (from soil, pasture) [inorganic]	9.7E-11	2.9E-09	1.5E-07	2.2E-11	1.0E-09	8.0E-08	1.7E-11	1.2E-09	5.1E-08	2.3E-11	1.2E-09	4.0E-08
Adult: beef (from water) [inorganic]	3.4E-08	1.7E-07	7.2E-07	8.1E-09	4.0E-08	1.5E-07	1.1E-09	5.3E-09	2.2E-08	6.5E-08	3.6E-07	1.4E-06
Adult: beef (Total) [inorganic]	5.1E-08	2.7E-07	1.5E-06	1.2E-08	6.6E-08	6.9E-07	2.0E-09	1.7E-08	3.7E-07	9.0E-08	5.3E-07	2.5E-06
Adult: milk (from air, pasture) [inorganic]	2.3E-11	3.8E-10	5.0E-09	8.2E-12	9.1E-11	1.2E-09	8.3E-13	1.2E-11	1.2E-10	7.5E-11	1.0E-09	1.0E-08
Adult: milk (from soil) [inorganic]	1.5E-11	2.0E-09	1.5E-07	6.6E-12	5.6E-10	7.6E-08	5.2E-12	6.6E-10	4.6E-08	6.2E-12	5.6E-10	7.2E-08
Adult: milk (from soil, pasture) [inorganic]	1.2E-11	5.1E-10	2.1E-08	3.6E-12	1.8E-10	1.5E-08	3.1E-12	1.8E-10	1.3E-08	2.5E-12	2.1E-10	8.4E-09
Adult: milk (from water) [inorganic]	2.1E-07	1.1E-06	6.6E-06	4.1E-08	2.6E-07	1.4E-06	6.9E-09	3.7E-08	2.4E-07	4.8E-07	2.2E-06	1.2E-05
Adult: milk (Total) [inorganic]	2.1E-07	1.2E-06	6.6E-06	4.6E-08	2.7E-07	1.5E-06	7.7E-09	4.1E-08	2.8E-07	4.8E-07	2.2E-06	1.2E-05
Adult: soil ingestion [inorganic]	3.0E-10	1.8E-08	1.5E-06	6.3E-11	7.4E-09	6.5E-07	8.4E-11	7.2E-09	4.3E-07	9.4E-11	7.1E-09	6.0E-07
Adult: skin contact (soil) [inorganic]	8.1E-09	8.8E-07	6.6E-05	1.8E-09	2.6E-07	2.2E-05	3.6E-09	2.6E-07	1.8E-05	5.2E-09	2.4E-07	2.3E-05
Adult: sediment ingestion [inorganic]	8.5E-11	4.9E-09	2.6E-07	4.4E-11	1.8E-09	1.1E-07	3.3E-11	1.7E-09	1.1E-07	2.4E-11	1.9E-09	1.0E-07
Adult: skin contact (sediment) [inorganic]	2.3E-09	2.0E-07	7.9E-06	1.5E-09	6.8E-08	5.9E-06	1.2E-09	7.4E-08	3.7E-06	1.1E-09	6.9E-08	3.1E-06
Adult: water ingestion [inorganic]	1.9E-09	4.2E-08	2.3E-07	3.1E-10	1.0E-08	5.7E-08	6.2E-11	1.5E-09	7.4E-09	4.0E-09	9.2E-08	4.4E-07
Adult: skin contact (water) [inorganic]	1.2E-08	1.0E-07	7.3E-07	3.1E-09	2.4E-08	1.7E-07	4.3E-10	3.4E-09	2.4E-08	2.6E-08	2.3E-07	1.2E-06
Adult: vegetables (from air) [inorganic]	3.3E-07	5.3E-06	7.6E-05	1.1E-07	1.3E-06	1.9E-05	9.9E-09	1.5E-07	2.2E-06	9.7E-07	1.3E-05	2.2E-04
Adult: vegetables (from soil) [inorganic]	2.5E-08	1.1E-06	4.4E-05	1.1E-08	3.1E-07	1.9E-05	7.1E-09	3.7E-07	1.7E-05	8.4E-09	3.4E-07	1.4E-05
Adult: vegetables (Total) [inorganic]	7.8E-07	8.6E-06	1.1E-04	2.4E-07	2.6E-06	3.0E-05	6.1E-08	6.8E-07	1.7E-05	1.2E-06	1.5E-05	2.2E-04
Adult: *Total* inorganic dose	3.9E-06	1.7E-05	2.0E-04	9.5E-07	5.0E-06	5.7E-05	3.0E-07	2.2E-06	4.4E-05	5.0E-06	2.5E-05	2.4E-04
Child: fish consumption [methyl]	1.4E-06	2.1E-05	3.0E-04	1.6E-06	2.1E-05	3.1E-04	1.3E-06	2.1E-05	3.4E-04	1.3E-06	2.1E-05	3.2E-04
Child: inhalation [elemental]	3.2E-07	1.8E-06	9.3E-06	1.0E-07	4.3E-07	2.4E-06	1.0E-08	5.1E-08	2.4E-07	9.0E-07	4.4E-06	3.0E-05
Child: beef (from air, pasture) [inorganic]	4.2E-09	6.2E-08	7.9E-07	1.2E-09	1.6E-08	1.7E-07	1.6E-10	1.9E-09	2.1E-08	1.4E-08	1.5E-07	1.8E-06
Child: beef (from soil) [inorganic]	1.9E-10	2.0E-08	1.1E-06	5.8E-11	6.3E-09	7.7E-07	4.5E-11	6.7E-09	5.5E-07	8.1E-11	6.5E-09	5.7E-07
Child: beef (from soil, pasture) [inorganic]	1.4E-10	5.6E-09	1.8E-07	3.9E-11	1.9E-09	1.4E-07	3.1E-11	2.0E-09	1.2E-07	4.0E-11	2.2E-09	8.8E-08
Child: beef (from water) [inorganic]	5.1E-08	3.3E-07	1.6E-06	1.5E-08	7.2E-08	3.3E-07	1.9E-09	1.1E-08	5.1E-08	1.4E-07	6.6E-07	2.8E-06
Child: beef (Total) [inorganic]	7.2E-08	5.1E-07	2.9E-06	2.1E-08	1.3E-07	1.2E-06	3.9E-09	3.0E-08	7.0E-07	2.2E-07	9.3E-07	4.9E-06
Child: milk (from air, pasture) [inorganic]	4.1E-09	5.3E-08	6.2E-07	1.2E-09	1.4E-08	1.3E-07	1.3E-10	1.5E-09	1.3E-08	1.2E-08	1.4E-07	1.7E-06
Child: milk (from soil) [inorganic]	1.8E-10	1.7E-08	1.3E-06	3.9E-11	6.0E-09	7.1E-07	4.7E-11	6.3E-09	3.4E-07	5.1E-11	5.9E-09	7.0E-07
Child: milk (from soil, pasture) [inorganic]	1.3E-10	4.7E-09	2.2E-07	3.2E-11	1.7E-09	1.1E-07	3.2E-11	1.6E-09	1.2E-07	3.3E-11	1.7E-09	7.6E-08
Child: milk (from water) [inorganic]	7.1E-08	3.1E-07	1.4E-06	1.5E-08	6.9E-08	3.0E-07	2.2E-09	1.0E-08	4.5E-08	1.4E-07	6.5E-07	2.6E-06
Child: milk (Total) [inorganic]	1.0E-07	4.6E-07	2.4E-06	2.2E-08	1.2E-07	1.1E-06	3.7E-09	2.8E-08	4.5E-07	1.9E-07	8.8E-07	4.2E-06
Child: soil ingestion [inorganic]	4.1E-09	3.7E-07	2.9E-05	1.1E-09	1.2E-07	1.3E-05	1.1E-09	1.3E-07	8.1E-06	2.0E-09	1.2E-07	1.0E-05
Child: skin contact (soil) [inorganic]	4.7E-08	3.3E-06	2.8E-04	1.5E-08	1.2E-06	9.4E-05	1.3E-08	1.3E-06	7.7E-05	1.7E-08	1.1E-06	1.5E-04
Child: sediment ingestion [inorganic]	1.2E-09	8.5E-08	4.1E-06	6.3E-10	2.7E-08	2.9E-06	3.0E-10	2.9E-08	2.5E-06	6.2E-10	3.1E-08	2.0E-06
Child: skin contact (sediment) [inorganic]	1.6E-08	9.8E-07	5.6E-05	4.6E-09	3.5E-07	1.7E-05	7.5E-09	3.0E-07	1.6E-05	4.8E-09	3.4E-07	1.7E-05
Child: water ingestion [inorganic]	2.5E-08	6.5E-07	3.7E-06	4.7E-09	1.5E-07	9.4E-07	1.0E-09	2.0E-08	1.2E-07	4.4E-08	1.3E-06	8.4E-06
Child: skin contact (water) [inorganic]	4.5E-08	4.6E-07	4.8E-06	8.3E-09	1.1E-07	1.0E-06	1.4E-09	1.6E-08	1.3E-07	8.3E-08	9.6E-07	1.0E-05
Child: vegetables (from air) [inorganic]	3.0E-07	1.0E-05	2.1E-04	1.3E-07	2.5E-06	5.1E-05	1.6E-08	2.7E-07	6.2E-06	1.0E-06	2.7E-05	3.9E-04
Child: vegetables (from soil) [inorganic]	6.7E-08	2.8E-06	1.6E-04	2.1E-08	1.2E-06	7.8E-05	1.9E-08	1.1E-06	7.9E-05	2.7E-08	1.1E-06	5.9E-05
Child: vegetables (Total) [inorganic]	1.5E-06	2.0E-05	3.2E-04	4.1E-07	6.0E-06	9.4E-05	1.3E-07	2.1E-06	8.0E-05	1.6E-06	3.5E-05	3.9E-04
Child: *Total* inorganic dose	7.3E-06	5.3E-05	6.1E-04	1.9E-06	1.5E-05	2.5E-04	8.6E-07	9.5E-06	1.9E-04	8.5E-06	5.8E-05	5.3E-04

a Underlined doses exceed the USEPA Reference Dose (RfD)

Table W-4: Estimated Annual Mercury Doses, EFPC Farm Family Population (mg kg^{-1} d^{-1}) [a]

	1974			1975			1976			1977		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Adult: fish consumption [methyl]	1.1E-06	1.9E-05	2.9E-04	9.3E-07	1.6E-05	2.5E-04	9.9E-07	1.6E-05	2.6E-04	9.3E-07	1.5E-05	2.4E-04
Adult: inhalation [elemental]	5.5E-08	3.1E-07	1.5E-06	3.8E-09	1.9E-08	1.0E-07	4.4E-09	2.1E-08	1.2E-07	7.5E-09	4.5E-08	2.3E-07
Adult: beef (from air, pasture) [inorganic]	1.4E-09	1.6E-08	1.7E-07	7.4E-11	1.1E-09	1.1E-08	8.2E-11	1.2E-09	1.3E-08	1.9E-10	2.2E-09	3.4E-08
Adult: beef (from soil) [inorganic]	4.4E-11	3.3E-09	4.1E-07	3.0E-11	2.3E-09	1.9E-07	2.5E-11	2.5E-09	2.0E-07	1.7E-11	2.5E-09	3.8E-07
Adult: beef (from soil, pasture) [inorganic]	1.8E-11	9.5E-10	7.5E-08	1.3E-11	7.5E-10	4.3E-08	1.2E-11	8.3E-10	3.8E-08	1.6E-11	8.5E-10	4.3E-08
Adult: beef (from water) [inorganic]	1.6E-08	7.7E-08	3.5E-07	1.0E-09	5.2E-09	2.0E-08	1.4E-09	6.1E-09	2.5E-08	2.2E-09	1.1E-08	4.7E-08
Adult: beef (Total) [inorganic]	2.3E-08	1.2E-07	7.0E-07	2.0E-09	1.3E-08	2.9E-07	2.3E-09	1.5E-08	2.5E-07	3.8E-09	2.5E-08	4.6E-07
Adult: milk (from air, pasture) [inorganic]	1.3E-11	1.8E-10	2.3E-09	7.2E-13	1.1E-11	1.5E-10	1.0E-12	1.3E-11	1.8E-10	1.9E-12	2.8E-11	3.2E-10
Adult: milk (from soil) [inorganic]	5.4E-12	5.6E-10	6.6E-08	4.2E-12	3.5E-10	4.7E-08	3.6E-12	4.4E-10	3.9E-08	3.3E-12	3.9E-10	7.3E-08
Adult: milk (from soil, pasture) [inorganic]	3.9E-12	1.9E-10	1.5E-08	1.8E-12	1.2E-10	6.4E-09	1.8E-12	1.3E-10	7.7E-09	1.3E-12	1.3E-10	1.0E-08
Adult: milk (from water) [inorganic]	9.1E-08	5.4E-07	2.7E-06	7.3E-09	3.5E-08	1.9E-07	8.0E-09	4.2E-08	2.2E-07	1.7E-08	8.3E-08	4.3E-07
Adult: milk (Total) [inorganic]	9.2E-08	5.4E-07	2.7E-06	8.0E-09	3.9E-08	2.2E-07	8.4E-09	4.6E-08	2.5E-07	1.7E-08	8.5E-08	5.0E-07
Adult: soil ingestion [inorganic]	7.9E-11	6.3E-09	6.3E-07	4.6E-11	4.7E-09	3.8E-07	5.7E-11	5.0E-09	3.4E-07	2.7E-11	4.7E-09	9.1E-07
Adult: skin contact (soil) [inorganic]	2.3E-09	2.5E-07	2.2E-05	1.6E-09	2.1E-07	1.4E-05	1.2E-09	1.9E-07	1.9E-05	2.1E-09	2.0E-07	1.4E-05
Adult: sediment ingestion [inorganic]	3.1E-11	1.6E-09	1.0E-07	1.7E-11	1.4E-09	7.0E-08	1.7E-11	1.2E-09	1.1E-07	1.7E-11	1.2E-09	6.1E-08
Adult: skin contact (sediment) [inorganic]	1.3E-09	6.6E-08	4.1E-06	6.9E-10	4.2E-08	3.8E-06	7.8E-10	4.6E-08	3.0E-06	8.8E-10	4.7E-08	2.4E-06
Adult: water ingestion [inorganic]	8.9E-10	1.9E-08	9.7E-08	5.8E-11	1.5E-09	6.8E-09	8.0E-11	1.5E-09	8.6E-09	1.5E-10	3.0E-09	1.7E-08
Adult: skin contact (water) [inorganic]	5.3E-09	4.7E-08	3.1E-07	3.7E-10	3.0E-09	2.2E-08	3.7E-10	3.8E-09	2.4E-08	1.1E-09	6.9E-09	5.0E-08
Adult: vegetables (from air) [inorganic]	2.1E-07	2.8E-06	4.0E-05	1.1E-08	1.9E-07	2.7E-06	1.1E-08	2.1E-07	3.4E-06	1.8E-08	3.9E-07	6.3E-06
Adult: vegetables (from soil) [inorganic]	8.0E-09	3.4E-07	1.3E-05	4.2E-09	2.5E-07	1.3E-05	6.5E-09	2.7E-07	1.1E-05	5.5E-09	2.3E-07	1.9E-05
Adult: vegetables (Total) [inorganic]	3.3E-07	4.0E-06	5.2E-05	4.9E-08	5.9E-07	1.4E-05	5.9E-08	6.9E-07	1.3E-05	1.0E-07	1.1E-06	2.0E-05
Adult: *Total* inorganic dose	1.3E-06	7.8E-06	6.5E-05	2.5E-07	1.8E-06	2.5E-05	2.6E-07	1.8E-06	3.6E-05	4.0E-07	2.3E-06	3.8E-05
Child: fish consumption [methyl]	1.3E-06	2.0E-05	3.5E-04	1.1E-06	1.8E-05	2.7E-04	1.3E-06	1.9E-05	2.6E-04	1.1E-06	1.8E-05	2.7E-04
Child: inhalation [elemental]	1.9E-07	8.9E-07	3.9E-06	1.1E-08	5.6E-08	2.9E-07	1.3E-08	6.5E-08	3.1E-07	2.4E-08	1.3E-07	6.3E-07
Child: beef (from air, pasture) [inorganic]	2.7E-09	3.0E-08	4.0E-07	1.6E-10	2.1E-09	2.2E-08	1.6E-10	2.3E-09	2.4E-08	3.0E-10	4.4E-09	6.6E-08
Child: beef (from soil) [inorganic]	5.5E-11	5.8E-09	7.5E-07	5.2E-11	4.1E-09	5.0E-07	6.2E-11	4.6E-09	4.1E-07	2.5E-11	5.0E-09	9.8E-07
Child: beef (from soil, pasture) [inorganic]	4.3E-11	2.0E-09	1.5E-07	2.1E-11	1.5E-09	7.9E-08	2.3E-11	1.6E-09	9.4E-08	1.9E-11	1.6E-09	8.7E-08
Child: beef (from water) [inorganic]	2.9E-08	1.4E-07	6.8E-07	1.7E-09	9.6E-09	5.2E-08	2.2E-09	1.2E-08	6.1E-08	4.1E-09	2.2E-08	1.0E-07
Child: beef (Total) [inorganic]	4.2E-08	2.2E-07	1.7E-06	3.7E-09	2.5E-08	5.6E-07	4.0E-09	2.9E-08	4.9E-07	5.6E-09	4.4E-08	1.1E-06
Child: milk (from air, pasture) [inorganic]	2.0E-09	2.5E-08	3.3E-07	9.5E-11	1.6E-09	1.7E-08	1.6E-10	1.9E-09	2.2E-08	3.3E-10	3.7E-09	5.8E-08
Child: milk (from soil) [inorganic]	5.4E-11	4.8E-09	6.3E-07	4.8E-11	3.3E-09	3.4E-07	4.3E-11	3.9E-09	3.7E-07	2.4E-11	4.4E-09	4.6E-07
Child: milk (from soil, pasture) [inorganic]	2.8E-11	1.8E-09	9.4E-08	1.7E-11	1.3E-09	6.1E-08	1.9E-11	1.2E-09	6.0E-08	1.3E-11	1.3E-09	9.9E-08
Child: milk (from water) [inorganic]	2.8E-08	1.5E-07	6.5E-07	2.0E-09	9.6E-09	4.1E-08	2.4E-09	1.1E-08	5.1E-08	4.4E-09	2.0E-08	9.3E-08
Child: milk (Total) [inorganic]	4.3E-08	2.2E-07	1.3E-06	3.4E-09	2.3E-08	4.1E-07	4.6E-09	2.5E-08	4.7E-07	6.8E-09	4.2E-08	6.2E-07
Child: soil ingestion [inorganic]	1.3E-09	1.2E-07	1.2E-05	9.8E-10	7.8E-08	8.3E-06	1.1E-09	8.0E-08	7.9E-06	7.6E-10	7.9E-08	1.1E-05
Child: skin contact (soil) [inorganic]	1.4E-08	1.3E-06	9.0E-05	9.2E-09	8.3E-07	9.2E-05	8.6E-09	9.3E-07	8.4E-05	1.1E-08	9.2E-07	8.3E-05
Child: sediment ingestion [inorganic]	6.3E-10	2.8E-08	1.3E-06	3.0E-10	2.2E-08	1.3E-06	1.9E-10	1.8E-08	1.6E-06	2.8E-10	2.2E-08	1.4E-06
Child: skin contact (sediment) [inorganic]	6.6E-09	3.5E-07	1.4E-05	3.4E-09	2.3E-07	1.1E-05	2.4E-09	2.5E-07	1.6E-05	3.7E-09	2.5E-07	1.5E-05
Child: water ingestion [inorganic]	1.2E-08	3.0E-07	1.7E-06	8.3E-10	1.9E-08	1.3E-07	1.0E-09	2.3E-08	1.5E-07	1.4E-09	4.6E-08	2.3E-07
Child: skin contact (water) [inorganic]	1.4E-08	2.4E-07	1.9E-06	1.2E-09	1.5E-08	1.4E-07	1.3E-09	1.8E-08	1.8E-07	2.9E-09	3.8E-08	2.9E-07
Child: vegetables (from air) [inorganic]	2.1E-07	5.1E-06	8.8E-05	1.3E-08	3.2E-07	7.4E-06	1.5E-08	3.7E-07	1.1E-05	3.7E-08	8.2E-07	1.5E-05
Child: vegetables (from soil) [inorganic]	2.2E-08	1.1E-06	8.7E-05	1.2E-08	7.3E-07	5.6E-05	9.9E-09	8.7E-07	4.0E-05	1.4E-08	7.5E-07	3.6E-05
Child: vegetables (Total) [inorganic]	9.7E-07	8.6E-06	1.6E-04	1.2E-07	1.5E-06	6.0E-05	1.2E-07	1.8E-06	4.2E-05	2.0E-07	2.5E-06	4.7E-05
Child: *Total* inorganic dose	3.3E-06	2.1E-05	1.9E-04	6.3E-07	7.1E-06	1.7E-04	8.6E-07	7.1E-06	1.5E-04	1.1E-06	8.1E-06	1.3E-04

a Underlined doses exceed the USEPA Reference Dose (RfD)

Table W-4: Estimated Annual Mercury Doses, EFPC Farm Family Population (mg kg^{-1} d^{-1}) [a]

	1978			1979			1980			1981		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Adult: fish consumption [methyl]	8.9E-07	1.5E-05	2.4E-04	9.8E-07	1.4E-05	2.5E-04	9.7E-07	1.4E-05	2.2E-04	8.0E-07	1.3E-05	2.0E-04
Adult: inhalation [elemental]	3.7E-09	2.0E-08	1.1E-07	6.6E-09	3.8E-08	2.5E-07	9.2E-09	4.6E-08	2.7E-07	6.0E-09	2.9E-08	1.6E-07
Adult: beef (from air, pasture) [inorganic]	7.3E-11	1.0E-09	9.8E-09	1.5E-10	2.0E-09	3.1E-08	1.8E-10	2.5E-09	3.1E-08	1.0E-10	1.6E-09	2.1E-08
Adult: beef (from soil) [inorganic]	2.5E-11	2.5E-09	2.0E-07	1.1E-11	1.4E-09	1.4E-07	1.3E-11	1.5E-09	1.1E-07	1.7E-11	1.2E-09	1.5E-07
Adult: beef (from soil, pasture) [inorganic]	1.6E-11	8.6E-10	4.8E-08	8.1E-12	3.9E-10	2.6E-08	8.2E-12	4.4E-10	2.6E-08	9.0E-12	3.9E-10	2.0E-08
Adult: beef (from water) [inorganic]	1.1E-09	5.6E-09	2.4E-08	2.0E-09	9.8E-09	4.6E-08	2.8E-09	1.4E-08	6.1E-08	2.7E-09	1.3E-08	5.8E-08
Adult: beef (Total) [inorganic]	2.1E-09	1.4E-08	2.5E-07	3.0E-09	1.9E-08	2.3E-07	4.6E-09	2.4E-08	1.8E-07	3.5E-09	2.2E-08	2.3E-07
Adult: milk (from air, pasture) [inorganic]	7.2E-13	1.2E-11	9.7E-11	2.1E-12	2.3E-11	2.9E-10	1.4E-12	2.8E-11	3.6E-10	1.6E-12	1.9E-11	2.2E-10
Adult: milk (from soil) [inorganic]	4.9E-12	4.0E-10	5.3E-08	1.8E-12	2.5E-10	2.4E-08	2.2E-12	2.5E-10	2.4E-08	3.0E-12	2.5E-10	2.6E-08
Adult: milk (from soil, pasture) [inorganic]	2.0E-12	1.2E-10	9.8E-09	1.0E-12	7.3E-11	5.6E-09	1.1E-12	7.4E-11	4.5E-09	1.4E-12	7.0E-11	5.2E-09
Adult: milk (from water) [inorganic]	7.4E-09	4.1E-08	1.9E-07	1.3E-08	7.4E-08	3.8E-07	1.8E-08	9.8E-08	4.6E-07	1.9E-08	8.8E-08	4.5E-07
Adult: milk (Total) [inorganic]	8.2E-09	4.4E-08	2.2E-07	1.4E-08	7.5E-08	3.9E-07	1.9E-08	1.0E-07	4.6E-07	1.9E-08	9.0E-08	4.8E-07
Adult: soil ingestion [inorganic]	4.3E-11	5.3E-09	7.4E-07	2.4E-11	2.7E-09	2.2E-07	2.9E-11	2.4E-09	2.2E-07	3.3E-11	2.3E-09	2.9E-07
Adult: skin contact (soil) [inorganic]	1.2E-09	1.9E-07	1.9E-05	9.9E-10	1.1E-07	7.9E-06	1.5E-09	9.4E-08	8.5E-06	9.5E-10	1.0E-07	8.6E-06
Adult: sediment ingestion [inorganic]	1.9E-11	1.1E-09	1.2E-07	1.2E-11	6.3E-10	4.8E-08	8.9E-12	7.9E-10	7.5E-08	1.1E-11	7.3E-10	6.3E-08
Adult: skin contact (sediment) [inorganic]	4.7E-10	4.5E-08	4.7E-06	3.5E-10	2.6E-08	1.3E-06	3.4E-10	2.5E-08	1.6E-06	5.0E-10	2.2E-08	2.0E-06
Adult: water ingestion [inorganic]	5.1E-11	1.5E-09	8.5E-09	1.4E-10	2.6E-09	1.5E-08	1.8E-10	3.6E-09	2.0E-08	1.5E-10	3.3E-09	1.9E-08
Adult: skin contact (water) [inorganic]	4.6E-10	3.6E-09	2.2E-08	8.2E-10	6.1E-09	4.3E-08	1.0E-09	8.6E-09	6.3E-08	9.6E-10	8.3E-09	5.8E-08
Adult: vegetables (from air) [inorganic]	1.1E-08	1.8E-07	2.3E-06	2.4E-08	3.3E-07	5.3E-06	2.1E-08	4.3E-07	4.8E-06	1.8E-08	2.6E-07	3.8E-06
Adult: vegetables (from soil) [inorganic]	6.1E-09	2.6E-07	7.1E-06	3.8E-09	1.2E-07	6.6E-06	2.7E-09	1.4E-07	7.1E-06	3.2E-09	1.4E-07	5.8E-06
Adult: vegetables (Total) [inorganic]	5.2E-08	6.7E-07	7.5E-06	5.5E-08	6.8E-07	1.1E-05	6.3E-08	8.2E-07	1.1E-05	4.5E-08	6.1E-07	8.0E-06
Adult: *Total* inorganic dose	2.6E-07	1.9E-06	3.7E-05	2.3E-07	1.5E-06	1.6E-05	2.6E-07	1.7E-06	1.9E-05	2.7E-07	1.4E-06	1.8E-05
Child: fish consumption [methyl]	1.0E-06	1.7E-05	2.9E-04	1.2E-06	1.6E-05	2.4E-04	1.1E-06	1.6E-05	2.4E-04	9.2E-07	1.5E-05	2.6E-04
Child: inhalation [elemental]	1.2E-08	5.7E-08	2.9E-07	2.3E-08	1.1E-07	6.0E-07	2.8E-08	1.4E-07	7.4E-07	1.8E-08	9.0E-08	4.2E-07
Child: beef (from air, pasture) [inorganic]	1.2E-10	1.9E-09	2.5E-08	2.7E-10	4.2E-09	6.7E-08	3.4E-10	4.4E-09	6.3E-08	1.6E-10	3.2E-09	4.1E-08
Child: beef (from soil) [inorganic]	3.7E-11	5.1E-09	4.1E-07	2.2E-11	2.5E-09	2.9E-07	2.1E-11	2.8E-09	2.3E-07	3.0E-11	2.3E-09	3.1E-07
Child: beef (from soil, pasture) [inorganic]	2.5E-11	1.6E-09	7.4E-08	1.5E-11	7.3E-10	5.3E-08	1.1E-11	8.0E-10	5.1E-08	1.8E-11	8.2E-10	5.5E-08
Child: beef (from water) [inorganic]	2.0E-09	1.1E-08	5.0E-08	3.3E-09	2.0E-08	9.2E-08	4.7E-09	2.7E-08	1.2E-07	5.4E-09	2.5E-08	1.2E-07
Child: beef (Total) [inorganic]	3.8E-09	2.7E-08	4.8E-07	4.7E-09	3.8E-08	4.0E-07	7.6E-09	4.4E-08	3.4E-07	6.9E-09	4.1E-08	5.0E-07
Child: milk (from air, pasture) [inorganic]	1.1E-10	1.7E-09	1.6E-08	2.6E-10	3.1E-09	5.0E-08	2.7E-10	4.0E-09	4.3E-08	2.0E-10	2.6E-09	2.6E-08
Child: milk (from soil) [inorganic]	5.3E-11	3.7E-09	4.4E-07	1.2E-11	2.2E-09	2.4E-07	2.5E-11	2.2E-09	2.2E-07	2.3E-11	2.4E-09	2.3E-07
Child: milk (from soil, pasture) [inorganic]	1.9E-11	1.1E-09	7.3E-08	8.8E-12	7.4E-10	4.9E-08	1.0E-11	5.9E-10	4.3E-08	1.3E-11	7.0E-10	4.5E-08
Child: milk (from water) [inorganic]	2.4E-09	9.9E-09	4.6E-08	4.2E-09	1.9E-08	8.6E-08	5.6E-09	2.5E-08	1.2E-07	4.8E-09	2.4E-08	1.0E-07
Child: milk (Total) [inorganic]	4.0E-09	2.3E-08	4.7E-07	5.8E-09	3.2E-08	3.2E-07	8.7E-09	4.3E-08	4.2E-07	6.3E-09	3.8E-08	2.7E-07
Child: soil ingestion [inorganic]	1.2E-09	9.1E-08	6.8E-06	4.3E-10	5.1E-08	6.0E-06	3.7E-10	4.7E-08	3.8E-06	6.0E-10	4.0E-08	6.1E-06
Child: skin contact (soil) [inorganic]	9.3E-09	8.9E-07	7.3E-05	4.1E-09	5.1E-07	4.2E-05	7.7E-09	4.8E-07	4.8E-05	5.9E-09	4.7E-07	3.3E-05
Child: sediment ingestion [inorganic]	2.9E-10	2.0E-08	1.8E-06	2.1E-10	1.0E-08	9.1E-07	1.5E-10	1.2E-08	1.3E-06	1.6E-10	1.2E-08	1.3E-06
Child: skin contact (sediment) [inorganic]	3.2E-09	2.1E-07	1.7E-05	1.9E-09	1.3E-07	7.7E-06	1.3E-09	1.3E-07	5.4E-06	1.6E-09	1.1E-07	1.4E-05
Child: water ingestion [inorganic]	8.0E-10	2.1E-08	1.2E-07	1.9E-09	3.9E-08	2.3E-07	2.0E-09	5.6E-08	3.1E-07	1.6E-09	5.0E-08	3.4E-07
Child: skin contact (water) [inorganic]	1.6E-09	1.7E-08	1.4E-07	2.1E-09	3.1E-08	2.7E-07	3.3E-09	4.0E-08	3.4E-07	3.9E-09	3.7E-08	3.7E-07
Child: vegetables (from air) [inorganic]	1.6E-08	3.0E-07	6.1E-06	4.0E-08	6.1E-07	1.5E-05	3.7E-08	7.9E-07	1.7E-05	1.7E-08	5.3E-07	1.3E-05
Child: vegetables (from soil) [inorganic]	8.1E-09	8.0E-07	6.9E-05	1.3E-08	3.8E-07	2.2E-05	7.5E-09	4.3E-07	3.7E-05	8.9E-09	4.2E-07	2.6E-05
Child: vegetables (Total) [inorganic]	1.1E-07	1.6E-06	6.9E-05	1.5E-07	1.7E-06	3.5E-05	1.5E-07	2.0E-06	4.3E-05	9.3E-08	1.5E-06	3.1E-05
Child: *Total* inorganic dose	7.1E-07	6.5E-06	1.3E-04	5.5E-07	5.2E-06	7.2E-05	8.2E-07	5.3E-06	1.0E-04	6.4E-07	4.6E-06	7.5E-05

a Underlined doses exceed the USEPA Reference Dose (RfD)

Table W-4: Estimated Annual Mercury Doses, EFPC Farm Family Population (mg kg^{-1} d^{-1}) [a]

	1982			1983			1984			1985		
	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile
Adult: fish consumption [methyl]	8.3E-07	1.3E-05	2.3E-04	6.9E-07	1.1E-05	1.7E-04	5.9E-07	1.0E-05	1.5E-04	4.4E-07	7.6E-06	1.2E-04
Adult: inhalation [elemental]	1.1E-08	5.9E-08	3.3E-07	1.0E-08	5.1E-08	3.1E-07	8.5E-09	4.1E-08	2.6E-07	8.8E-09	5.0E-08	2.2E-07
Adult: beef (from air, pasture) [inorganic]	2.3E-10	3.2E-09	3.2E-08	1.9E-10	2.8E-09	3.0E-08	2.2E-10	1.9E-09	3.7E-08	2.4E-10	2.3E-09	2.9E-08
Adult: beef (from soil) [inorganic]	1.7E-11	1.1E-09	1.3E-07	4.9E-12	7.6E-10	1.2E-07	6.5E-12	6.7E-10	1.2E-07	4.7E-12	7.6E-10	8.9E-08
Adult: beef (from soil, pasture) [inorganic]	6.5E-12	3.7E-10	3.8E-08	3.4E-12	2.5E-10	2.5E-08	3.0E-12	2.4E-10	1.8E-08	2.9E-12	2.4E-10	2.7E-08
Adult: beef (from water) [inorganic]	4.1E-09	1.7E-08	8.3E-08	2.6E-09	1.3E-08	6.4E-08	2.2E-09	1.0E-08	3.9E-08	2.4E-09	1.3E-08	5.9E-08
Adult: beef (Total) [inorganic]	6.1E-09	2.8E-08	2.4E-07	3.4E-09	2.3E-08	1.7E-07	3.2E-09	1.7E-08	1.9E-07	4.0E-09	2.2E-08	1.6E-07
Adult: milk (from air, pasture) [inorganic]	2.6E-12	3.4E-11	5.7E-10	2.0E-12	3.0E-11	4.2E-10	2.0E-12	2.6E-11	3.7E-10	2.0E-12	3.0E-11	3.6E-10
Adult: milk (from soil) [inorganic]	2.3E-12	1.9E-10	2.9E-08	7.1E-13	1.4E-10	2.2E-08	9.1E-13	1.4E-10	1.5E-08	8.0E-13	1.3E-10	2.3E-08
Adult: milk (from soil, pasture) [inorganic]	1.2E-12	6.4E-11	6.4E-09	4.0E-13	4.5E-11	2.9E-09	5.5E-13	4.3E-11	2.9E-09	5.3E-13	3.8E-11	5.3E-09
Adult: milk (from water) [inorganic]	2.4E-08	1.3E-07	5.9E-07	1.5E-08	9.5E-08	5.3E-07	1.5E-08	7.0E-08	3.6E-07	1.7E-08	8.5E-08	4.4E-07
Adult: milk (Total) [inorganic]	2.5E-08	1.3E-07	6.0E-07	1.6E-08	9.5E-08	5.3E-07	1.5E-08	7.2E-08	3.6E-07	1.7E-08	8.6E-08	4.6E-07
Adult: soil ingestion [inorganic]	3.5E-11	2.6E-09	3.6E-07	1.2E-11	1.5E-09	2.4E-07	9.3E-12	1.5E-09	3.7E-07	9.9E-12	1.6E-09	3.0E-07
Adult: skin contact (soil) [inorganic]	1.1E-09	9.4E-08	1.1E-05	4.9E-10	6.0E-08	5.8E-06	3.5E-10	5.4E-08	1.0E-05	5.0E-10	5.6E-08	7.4E-06
Adult: sediment ingestion [inorganic]	8.5E-12	6.0E-10	5.4E-08	3.2E-12	4.1E-10	3.4E-08	5.1E-12	4.1E-10	3.9E-08	3.7E-12	3.5E-10	4.5E-08
Adult: skin contact (sediment) [inorganic]	3.8E-10	2.2E-08	1.3E-06	2.3E-10	1.3E-08	1.1E-06	1.6E-10	1.4E-08	1.3E-06	1.6E-10	1.6E-08	1.2E-06
Adult: water ingestion [inorganic]	2.2E-10	4.9E-09	2.5E-08	1.8E-10	3.5E-09	1.7E-08	1.2E-10	2.8E-09	1.3E-08	1.4E-10	3.3E-09	1.8E-08
Adult: skin contact (water) [inorganic]	1.4E-09	1.1E-08	7.9E-08	9.8E-10	8.6E-09	5.0E-08	7.7E-10	6.3E-09	3.7E-08	9.2E-10	8.0E-09	5.1E-08
Adult: vegetables (from air) [inorganic]	3.3E-08	5.0E-07	7.3E-06	2.7E-08	4.4E-07	6.3E-06	2.5E-08	3.6E-07	6.5E-06	1.9E-08	4.4E-07	5.8E-06
Adult: vegetables (from soil) [inorganic]	4.7E-09	1.3E-07	5.3E-06	1.2E-09	7.3E-08	5.2E-06	1.2E-09	8.2E-08	3.6E-06	1.3E-09	8.1E-08	5.5E-06
Adult: vegetables (Total) [inorganic]	8.2E-08	9.9E-07	1.0E-05	7.9E-08	7.7E-07	1.0E-05	6.4E-08	6.5E-07	8.1E-06	6.2E-08	7.7E-07	7.9E-06
Adult: *Total* inorganic dose	3.3E-07	1.9E-06	2.1E-05	2.6E-07	1.5E-06	1.5E-05	2.6E-07	1.4E-06	1.5E-05	2.5E-07	1.4E-06	1.5E-05
Child: fish consumption [methyl]	9.9E-07	1.5E-05	2.4E-04	8.2E-07	1.3E-05	2.0E-04	7.5E-07	1.2E-05	1.6E-04	5.7E-07	8.6E-06	1.4E-04
Child: inhalation [elemental]	3.4E-08	1.7E-07	8.7E-07	3.1E-08	1.5E-07	7.5E-07	2.8E-08	1.2E-07	7.1E-07	2.7E-08	1.5E-07	6.9E-07
Child: beef (from air, pasture) [inorganic]	4.6E-10	6.4E-09	7.7E-08	3.5E-10	5.0E-09	7.0E-08	3.2E-10	3.9E-09	6.7E-08	4.9E-10	4.6E-09	6.6E-08
Child: beef (from soil) [inorganic]	3.4E-11	2.3E-09	2.5E-07	7.3E-12	1.4E-09	1.9E-07	1.2E-11	1.3E-09	1.7E-07	8.9E-12	1.5E-09	1.6E-07
Child: beef (from soil, pasture) [inorganic]	1.5E-11	7.3E-10	8.4E-08	6.1E-12	4.5E-10	4.8E-08	5.9E-12	4.4E-10	4.0E-08	5.7E-12	4.4E-10	4.4E-08
Child: beef (from water) [inorganic]	6.9E-09	3.7E-08	1.8E-07	4.6E-09	2.6E-08	1.1E-07	3.9E-09	1.9E-08	9.1E-08	4.5E-09	2.4E-08	1.2E-07
Child: beef (Total) [inorganic]	1.1E-08	5.6E-08	4.7E-07	6.5E-09	4.2E-08	2.9E-07	5.5E-09	3.3E-08	3.5E-07	7.2E-09	4.1E-08	2.6E-07
Child: milk (from air, pasture) [inorganic]	3.6E-10	4.9E-09	5.2E-08	3.4E-10	3.9E-09	6.3E-08	2.4E-10	3.4E-09	5.7E-08	2.4E-10	4.2E-09	5.5E-08
Child: milk (from soil) [inorganic]	2.3E-11	1.8E-09	2.1E-07	9.7E-12	1.3E-09	1.5E-07	6.7E-12	1.2E-09	1.4E-07	4.6E-12	1.4E-09	1.8E-07
Child: milk (from soil, pasture) [inorganic]	1.2E-11	5.6E-10	5.8E-08	5.1E-12	3.5E-10	2.4E-08	3.3E-12	4.0E-10	2.2E-08	5.1E-12	3.6E-10	5.5E-08
Child: milk (from water) [inorganic]	7.3E-09	3.3E-08	1.4E-07	5.6E-09	2.5E-08	1.1E-07	4.0E-09	1.9E-08	8.6E-08	5.1E-09	2.2E-08	1.0E-07
Child: milk (Total) [inorganic]	1.0E-08	5.2E-08	3.9E-07	7.0E-09	3.9E-08	2.9E-07	5.6E-09	3.2E-08	2.5E-07	6.5E-09	3.7E-08	3.4E-07
Child: soil ingestion [inorganic]	4.8E-10	4.1E-08	4.9E-06	1.5E-10	2.8E-08	2.7E-06	2.0E-10	2.6E-08	4.3E-06	1.9E-10	2.8E-08	3.6E-06
Child: skin contact (soil) [inorganic]	5.1E-09	4.5E-07	4.8E-05	2.6E-09	2.6E-07	3.2E-05	2.1E-09	2.5E-07	3.6E-05	3.3E-09	2.8E-07	3.7E-05
Child: sediment ingestion [inorganic]	2.0E-10	1.1E-08	1.1E-06	9.1E-11	6.4E-09	6.7E-07	7.1E-11	6.7E-09	6.1E-07	8.3E-11	5.9E-09	8.3E-07
Child: skin contact (sediment) [inorganic]	1.9E-09	1.3E-07	9.5E-06	7.9E-10	7.2E-08	7.7E-06	8.9E-10	7.6E-08	3.9E-06	5.2E-10	7.7E-08	1.1E-05
Child: water ingestion [inorganic]	3.2E-09	7.6E-08	5.3E-07	2.2E-09	5.5E-08	3.4E-07	1.4E-09	3.6E-08	2.4E-07	1.7E-09	4.9E-08	2.7E-07
Child: skin contact (water) [inorganic]	3.8E-09	5.6E-08	4.9E-07	4.4E-09	4.0E-08	3.0E-07	2.9E-09	2.8E-08	2.5E-07	3.0E-09	3.8E-08	2.7E-07
Child: vegetables (from air) [inorganic]	3.9E-08	9.6E-07	2.2E-05	3.5E-08	8.1E-07	2.0E-05	3.6E-08	7.0E-07	1.4E-05	3.0E-08	7.6E-07	1.7E-05
Child: vegetables (from soil) [inorganic]	1.1E-08	4.3E-07	2.2E-05	2.6E-09	2.4E-07	2.1E-05	4.4E-09	2.7E-07	1.4E-05	4.0E-09	2.6E-07	2.1E-05
Child: vegetables (Total) [inorganic]	1.3E-07	2.2E-06	3.3E-05	1.1E-07	1.8E-06	3.4E-05	1.0E-07	1.4E-06	3.8E-05	1.9E-07	1.7E-06	3.4E-05
Child: *Total* inorganic dose	7.8E-07	6.2E-06	8.1E-05	5.6E-07	4.4E-06	9.9E-05	5.4E-07	3.9E-06	6.3E-05	6.1E-07	4.1E-06	6.0E-05

a Underlined doses exceed the USEPA Reference Dose (RfD)

Table W-4: Estimated Annual Mercury Doses, EFPC Farm Family Population (mg kg^{-1} d^{-1}) [a]

	1986			1987			1988			1989		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Adult: fish consumption [methyl]	5.6E-07	7.7E-06	1.3E-04	5.2E-07	7.9E-06	1.2E-04	5.0E-07	7.7E-06	1.3E-04	5.2E-07	8.0E-06	1.2E-04
Adult: inhalation [elemental]	1.1E-08	5.8E-08	3.1E-07	1.2E-08	6.5E-08	3.5E-07	7.7E-09	3.5E-08	1.9E-07	6.3E-09	3.5E-08	1.8E-07
Adult: beef (from air, pasture) [inorganic]	2.5E-10	2.9E-09	3.3E-08	2.4E-10	3.1E-09	4.4E-08	1.9E-10	1.7E-09	2.4E-08	1.0E-10	2.0E-09	2.2E-08
Adult: beef (from soil) [inorganic]	6.6E-12	7.8E-10	8.1E-08	5.1E-12	7.1E-10	7.1E-08	6.2E-12	7.9E-10	8.4E-08	5.6E-12	7.9E-10	1.0E-07
Adult: beef (from soil, pasture) [inorganic]	4.0E-12	2.7E-10	2.3E-08	3.1E-12	2.6E-10	1.8E-08	3.3E-12	2.2E-10	1.9E-08	3.4E-12	2.3E-10	1.8E-08
Adult: beef (from water) [inorganic]	3.9E-09	1.6E-08	7.2E-08	4.4E-09	2.0E-08	7.7E-08	2.4E-09	1.1E-08	4.8E-08	1.7E-09	8.9E-09	4.1E-08
Adult: beef (Total) [inorganic]	4.8E-09	2.5E-08	1.8E-07	6.2E-09	3.1E-08	1.7E-07	3.3E-09	1.7E-08	1.6E-07	2.7E-09	1.6E-08	1.3E-07
Adult: milk (from air, pasture) [inorganic]	2.9E-12	3.4E-11	4.7E-10	2.9E-12	3.7E-11	4.4E-10	1.6E-12	2.3E-11	2.5E-10	2.1E-12	2.1E-11	2.8E-10
Adult: milk (from soil) [inorganic]	1.3E-12	1.2E-10	1.4E-08	8.2E-13	1.4E-10	1.8E-08	8.2E-13	1.4E-10	1.7E-08	1.1E-12	1.2E-10	1.7E-08
Adult: milk (from soil, pasture) [inorganic]	4.2E-13	4.4E-11	3.3E-09	4.0E-13	4.0E-11	4.3E-09	5.1E-13	4.3E-11	3.2E-09	6.4E-13	4.3E-11	4.4E-09
Adult: milk (from water) [inorganic]	2.1E-08	1.1E-07	5.5E-07	2.5E-08	1.4E-07	7.2E-07	1.4E-08	7.6E-08	3.8E-07	1.1E-08	6.2E-08	3.1E-07
Adult: milk (Total) [inorganic]	2.1E-08	1.2E-07	5.5E-07	2.6E-08	1.4E-07	7.2E-07	1.4E-08	7.6E-08	4.3E-07	1.1E-08	6.5E-08	3.2E-07
Adult: soil ingestion [inorganic]	1.6E-11	1.5E-09	2.0E-07	8.1E-12	1.6E-09	1.7E-07	1.7E-11	1.4E-09	2.0E-07	1.3E-11	1.5E-09	1.7E-07
Adult: skin contact (soil) [inorganic]	4.5E-10	5.8E-08	7.7E-06	7.7E-10	5.5E-08	5.7E-06	5.2E-10	6.4E-08	6.0E-06	2.9E-10	6.1E-08	6.4E-06
Adult: sediment ingestion [inorganic]	3.6E-12	4.0E-10	2.2E-08	2.4E-12	4.0E-10	3.5E-08	6.9E-12	3.7E-10	4.7E-08	4.3E-12	3.5E-10	3.8E-08
Adult: skin contact (sediment) [inorganic]	2.4E-10	1.6E-08	1.3E-06	1.6E-10	1.6E-08	1.5E-06	1.4E-10	1.5E-08	2.2E-06	1.6E-10	1.5E-08	1.0E-06
Adult: water ingestion [inorganic]	1.9E-10	4.5E-09	2.2E-08	2.0E-10	5.3E-09	2.6E-08	1.3E-10	2.9E-09	1.5E-08	1.0E-10	2.4E-09	1.3E-08
Adult: skin contact (water) [inorganic]	1.3E-09	9.7E-09	7.1E-08	1.5E-09	1.3E-08	7.1E-08	7.7E-10	7.5E-09	4.1E-08	7.1E-10	5.2E-09	3.4E-08
Adult: vegetables (from air) [inorganic]	3.0E-08	4.7E-07	8.8E-06	2.3E-08	5.5E-07	9.9E-06	2.1E-08	3.2E-07	4.0E-06	1.8E-08	3.2E-07	5.5E-06
Adult: vegetables (from soil) [inorganic]	1.5E-09	7.7E-08	4.5E-06	1.5E-09	7.6E-08	6.6E-06	1.2E-09	7.2E-08	6.0E-06	1.4E-09	8.1E-08	4.0E-06
Adult: vegetables (Total) [inorganic]	5.4E-08	8.5E-07	1.1E-05	6.9E-08	9.1E-07	1.9E-05	6.0E-08	5.5E-07	6.9E-06	4.1E-08	5.6E-07	9.2E-06
Adult: *Total* inorganic dose	2.9E-07	1.7E-06	2.0E-05	3.2E-07	1.6E-06	2.4E-05	2.5E-07	1.3E-06	1.7E-05	2.0E-07	1.2E-06	1.3E-05
Child: fish consumption [methyl]	5.6E-07	8.8E-06	1.5E-04	5.5E-07	8.6E-06	1.4E-04	5.7E-07	8.9E-06	1.3E-04	5.5E-07	8.8E-06	1.3E-04
Child: inhalation [elemental]	3.1E-08	1.7E-07	8.7E-07	3.5E-08	1.8E-07	1.1E-06	2.2E-08	1.0E-07	5.9E-07	1.9E-08	9.8E-08	5.7E-07
Child: beef (from air, pasture) [inorganic]	4.0E-10	5.6E-09	8.0E-08	5.1E-10	5.9E-09	9.5E-08	2.6E-10	3.5E-09	5.5E-08	2.9E-10	3.7E-09	4.2E-08
Child: beef (from soil) [inorganic]	1.4E-11	1.3E-09	2.2E-07	1.1E-11	1.4E-09	1.6E-07	7.1E-12	1.4E-09	1.6E-07	1.3E-11	1.3E-09	2.3E-07
Child: beef (from soil, pasture) [inorganic]	6.8E-12	4.8E-10	4.9E-08	5.3E-12	4.7E-10	3.9E-08	6.4E-12	4.7E-10	4.0E-08	8.5E-12	4.3E-10	4.4E-08
Child: beef (from water) [inorganic]	6.4E-09	3.3E-08	1.3E-07	6.6E-09	3.9E-08	2.1E-07	4.1E-09	2.0E-08	1.0E-07	3.7E-09	1.7E-08	7.8E-08
Child: beef (Total) [inorganic]	8.6E-09	4.8E-08	3.8E-07	8.8E-09	5.9E-08	4.1E-07	5.9E-09	3.5E-08	2.8E-07	5.4E-09	2.9E-08	2.9E-07
Child: milk (from air, pasture) [inorganic]	4.0E-10	4.4E-09	6.1E-08	4.3E-10	5.1E-09	7.0E-08	2.7E-10	3.0E-09	3.1E-08	2.6E-10	2.9E-09	3.7E-08
Child: milk (from soil) [inorganic]	1.3E-11	1.3E-09	1.3E-07	7.0E-12	1.3E-09	1.3E-07	5.8E-12	1.3E-09	1.2E-07	9.2E-12	1.2E-09	1.8E-07
Child: milk (from soil, pasture) [inorganic]	6.1E-12	3.7E-10	3.8E-08	4.8E-12	3.9E-10	2.7E-08	3.7E-12	3.8E-10	3.5E-08	5.3E-12	3.8E-10	3.3E-08
Child: milk (from water) [inorganic]	6.7E-09	3.2E-08	1.3E-07	8.4E-09	3.7E-08	1.4E-07	4.8E-09	2.0E-08	8.1E-08	3.6E-09	1.6E-08	7.0E-08
Child: milk (Total) [inorganic]	8.5E-09	4.6E-08	3.3E-07	1.0E-08	5.2E-08	2.9E-07	6.0E-09	3.3E-08	2.3E-07	5.5E-09	2.8E-08	2.5E-07
Child: soil ingestion [inorganic]	2.1E-10	2.7E-08	3.3E-06	2.1E-10	2.5E-08	2.8E-06	2.0E-10	2.8E-08	3.0E-06	3.0E-10	2.7E-08	2.9E-06
Child: skin contact (soil) [inorganic]	2.7E-09	2.8E-07	2.7E-05	1.8E-09	2.8E-07	3.9E-05	1.9E-09	2.7E-07	2.9E-05	2.8E-09	2.6E-07	3.6E-05
Child: sediment ingestion [inorganic]	7.0E-11	7.5E-09	5.0E-07	6.8E-11	5.9E-09	7.1E-07	5.2E-11	6.0E-09	5.7E-07	6.5E-11	6.2E-09	6.3E-07
Child: skin contact (sediment) [inorganic]	1.1E-09	6.0E-08	7.9E-06	5.9E-10	7.3E-08	5.4E-06	1.1E-09	6.9E-08	6.2E-06	5.6E-10	7.2E-08	9.1E-06
Child: water ingestion [inorganic]	2.8E-09	6.6E-08	3.5E-07	3.0E-09	7.6E-08	4.6E-07	1.6E-09	4.3E-08	2.4E-07	1.2E-09	3.2E-08	1.9E-07
Child: skin contact (water) [inorganic]	4.0E-09	5.0E-08	3.9E-07	5.1E-09	5.9E-08	4.3E-07	2.4E-09	3.1E-08	3.0E-07	2.5E-09	2.5E-08	2.2E-07
Child: vegetables (from air) [inorganic]	3.3E-08	9.5E-07	1.8E-05	4.5E-08	1.0E-06	2.0E-05	2.2E-08	6.3E-07	1.2E-05	3.0E-08	6.1E-07	8.6E-06
Child: vegetables (from soil) [inorganic]	3.2E-09	2.7E-07	1.9E-05	4.1E-09	2.2E-07	3.7E-05	3.8E-09	2.5E-07	2.5E-05	4.4E-09	2.4E-07	1.7E-05
Child: vegetables (Total) [inorganic]	1.1E-07	1.9E-06	3.2E-05	1.1E-07	2.4E-06	4.4E-05	8.7E-08	1.5E-06	3.7E-05	8.0E-08	1.5E-06	2.2E-05
Child: *Total* inorganic dose	7.0E-07	4.8E-06	5.2E-05	7.4E-07	5.0E-06	8.0E-05	4.8E-07	3.9E-06	8.5E-05	4.2E-07	3.9E-06	4.9E-05

a Underlined doses exceed the USEPA Reference Dose (RfD)

Table W-4: Estimated Annual Mercury Doses, EFPC Farm Family Population (mg kg^{-1} d^{-1}) [a]

	1990		
	2.5%-ile	**Central**	**97.5%-ile**
Adult: fish consumption [methyl]	4.9E-07	7.8E-06	1.2E-04
Adult: inhalation [elemental]	6.3E-09	3.2E-08	1.9E-07
Adult: beef (from air, pasture) [inorganic]	1.3E-10	1.7E-09	2.1E-08
Adult: beef (from soil) [inorganic]	5.8E-12	7.2E-10	9.2E-08
Adult: beef (from soil, pasture) [inorganic]	3.1E-12	2.4E-10	1.8E-08
Adult: beef (from water) [inorganic]	2.5E-09	1.0E-08	4.8E-08
Adult: beef (Total) [inorganic]	3.4E-09	1.8E-08	1.4E-07
Adult: milk (from air, pasture) [inorganic]	1.3E-12	1.9E-11	2.5E-10
Adult: milk (from soil) [inorganic]	6.8E-13	1.3E-10	1.4E-08
Adult: milk (from soil, pasture) [inorganic]	4.8E-13	3.7E-11	3.6E-09
Adult: milk (from water) [inorganic]	1.4E-08	7.4E-08	3.8E-07
Adult: milk (Total) [inorganic]	1.5E-08	7.5E-08	3.8E-07
Adult: soil ingestion [inorganic]	6.7E-12	1.4E-09	2.4E-07
Adult: skin contact (soil) [inorganic]	3.7E-10	6.1E-08	6.9E-06
Adult: sediment ingestion [inorganic]	5.5E-12	3.7E-10	4.5E-08
Adult: skin contact (sediment) [inorganic]	1.4E-10	1.4E-08	1.4E-06
Adult: water ingestion [inorganic]	1.2E-10	3.1E-09	1.5E-08
Adult: skin contact (water) [inorganic]	8.5E-10	6.4E-09	5.1E-08
Adult: vegetables (from air) [inorganic]	1.3E-08	2.6E-07	4.8E-06
Adult: vegetables (from soil) [inorganic]	8.6E-10	7.9E-08	6.4E-06
Adult: vegetables (Total) [inorganic]	5.5E-08	5.3E-07	9.9E-06
Adult: *Total* inorganic dose	2.2E-07	1.3E-06	1.6E-05
Child: fish consumption [methyl]	5.8E-07	8.6E-06	1.2E-04
Child: inhalation [elemental]	2.0E-08	9.2E-08	4.9E-07
Child: beef (from air, pasture) [inorganic]	2.2E-10	3.0E-09	4.7E-08
Child: beef (from soil) [inorganic]	6.3E-12	1.5E-09	2.0E-07
Child: beef (from soil, pasture) [inorganic]	4.7E-12	5.4E-10	4.7E-08
Child: beef (from water) [inorganic]	4.0E-09	2.0E-08	1.1E-07
Child: beef (Total) [inorganic]	6.1E-09	3.3E-08	3.0E-07
Child: milk (from air, pasture) [inorganic]	2.0E-10	2.7E-09	3.6E-08
Child: milk (from soil) [inorganic]	5.0E-12	1.1E-09	1.3E-07
Child: milk (from soil, pasture) [inorganic]	4.3E-12	3.7E-10	3.4E-08
Child: milk (from water) [inorganic]	4.8E-09	1.9E-08	8.1E-08
Child: milk (Total) [inorganic]	6.5E-09	3.2E-08	2.1E-07
Child: soil ingestion [inorganic]	1.6E-10	2.6E-08	3.2E-06
Child: skin contact (soil) [inorganic]	1.4E-09	2.7E-07	4.6E-05
Child: sediment ingestion [inorganic]	7.2E-11	5.3E-09	8.8E-07
Child: skin contact (sediment) [inorganic]	9.0E-10	7.6E-08	6.1E-06
Child: water ingestion [inorganic]	1.4E-09	4.4E-08	2.5E-07
Child: skin contact (water) [inorganic]	3.0E-09	3.4E-08	3.1E-07
Child: vegetables (from air) [inorganic]	1.6E-08	5.6E-07	1.1E-05
Child: vegetables (from soil) [inorganic]	3.0E-09	2.5E-07	2.1E-05
Child: vegetables (Total) [inorganic]	7.3E-08	1.4E-06	2.8E-05
Child: *Total* inorganic dose	5.6E-07	3.8E-06	1.1E-04

a Underlined doses exceed the USEPA Reference Dose (RfD)

Table W-5: Estimated Annual Mercury Doses, Oak Ridge Community Resident (Location 1) Population (mg kg^{-1} d^{-1}) [a]

	1950			1951			1952			1953		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Adult: inhalation [elemental]	1.3E-09	7.7E-09	4.2E-08	3.3E-09	1.5E-08	8.4E-08	1.6E-08	7.7E-08	4.0E-07	7.4E-08	3.5E-07	2.0E-06
Adult: vegetables (from air) [inorganic]	3.4E-09	7.0E-08	1.5E-06	7.8E-09	1.5E-07	2.0E-06	4.6E-08	6.6E-07	1.1E-05	1.5E-07	3.1E-06	7.1E-05
Child: inhalation [elemental]	2.5E-09	1.5E-08	8.8E-08	5.4E-09	3.1E-08	1.8E-07	3.1E-08	1.6E-07	9.2E-07	1.3E-07	6.6E-07	4.3E-06
Child: vegetables (from air) [inorganic]	5.8E-09	1.4E-07	2.8E-06	1.1E-08	2.9E-07	4.4E-06	7.1E-08	1.2E-06	2.7E-05	2.0E-07	6.1E-06	1.5E-04

	1954			1955			1956			1957		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Adult: inhalation [elemental]	4.2E-08	2.1E-07	1.2E-06	2.2E-07	1.0E-06	5.8E-06	1.7E-07	9.1E-07	4.6E-06	4.1E-07	2.1E-06	1.3E-05
Adult: vegetables (from air) [inorganic]	8.2E-08	2.0E-06	3.1E-05	5.2E-07	9.3E-06	1.3E-04	5.6E-07	7.2E-06	1.2E-04	9.2E-07	2.0E-05	2.9E-04
Child: inhalation [elemental]	8.0E-08	4.1E-07	2.5E-06	4.0E-07	2.1E-06	1.2E-05	3.6E-07	1.7E-06	1.1E-05	9.1E-07	4.0E-06	2.6E-05
Child: vegetables (from air) [inorganic]	1.3E-07	3.5E-06	8.4E-05	7.9E-07	1.8E-05	3.5E-04	8.3E-07	1.5E-05	2.6E-04	1.7E-06	3.4E-05	6.2E-04

	1958			1959			1960			1961		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Adult: inhalation [elemental]	3.4E-07	1.9E-06	9.4E-06	1.1E-07	5.5E-07	3.3E-06	4.3E-08	2.0E-07	1.2E-06	3.9E-08	2.1E-07	9.3E-07
Adult: vegetables (from air) [inorganic]	8.6E-07	1.7E-05	2.3E-04	3.2E-07	4.8E-06	6.8E-05	1.2E-07	1.8E-06	3.1E-05	7.8E-08	1.7E-06	2.4E-05
Child: inhalation [elemental]	7.7E-07	3.8E-06	1.9E-05	2.0E-07	1.1E-06	6.0E-06	9.2E-08	4.1E-07	2.7E-06	7.6E-08	3.9E-07	2.4E-06
Child: vegetables (from air) [inorganic]	1.9E-06	3.0E-05	6.7E-04	4.3E-07	9.8E-06	1.6E-04	1.5E-07	3.3E-06	7.5E-05	1.4E-07	3.2E-06	5.8E-05

	1962			1963			1964			1965		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Adult: inhalation [elemental]	2.7E-08	1.4E-07	8.1E-07	1.7E-08	9.2E-08	5.1E-07	7.3E-09	3.4E-08	1.7E-07	1.5E-08	7.4E-08	3.4E-07
Adult: vegetables (from air) [inorganic]	7.3E-08	1.2E-06	2.1E-05	5.7E-08	7.9E-07	1.2E-05	1.8E-08	3.1E-07	3.7E-06	5.0E-08	6.1E-07	8.1E-06
Child: inhalation [elemental]	5.5E-08	2.8E-07	1.5E-06	3.4E-08	1.7E-07	1.1E-06	1.3E-08	6.1E-08	3.7E-07	3.1E-08	1.5E-07	7.6E-07
Child: vegetables (from air) [inorganic]	1.1E-07	2.3E-06	4.6E-05	7.8E-08	1.5E-06	3.7E-05	2.2E-08	5.7E-07	1.0E-05	5.8E-08	1.3E-06	1.8E-05

a Underlined doses exceed the USEPA Reference Dose (RfD)

Table W-5: Estimated Annual Mercury Doses, Oak Ridge Community Resident (Location 1) Population (mg kg^{-1} d^{-1}) [a]

	1966			1967			1968			1969		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Adult: inhalation [elemental]	8.5E-09	4.0E-08	2.2E-07	4.5E-09	2.4E-08	1.6E-07	7.2E-10	4.2E-09	2.2E-08	1.1E-09	5.5E-09	2.7E-08
Adult: vegetables (from air) [inorganic]	2.3E-08	3.6E-07	5.3E-06	1.3E-08	2.4E-07	3.2E-06	2.5E-09	3.6E-08	5.3E-07	2.3E-09	4.6E-08	6.3E-07
Child: inhalation [elemental]	1.3E-08	8.4E-08	4.3E-07	9.4E-09	4.7E-08	3.3E-07	1.6E-09	7.9E-09	4.7E-08	2.0E-09	1.1E-08	5.6E-08
Child: vegetables (from air) [inorganic]	3.0E-08	7.2E-07	1.8E-05	2.3E-08	4.0E-07	7.2E-06	3.6E-09	6.9E-08	1.1E-06	3.5E-09	8.4E-08	1.7E-06

	1970			1971			1972			1973		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Adult: inhalation [elemental]	3.8E-09	2.1E-08	1.1E-07	9.5E-10	5.1E-09	2.6E-08	1.2E-10	5.8E-10	3.0E-09	8.9E-09	5.4E-08	3.1E-07
Adult: vegetables (from air) [inorganic]	1.1E-08	1.7E-07	3.3E-06	2.6E-09	4.2E-08	6.7E-07	2.9E-10	5.3E-09	7.3E-08	3.4E-08	4.2E-07	7.3E-06
Child: inhalation [elemental]	7.6E-09	4.0E-08	2.5E-07	1.6E-09	1.0E-08	5.4E-08	2.0E-10	1.2E-09	5.9E-09	1.8E-08	1.0E-07	5.8E-07
Child: vegetables (from air) [inorganic]	1.6E-08	3.4E-07	7.2E-06	3.3E-09	7.9E-08	1.8E-06	3.5E-10	1.0E-08	2.1E-07	4.4E-08	8.4E-07	1.5E-05

	1974			1975			1976			1977		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Adult: inhalation [elemental]	2.0E-09	9.5E-09	5.9E-08	1.1E-10	6.1E-10	3.7E-09	1.4E-10	7.3E-10	3.8E-09	2.8E-10	1.4E-09	7.3E-09
Adult: vegetables (from air) [inorganic]	4.5E-09	9.1E-08	1.4E-06	4.4E-10	5.7E-09	6.7E-08	4.4E-10	6.4E-09	8.6E-08	8.8E-10	1.3E-08	1.9E-07
Child: inhalation [elemental]	3.4E-09	1.9E-08	1.2E-07	2.5E-10	1.2E-09	6.6E-09	2.7E-10	1.4E-09	8.9E-09	5.2E-10	2.9E-09	1.5E-08
Child: vegetables (from air) [inorganic]	7.2E-09	1.6E-07	3.2E-06	6.3E-10	9.5E-09	1.9E-07	6.2E-10	1.2E-08	2.4E-07	1.1E-09	2.4E-08	4.1E-07

	1978			1979			1980			1981		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Adult: inhalation [elemental]	1.3E-10	6.3E-10	3.2E-09	2.6E-10	1.2E-09	6.3E-09	2.9E-10	1.5E-09	9.2E-09	2.2E-10	9.6E-10	4.8E-09
Adult: vegetables (from air) [inorganic]	3.4E-10	4.9E-09	9.9E-08	7.0E-10	1.2E-08	1.4E-07	6.0E-10	1.4E-08	2.2E-07	4.9E-10	9.2E-09	1.3E-07
Child: inhalation [elemental]	2.4E-10	1.2E-09	6.6E-09	4.2E-10	2.5E-09	1.4E-08	5.3E-10	3.1E-09	1.9E-08	4.0E-10	1.9E-09	1.0E-08
Child: vegetables (from air) [inorganic]	4.1E-10	1.1E-08	2.1E-07	8.7E-10	2.2E-08	3.6E-07	1.1E-09	2.5E-08	5.7E-07	7.5E-10	1.6E-08	3.7E-07

a Underlined doses exceed the USEPA Reference Dose (RfD)

Table W-5: Estimated Annual Mercury Doses, Oak Ridge Community Resident (Location 1) Population (mg kg^{-1} d^{-1}) [a]

	1982			1983			1984		
	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile
Adult: inhalation [elemental]	3.6E-10	1.9E-09	1.0E-08	3.0E-10	1.7E-09	8.6E-09	2.7E-10	1.4E-09	6.7E-09
Adult: vegetables (from air) [inorganic]	1.0E-09	1.7E-08	2.2E-07	7.6E-10	1.4E-08	2.6E-07	9.8E-10	1.2E-08	1.4E-07
Child: inhalation [elemental]	7.7E-10	3.6E-09	2.2E-08	6.1E-10	3.5E-09	1.9E-08	5.2E-10	2.6E-09	1.3E-08
Child: vegetables (from air) [inorganic]	1.2E-09	3.2E-08	5.7E-07	1.3E-09	2.6E-08	6.8E-07	1.4E-09	2.0E-08	4.1E-07

	1985			1986		
	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile
Adult: inhalation [elemental]	3.1E-10	1.6E-09	8.2E-09	3.6E-10	1.9E-09	9.6E-09
Adult: vegetables (from air) [inorganic]	7.5E-10	1.3E-08	2.4E-07	7.1E-10	1.8E-08	2.6E-07
Child: inhalation [elemental]	5.7E-10	3.3E-09	1.8E-08	7.3E-10	3.8E-09	2.2E-08
Child: vegetables (from air) [inorganic]	1.1E-09	2.6E-08	5.1E-07	1.4E-09	3.0E-08	6.3E-07

	1987			1988		
	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile
Adult: inhalation [elemental]	4.2E-10	2.0E-09	1.2E-08	2.4E-10	1.2E-09	5.4E-09
Adult: vegetables (from air) [inorganic]	1.4E-09	1.7E-08	3.4E-07	4.4E-10	1.0E-08	1.5E-07
Child: inhalation [elemental]	8.7E-10	4.1E-09	2.3E-08	3.9E-10	2.3E-09	1.2E-08
Child: vegetables (from air) [inorganic]	1.5E-09	3.3E-08	7.5E-07	6.8E-10	1.9E-08	6.6E-07

	1989			1990		
	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile
Adult: inhalation [elemental]	2.5E-10	1.1E-09	5.8E-09	1.9E-10	1.1E-09	5.4E-09
Adult: vegetables (from air) [inorganic]	5.3E-10	1.1E-08	1.7E-07	5.6E-10	9.4E-09	1.8E-07
Child: inhalation [elemental]	4.5E-10	2.2E-09	1.2E-08	3.6E-10	2.2E-09	1.1E-08
Child: vegetables (from air) [inorganic]	9.2E-10	2.0E-08	3.9E-07	8.4E-10	1.8E-08	3.1E-07

a Underlined doses exceed the USEPA Reference Dose (RfD)

Table W-6: Estimated Annual Mercury Doses, Oak Ridge Community Resident (Location 2) Population (mg kg^{-1} d^{-1}) [a]

	1950			1951			1952			1953		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Adult: inhalation [elemental]	7.8E-10	3.9E-09	1.9E-08	1.7E-09	7.7E-09	4.1E-08	7.4E-09	3.8E-08	2.0E-07	3.6E-08	1.7E-07	1.0E-06
Adult: vegetables (from air) [inorganic]	2.2E-09	3.1E-08	6.3E-07	4.1E-09	6.4E-08	1.2E-06	1.4E-08	3.5E-07	6.5E-06	1.1E-07	1.4E-06	2.7E-05
Child: inhalation [elemental]	1.4E-09	7.7E-09	3.9E-08	3.0E-09	1.5E-08	8.1E-08	1.5E-08	7.1E-08	3.6E-07	6.2E-08	3.3E-07	2.1E-06
Child: vegetables (from air) [inorganic]	3.7E-09	6.6E-08	1.1E-06	7.1E-09	1.2E-07	2.2E-06	2.7E-08	6.9E-07	1.1E-05	1.5E-07	2.9E-06	5.9E-05

	1954			1955			1956			1957		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Adult: inhalation [elemental]	1.9E-08	1.0E-07	5.3E-07	1.2E-07	5.5E-07	2.3E-06	8.8E-08	4.1E-07	2.3E-06	2.2E-07	1.1E-06	5.4E-06
Adult: vegetables (from air) [inorganic]	4.8E-08	9.1E-07	1.6E-05	2.2E-07	4.5E-06	9.5E-05	2.5E-07	3.8E-06	4.8E-05	5.7E-07	9.4E-06	1.7E-04
Child: inhalation [elemental]	3.3E-08	2.0E-07	1.2E-06	2.1E-07	9.8E-07	5.4E-06	1.8E-07	8.5E-07	4.6E-06	4.2E-07	2.0E-06	1.1E-05
Child: vegetables (from air) [inorganic]	6.4E-08	1.6E-06	5.1E-05	4.4E-07	8.4E-06	1.9E-04	2.5E-07	7.4E-06	1.6E-04	9.4E-07	1.8E-05	2.7E-04

	1958			1959			1960			1961		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Adult: inhalation [elemental]	2.0E-07	9.5E-07	5.2E-06	5.0E-08	2.7E-07	1.5E-06	2.0E-08	1.0E-07	5.5E-07	1.8E-08	9.3E-08	5.5E-07
Adult: vegetables (from air) [inorganic]	4.7E-07	7.8E-06	1.5E-04	1.5E-07	2.6E-06	3.5E-05	5.6E-08	8.6E-07	1.5E-05	6.0E-08	9.2E-07	1.3E-05
Child: inhalation [elemental]	4.0E-07	1.9E-06	1.1E-05	1.1E-07	5.6E-07	3.0E-06	3.8E-08	2.0E-07	1.1E-06	4.0E-08	1.8E-07	1.1E-06
Child: vegetables (from air) [inorganic]	5.8E-07	1.6E-05	4.0E-04	2.1E-07	4.7E-06	1.1E-04	5.7E-08	1.7E-06	4.1E-05	8.6E-08	1.5E-06	4.8E-05

	1962			1963			1964			1965		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Adult: inhalation [elemental]	1.4E-08	6.4E-08	4.7E-07	8.9E-09	4.6E-08	2.4E-07	3.0E-09	1.7E-08	9.3E-08	5.5E-09	3.6E-08	2.0E-07
Adult: vegetables (from air) [inorganic]	3.2E-08	6.1E-07	9.3E-06	1.9E-08	4.2E-07	6.7E-06	5.6E-09	1.5E-07	2.0E-06	1.6E-08	3.0E-07	5.5E-06
Child: inhalation [elemental]	3.0E-08	1.3E-07	9.1E-07	2.0E-08	8.6E-08	4.8E-07	5.7E-09	3.3E-08	1.8E-07	1.4E-08	7.4E-08	3.7E-07
Child: vegetables (from air) [inorganic]	4.4E-08	1.1E-06	2.6E-05	4.3E-08	7.2E-07	1.7E-05	1.1E-08	2.7E-07	6.6E-06	2.7E-08	6.2E-07	1.1E-05

a Underlined doses exceed the USEPA Reference Dose (RfD)

Table W-6: Estimated Annual Mercury Doses, Oak Ridge Community Resident (Location 2) Population (mg kg^{-1} d^{-1}) [a]

	1966			1967			1968			1969		
	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile
Adult: inhalation [elemental]	3.8E-09	2.0E-08	1.1E-07	2.1E-09	1.2E-08	7.0E-08	3.8E-10	1.9E-09	1.0E-08	4.3E-10	2.7E-09	1.4E-08
Adult: vegetables (from air) [inorganic]	1.1E-08	1.7E-07	2.8E-06	5.7E-09	1.2E-07	1.3E-06	1.0E-09	1.7E-08	2.9E-07	1.3E-09	2.1E-08	3.5E-07
Child: inhalation [elemental]	7.9E-09	3.6E-08	2.2E-07	4.5E-09	2.4E-08	1.5E-07	7.4E-10	4.0E-09	2.3E-08	8.9E-10	5.2E-09	2.8E-08
Child: vegetables (from air) [inorganic]	1.6E-08	3.4E-07	6.5E-06	7.7E-09	2.0E-07	3.7E-06	1.4E-09	3.3E-08	5.5E-07	2.0E-09	4.2E-08	8.2E-07

	1970			1971			1972			1973		
	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile
Adult: inhalation [elemental]	1.8E-09	9.8E-09	4.9E-08	5.1E-10	2.5E-09	1.5E-08	6.2E-11	2.8E-10	1.5E-09	4.5E-09	2.4E-08	1.5E-07
Adult: vegetables (from air) [inorganic]	6.3E-09	8.8E-08	1.3E-06	1.4E-09	2.2E-08	3.7E-07	1.7E-10	2.5E-09	3.9E-08	1.1E-08	2.2E-07	4.0E-06
Child: inhalation [elemental]	3.5E-09	2.0E-08	1.1E-07	1.0E-09	4.8E-09	2.7E-08	1.2E-10	5.2E-10	3.0E-09	1.0E-08	4.8E-08	2.9E-07
Child: vegetables (from air) [inorganic]	9.7E-09	1.6E-07	3.4E-06	1.6E-09	3.7E-08	1.0E-06	2.1E-10	4.9E-09	9.2E-08	2.3E-08	4.1E-07	1.3E-05

	1974			1975			1976			1977		
	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile
Adult: inhalation [elemental]	8.9E-10	4.9E-09	2.5E-08	6.2E-11	3.0E-10	1.8E-09	7.4E-11	3.6E-10	1.9E-09	1.2E-10	7.2E-10	3.6E-09
Adult: vegetables (from air) [inorganic]	2.1E-09	4.3E-08	8.6E-07	2.1E-10	2.7E-09	5.2E-08	1.5E-10	3.4E-09	4.6E-08	3.7E-10	6.7E-09	7.6E-08
Child: inhalation [elemental]	1.4E-09	9.6E-09	5.0E-08	9.9E-11	5.8E-10	3.5E-09	1.2E-10	7.1E-10	3.5E-09	2.8E-10	1.3E-09	8.2E-09
Child: vegetables (from air) [inorganic]	2.8E-09	8.2E-08	2.1E-06	2.2E-10	4.8E-09	9.7E-08	2.1E-10	6.1E-09	9.8E-08	5.5E-10	1.2E-08	2.7E-07

	1978			1979			1980			1981		
	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile	2.5%-ile	Central	97.5%-ile
Adult: inhalation [elemental]	5.9E-11	3.0E-10	1.9E-09	1.2E-10	6.1E-10	3.3E-09	1.5E-10	7.6E-10	4.1E-09	9.4E-11	4.9E-10	2.5E-09
Adult: vegetables (from air) [inorganic]	1.4E-10	3.0E-09	4.4E-08	2.9E-10	5.6E-09	7.4E-08	2.9E-10	6.7E-09	1.1E-07	2.2E-10	4.1E-09	6.2E-08
Child: inhalation [elemental]	1.1E-10	6.2E-10	3.3E-09	2.6E-10	1.2E-09	6.9E-09	3.2E-10	1.5E-09	8.5E-09	2.0E-10	9.4E-10	5.6E-09
Child: vegetables (from air) [inorganic]	1.8E-10	5.4E-09	1.0E-07	3.7E-10	9.8E-09	2.0E-07	4.3E-10	1.2E-08	2.6E-07	3.5E-10	8.5E-09	1.4E-07

a Underlined doses exceed the USEPA Reference Dose (RfD)

Table W-6: Estimated Annual Mercury Doses, Oak Ridge Community Resident (Location 2) Population (mg kg^{-1} d^{-1}) [a]

	1982			1983			1984		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Adult: inhalation [elemental]	1.7E-10	9.0E-10	5.6E-09	1.5E-10	7.9E-10	4.3E-09	1.4E-10	6.7E-10	3.7E-09
Adult: vegetables (from air) [inorganic]	5.5E-10	7.9E-09	1.3E-07	4.5E-10	7.3E-09	9.3E-08	3.0E-10	5.5E-09	9.6E-08
Child: inhalation [elemental]	3.7E-10	1.7E-09	1.1E-08	2.7E-10	1.6E-09	8.8E-09	2.3E-10	1.3E-09	6.9E-09
Child: vegetables (from air) [inorganic]	5.3E-10	1.7E-08	2.7E-07	7.7E-10	1.3E-08	2.6E-07	5.7E-10	1.1E-08	1.8E-07

	1985			1986		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Adult: inhalation [elemental]	1.4E-10	7.9E-10	4.2E-09	1.8E-10	9.4E-10	4.9E-09
Adult: vegetables (from air) [inorganic]	4.0E-10	6.2E-09	1.1E-07	4.5E-10	7.7E-09	1.5E-07
Child: inhalation [elemental]	2.7E-10	1.5E-09	9.2E-09	3.4E-10	1.9E-09	1.2E-08
Child: vegetables (from air) [inorganic]	7.1E-10	1.3E-08	2.6E-07	5.4E-10	1.5E-08	2.9E-07

	1987			1988		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Adult: inhalation [elemental]	2.0E-10	1.1E-09	5.4E-09	1.1E-10	5.8E-10	3.4E-09
Adult: vegetables (from air) [inorganic]	5.0E-10	8.6E-09	1.6E-07	2.1E-10	4.8E-09	8.6E-08
Child: inhalation [elemental]	4.3E-10	2.1E-09	1.0E-08	2.3E-10	1.1E-09	6.2E-09
Child: vegetables (from air) [inorganic]	8.9E-10	1.5E-08	3.0E-07	4.4E-10	9.3E-09	2.5E-07

	1989			1990		
	2.5%-ile	**Central**	**97.5%-ile**	**2.5%-ile**	**Central**	**97.5%-ile**
Adult: inhalation [elemental]	1.0E-10	5.8E-10	3.3E-09	8.7E-11	5.2E-10	2.7E-09
Adult: vegetables (from air) [inorganic]	3.0E-10	5.2E-09	7.3E-08	3.4E-10	4.5E-09	6.6E-08
Child: inhalation [elemental]	1.9E-10	1.2E-09	5.6E-09	1.8E-10	1.0E-09	5.4E-09
Child: vegetables (from air) [inorganic]	4.6E-10	9.2E-09	2.1E-07	3.9E-10	8.1E-09	1.7E-07

a Underlined doses exceed the USEPA Reference Dose (RfD)

Table W-7: Estimated Annual Mercury Doses, Fish Consumers (mg kg^{-1} d^{-1}) [a]

	1950			1951			1952			1953		
	2.5%-ile	**50%-ile**	**97.5%-ile**	**2.5%-ile**	**50%-ile**	**97.5%-ile**	**2.5%-ile**	**50%-ile**	**97.5%-ile**	**2.5%-ile**	**50%-ile**	**97.5%-ile**
CR/PC Category1 (Adult)	3.8E-04	7.8E-04	1.6E-03	3.8E-04	7.7E-04	1.5E-03	3.4E-04	8.0E-04	1.5E-03	4.2E-04	9.4E-04	1.7E-03
CR/PC Category2 (Adult)	1.3E-04	3.0E-04	6.0E-04	1.2E-04	2.9E-04	5.8E-04	1.3E-04	3.0E-04	6.0E-04	1.5E-04	3.6E-04	7.0E-04
CR/PC Category3 (Adult)	1.8E-05	8.3E-05	2.0E-04	2.0E-05	8.3E-05	1.9E-04	2.0E-05	8.2E-05	1.9E-04	2.6E-05	9.8E-05	2.2E-04
WB Category1 (Adult)	1.7E-05	8.4E-05	1.8E-04	2.0E-05	8.2E-05	1.9E-04	2.0E-05	9.6E-05	2.1E-04	2.9E-05	1.0E-04	2.2E-04
WB Category2 (Adult)	7.5E-06	3.0E-05	7.2E-05	7.1E-06	3.1E-05	7.0E-05	8.4E-06	3.5E-05	7.9E-05	9.4E-06	3.7E-05	8.4E-05
WB Category3 (Adult)	1.4E-06	8.2E-06	2.2E-05	1.3E-06	7.9E-06	2.5E-05	1.5E-06	9.9E-06	2.7E-05	1.8E-06	1.0E-05	3.0E-05
EFPC Category3 (Adult)	4.3E-05	1.9E-04	4.4E-04	4.6E-05	1.9E-04	4.5E-04	4.4E-05	1.9E-04	4.6E-04	4.4E-05	1.9E-04	4.6E-04
Adult CR/PC commercial	1.0E-06	1.6E-05	2.5E-04	1.1E-06	1.6E-05	2.9E-04	1.0E-06	1.6E-05	2.4E-04	1.2E-06	2.0E-05	3.2E-04
Adult CR/PC recreational	8.1E-06	1.3E-04	2.0E-03	8.5E-06	1.3E-04	2.1E-03	7.6E-06	1.4E-04	2.0E-03	9.4E-06	1.6E-04	2.7E-03
Child CR/PC commercial	9.3E-07	1.4E-05	2.1E-04	1.0E-06	1.4E-05	2.4E-04	9.5E-07	1.4E-05	2.3E-04	1.1E-06	1.7E-05	2.7E-04
Child CR/PC recreational	7.0E-06	1.1E-04	1.9E-03	7.8E-06	1.1E-04	1.9E-03	7.5E-06	1.2E-04	1.7E-03	8.1E-06	1.3E-04	2.0E-03
Adult WB commercial	1.0E-06	1.7E-05	3.4E-04	9.8E-07	1.7E-05	2.5E-04	1.2E-06	2.1E-05	3.3E-04	1.4E-06	2.2E-05	3.4E-04
Adult WB recreational	1.4E-06	2.2E-05	3.5E-04	1.2E-06	2.3E-05	3.4E-04	1.4E-06	2.7E-05	3.8E-04	1.8E-06	2.6E-05	4.2E-04
Child WB commercial	9.3E-07	1.6E-05	2.6E-04	9.3E-07	1.5E-05	2.1E-04	9.7E-07	1.8E-05	2.7E-04	1.2E-06	1.9E-05	3.2E-04
Child WB recreational	1.2E-06	2.0E-05	2.9E-04	9.6E-07	1.9E-05	2.9E-04	1.2E-06	2.4E-05	3.6E-04	1.6E-06	2.3E-05	3.7E-04

	1954			1955			1956			1957		
	2.5%-ile	**50%-ile**	**97.5%-ile**	**2.5%-ile**	**50%-ile**	**97.5%-ile**	**2.5%-ile**	**50%-ile**	**97.5%-ile**	**2.5%-ile**	**50%-ile**	**97.5%-ile**
CR/PC Category1 (Adult)	3.6E-04	7.9E-04	1.6E-03	2.7E-04	6.0E-04	1.1E-03	6.6E-04	1.6E-03	3.4E-03	7.9E-04	2.0E-03	4.2E-03
CR/PC Category2 (Adult)	1.3E-04	3.0E-04	5.8E-04	9.3E-05	2.3E-04	4.4E-04	2.2E-04	6.1E-04	1.3E-03	2.8E-04	7.0E-04	1.6E-03
CR/PC Category3 (Adult)	2.1E-05	8.0E-05	1.9E-04	1.6E-05	6.1E-05	1.4E-04	3.6E-05	1.6E-04	4.4E-04	4.9E-05	2.0E-04	5.0E-04
WB Category1 (Adult)	3.1E-05	1.2E-04	2.5E-04	8.9E-05	2.2E-04	4.3E-04	1.6E-04	3.4E-04	6.7E-04	2.0E-04	4.5E-04	8.7E-04
WB Category2 (Adult)	1.1E-05	4.3E-05	1.0E-04	3.2E-05	8.2E-05	1.7E-04	5.4E-05	1.3E-04	2.6E-04	7.4E-05	1.6E-04	3.2E-04
WB Category3 (Adult)	2.0E-06	1.1E-05	3.2E-05	5.0E-06	2.3E-05	6.0E-05	8.2E-06	3.7E-05	8.5E-05	1.1E-05	4.5E-05	1.2E-04
EFPC Category3 (Adult)	4.6E-05	1.8E-04	4.4E-04	4.8E-05	1.8E-04	4.6E-04	4.5E-05	1.9E-04	4.5E-04	4.5E-05	1.9E-04	4.4E-04
Adult CR/PC commercial	9.5E-07	1.6E-05	2.7E-04	8.2E-07	1.2E-05	1.8E-04	2.3E-06	3.1E-05	5.0E-04	2.2E-06	3.7E-05	7.1E-04
Adult CR/PC recreational	9.2E-06	1.3E-04	2.0E-03	6.8E-06	9.7E-05	1.5E-03	1.7E-05	2.9E-04	4.4E-03	2.2E-05	3.3E-04	5.0E-03
Child CR/PC commercial	1.1E-06	1.4E-05	2.4E-04	7.2E-07	1.1E-05	1.6E-04	2.1E-06	2.7E-05	4.0E-04	2.1E-06	3.5E-05	5.4E-04
Child CR/PC recreational	7.1E-06	1.2E-04	1.9E-03	6.2E-06	8.5E-05	1.2E-03	1.3E-05	2.5E-04	3.8E-03	1.8E-05	2.9E-04	4.3E-03
Adult WB commercial	1.5E-06	2.6E-05	3.9E-04	3.7E-06	4.7E-05	8.0E-04	5.0E-06	7.8E-05	1.1E-03	6.3E-06	9.8E-05	1.5E-03
Adult WB recreational	1.8E-06	3.0E-05	4.8E-04	3.9E-06	6.2E-05	9.5E-04	6.6E-06	9.8E-05	1.4E-03	8.5E-06	1.3E-04	1.6E-03
Child WB commercial	1.4E-06	2.3E-05	3.5E-04	2.9E-06	4.1E-05	6.8E-04	4.8E-06	6.9E-05	9.4E-04	5.8E-06	8.5E-05	1.3E-03
Child WB recreational	1.6E-06	2.7E-05	3.7E-04	3.2E-06	5.4E-05	7.5E-04	5.8E-06	8.3E-05	1.2E-03	8.3E-06	1.1E-04	1.6E-03

NOTE: Doses to Watts Bar Reservoir and Clinch River fish consumers for years before 1953 have likely been overestimated because of the way that methylmercury concentrations in fish were estimated using core sample data and a relationship between mercury levels in sediment and those in fish (See Sect. 7.5 of the Task 2 report). Estimated fish concentrations were not constrained to be at or near zero in these early years of mercury use.

a Underlined doses exceed the USEPA RfD for methylmercury (0.0001 mg/kg-d)

Table W-7: Estimated Annual Mercury Doses, Fish Consumers (mg kg^{-1} d^{-1}) [a]

	1958			1959			1960			1961		
	2.5%-ile	**50%-ile**	**97.5%-ile**	**2.5%-ile**	**50%-ile**	**97.5%-ile**	**2.5%-ile**	**50%-ile**	**97.5%-ile**	**2.5%-ile**	**50%-ile**	**97.5%-ile**
CR/PC Category1 (Adult)	8.2E-04	1.8E-03	3.8E-03	7.4E-04	1.7E-03	3.6E-03	6.7E-04	1.6E-03	3.4E-03	6.0E-04	1.4E-03	3.5E-03
CR/PC Category2 (Adult)	2.7E-04	7.0E-04	1.4E-03	2.8E-04	6.5E-04	1.4E-03	2.4E-04	6.1E-04	1.4E-03	2.2E-04	5.6E-04	1.3E-03
CR/PC Category3 (Adult)	4.7E-05	1.9E-04	4.6E-04	4.0E-05	1.8E-04	4.6E-04	4.1E-05	1.7E-04	4.3E-04	3.2E-05	1.6E-04	4.2E-04
WB Category1 (Adult)	2.5E-04	4.9E-04	9.9E-04	2.4E-04	5.0E-04	9.7E-04	1.5E-04	3.5E-04	6.9E-04	6.8E-05	1.9E-04	4.0E-04
WB Category2 (Adult)	8.0E-05	1.8E-04	3.9E-04	8.3E-05	1.9E-04	3.7E-04	5.3E-05	1.3E-04	2.5E-04	2.7E-05	6.9E-05	1.5E-04
WB Category3 (Adult)	1.3E-05	5.0E-05	1.3E-04	1.3E-05	5.3E-05	1.2E-04	8.4E-06	3.7E-05	8.4E-05	4.0E-06	1.9E-05	4.8E-05
EFPC Category3 (Adult)	4.5E-05	1.9E-04	4.6E-04	4.9E-05	1.9E-04	4.5E-04	4.4E-05	1.9E-04	4.6E-04	4.7E-05	1.9E-04	4.4E-04
Adult CR/PC commercial	2.4E-06	3.9E-05	6.3E-04	2.3E-06	3.6E-05	5.8E-04	1.9E-06	3.3E-05	5.3E-04	2.3E-06	2.9E-05	5.5E-04
Adult CR/PC recreational	1.9E-05	3.1E-04	5.1E-03	1.8E-05	2.9E-04	5.2E-03	1.7E-05	2.6E-04	4.4E-03	1.4E-05	2.4E-04	3.6E-03
Child CR/PC commercial	2.2E-06	3.4E-05	5.7E-04	2.2E-06	3.2E-05	5.0E-04	1.8E-06	3.0E-05	4.6E-04	2.0E-06	2.7E-05	4.8E-04
Child CR/PC recreational	1.5E-05	2.7E-04	4.7E-03	1.6E-05	2.6E-04	4.1E-03	1.6E-05	2.3E-04	3.9E-03	1.3E-05	2.0E-04	3.4E-03
Adult WB commercial	7.1E-06	1.2E-04	1.4E-03	7.2E-06	1.0E-04	1.9E-03	4.4E-06	7.9E-05	1.1E-03	2.4E-06	4.0E-05	7.5E-04
Adult WB recreational	8.8E-06	1.5E-04	2.0E-03	8.4E-06	1.4E-04	2.4E-03	6.1E-06	9.5E-05	1.5E-03	2.8E-06	5.0E-05	8.0E-04
Child WB commercial	7.1E-06	1.0E-04	1.5E-03	6.5E-06	9.2E-05	1.6E-03	4.3E-06	7.1E-05	9.9E-04	2.1E-06	3.6E-05	6.7E-04
Child WB recreational	7.8E-06	1.2E-04	1.7E-03	7.9E-06	1.3E-04	2.0E-03	5.9E-06	8.5E-05	1.3E-03	2.5E-06	4.6E-05	6.6E-04

	1962			1963			1964			1965		
	2.5%-ile	**50%-ile**	**97.5%-ile**	**2.5%-ile**	**50%-ile**	**97.5%-ile**	**2.5%-ile**	**50%-ile**	**97.5%-ile**	**2.5%-ile**	**50%-ile**	**97.5%-ile**
CR/PC Category1 (Adult)	5.2E-04	1.3E-03	2.7E-03	3.8E-04	8.5E-04	1.7E-03	3.2E-04	6.7E-04	1.3E-03	2.5E-04	5.7E-04	1.1E-03
CR/PC Category2 (Adult)	2.0E-04	5.0E-04	1.1E-03	1.4E-04	3.2E-04	6.4E-04	1.1E-04	2.5E-04	5.2E-04	8.6E-05	2.2E-04	4.2E-04
CR/PC Category3 (Adult)	2.9E-05	1.4E-04	3.5E-04	2.2E-05	9.1E-05	2.0E-04	1.7E-05	6.9E-05	1.7E-04	1.5E-05	5.6E-05	1.3E-04
WB Category1 (Adult)	8.1E-05	1.8E-04	3.6E-04	5.7E-05	1.7E-04	3.5E-04	5.5E-05	1.5E-04	3.2E-04	5.4E-05	1.6E-04	3.1E-04
WB Category2 (Adult)	2.7E-05	6.9E-05	1.4E-04	2.1E-05	6.2E-05	1.4E-04	1.8E-05	5.6E-05	1.3E-04	2.1E-05	5.7E-05	1.1E-04
WB Category3 (Adult)	4.9E-06	1.9E-05	4.4E-05	4.0E-06	1.7E-05	4.2E-05	3.8E-06	1.5E-05	4.0E-05	3.4E-06	1.6E-05	3.9E-05
EFPC Category3 (Adult)	4.7E-05	1.9E-04	4.4E-04	5.0E-05	1.9E-04	4.5E-04	4.6E-05	1.9E-04	4.4E-04	4.5E-05	1.8E-04	3.9E-04
Adult CR/PC commercial	1.7E-06	2.7E-05	4.4E-04	1.1E-06	1.8E-05	2.6E-04	9.4E-07	1.4E-05	2.0E-04	6.3E-07	1.2E-05	1.8E-04
Adult CR/PC recreational	1.3E-05	2.2E-04	3.2E-03	9.2E-06	1.4E-04	2.2E-03	7.0E-06	1.2E-04	1.9E-03	5.9E-06	9.3E-05	1.6E-03
Child CR/PC commercial	1.5E-06	2.4E-05	3.5E-04	9.6E-07	1.6E-05	2.3E-04	8.7E-07	1.2E-05	1.7E-04	5.7E-07	1.0E-05	1.5E-04
Child CR/PC recreational	1.3E-05	2.1E-04	2.9E-03	7.9E-06	1.2E-04	1.8E-03	6.1E-06	9.9E-05	1.6E-03	4.9E-06	8.2E-05	1.4E-03
Adult WB commercial	2.6E-06	4.1E-05	6.3E-04	2.5E-06	3.8E-05	5.5E-04	2.1E-06	3.6E-05	5.3E-04	2.3E-06	3.3E-05	4.8E-04
Adult WB recreational	3.2E-06	5.0E-05	8.4E-04	3.1E-06	4.8E-05	7.4E-04	2.7E-06	4.1E-05	7.3E-04	2.7E-06	4.4E-05	7.1E-04
Child WB commercial	2.2E-06	3.6E-05	5.7E-04	2.1E-06	3.3E-05	5.0E-04	2.0E-06	3.1E-05	4.4E-04	2.3E-06	2.9E-05	3.8E-04
Child WB recreational	2.6E-06	4.2E-05	6.9E-04	2.5E-06	4.0E-05	5.9E-04	2.8E-06	3.6E-05	6.0E-04	2.6E-06	3.8E-05	6.2E-04

a Underlined doses exceed the USEPA RfD for methylmercury (0.0001 mg/kg-d)

Table W-7: Estimated Annual Mercury Doses, Fish Consumers (mg kg^{-1} d^{-1}) [a]

	1966			1967			1968			1969		
	2.5%-ile	**50%-ile**	**97.5%-ile**	**2.5%-ile**	**50%-ile**	**97.5%-ile**	**2.5%-ile**	**50%-ile**	**97.5%-ile**	**2.5%-ile**	**50%-ile**	**97.5%-ile**
CR/PC Category1 (Adult)	2.3E-04	5.0E-04	9.5E-04	1.9E-04	4.3E-04	8.1E-04	1.6E-04	3.4E-04	6.7E-04	1.7E-04	3.7E-04	7.4E-04
CR/PC Category2 (Adult)	8.2E-05	1.9E-04	3.8E-04	6.5E-05	1.6E-04	3.2E-04	5.5E-05	1.3E-04	2.7E-04	6.4E-05	1.4E-04	2.9E-04
CR/PC Category3 (Adult)	1.2E-05	5.2E-05	1.1E-04	1.0E-05	4.4E-05	9.8E-05	8.7E-06	3.5E-05	8.3E-05	9.0E-06	3.9E-05	8.7E-05
WB Category1 (Adult)	5.7E-05	1.4E-04	3.0E-04	4.5E-05	1.4E-04	3.1E-04	4.7E-05	1.4E-04	3.0E-04	4.1E-05	1.3E-04	2.6E-04
WB Category2 (Adult)	1.9E-05	5.3E-05	1.2E-04	1.8E-05	5.1E-05	1.1E-04	1.7E-05	5.1E-05	1.2E-04	1.5E-05	4.4E-05	1.1E-04
WB Category3 (Adult)	3.4E-06	1.4E-05	4.1E-05	2.7E-06	1.4E-05	3.6E-05	2.7E-06	1.4E-05	3.5E-05	2.3E-06	1.3E-05	3.4E-05
EFPC Category3 (Adult)	4.1E-05	1.8E-04	4.1E-04	4.2E-05	1.9E-04	4.0E-04	4.5E-05	1.8E-04	4.0E-04	4.1E-05	1.8E-04	4.0E-04
Adult CR/PC commercial	6.7E-07	9.9E-06	1.5E-04	5.6E-07	7.9E-06	1.4E-04	4.6E-07	6.9E-06	1.1E-04	4.7E-07	7.5E-06	1.3E-04
Adult CR/PC recreational	5.0E-06	8.0E-05	1.3E-03	4.8E-06	6.9E-05	1.1E-03	2.8E-06	5.7E-05	9.8E-04	3.9E-06	6.0E-05	9.4E-04
Child CR/PC commercial	5.1E-07	8.6E-06	1.4E-04	4.6E-07	7.0E-06	1.2E-04	4.0E-07	6.3E-06	9.2E-05	4.1E-07	6.5E-06	1.0E-04
Child CR/PC recreational	4.4E-06	7.2E-05	1.1E-03	4.0E-06	6.1E-05	9.5E-04	2.9E-06	5.1E-05	8.4E-04	3.4E-06	5.3E-05	8.4E-04
Adult WB commercial	1.9E-06	3.1E-05	5.3E-04	1.7E-06	3.2E-05	4.5E-04	1.9E-06	3.1E-05	4.9E-04	1.6E-06	2.7E-05	4.6E-04
Adult WB recreational	2.7E-06	3.7E-05	5.8E-04	2.6E-06	3.7E-05	5.0E-04	2.3E-06	4.0E-05	5.5E-04	2.3E-06	3.4E-05	5.5E-04
Child WB commercial	1.6E-06	2.7E-05	4.5E-04	1.5E-06	2.8E-05	3.7E-04	1.8E-06	2.6E-05	4.2E-04	1.4E-06	2.3E-05	4.0E-04
Child WB recreational	2.3E-06	3.3E-05	4.7E-04	2.4E-06	3.3E-05	5.2E-04	1.9E-06	3.5E-05	5.4E-04	1.8E-06	3.0E-05	4.6E-04

	1970			1971			1972			1973		
	2.5%-ile	**50%-ile**	**97.5%-ile**	**2.5%-ile**	**50%-ile**	**97.5%-ile**	**2.5%-ile**	**50%-ile**	**97.5%-ile**	**2.5%-ile**	**50%-ile**	**97.5%-ile**
CR/PC Category1 (Adult)	1.8E-04	3.9E-04	7.1E-04	1.9E-04	4.0E-04	8.4E-04	2.1E-04	4.2E-04	8.5E-04	1.1E-04	2.8E-04	5.8E-04
CR/PC Category2 (Adult)	5.8E-05	1.4E-04	2.9E-04	6.4E-05	1.5E-04	3.2E-04	6.7E-05	1.6E-04	3.3E-04	4.4E-05	1.0E-04	2.3E-04
CR/PC Category3 (Adult)	9.3E-06	4.0E-05	9.5E-05	1.0E-05	4.2E-05	1.0E-04	1.1E-05	4.4E-05	1.0E-04	7.2E-06	2.9E-05	7.1E-05
WB Category1 (Adult)	4.3E-05	1.2E-04	2.6E-04	3.8E-05	1.2E-04	2.6E-04	3.6E-05	1.2E-04	2.7E-04	4.0E-05	1.2E-04	2.7E-04
WB Category2 (Adult)	1.3E-05	4.5E-05	1.1E-04	1.3E-05	4.5E-05	9.6E-05	1.5E-05	4.3E-05	1.0E-04	1.5E-05	4.5E-05	1.0E-04
WB Category3 (Adult)	2.1E-06	1.1E-05	3.4E-05	2.4E-06	1.2E-05	3.1E-05	2.6E-06	1.1E-05	2.9E-05	2.8E-06	1.2E-05	3.2E-05
EFPC Category3 (Adult)	4.6E-05	1.8E-04	4.1E-04	4.5E-05	1.8E-04	3.8E-04	4.1E-05	1.8E-04	3.9E-04	4.4E-05	1.7E-04	3.9E-04
Adult CR/PC commercial	5.1E-07	8.3E-06	1.2E-04	5.3E-07	8.5E-06	1.3E-04	5.6E-07	8.9E-06	1.3E-04	4.1E-07	5.8E-06	1.0E-04
Adult CR/PC recreational	3.6E-06	6.3E-05	1.1E-03	4.0E-06	6.5E-05	9.9E-04	4.0E-06	6.9E-05	1.0E-03	2.8E-06	4.6E-05	7.6E-04
Child CR/PC commercial	4.8E-07	7.0E-06	1.0E-04	4.5E-07	7.5E-06	1.1E-04	4.9E-07	7.5E-06	1.1E-04	3.5E-07	5.3E-06	8.7E-05
Child CR/PC recreational	3.6E-06	5.4E-05	9.2E-04	3.9E-06	5.6E-05	8.7E-04	3.8E-06	6.1E-05	1.0E-03	2.6E-06	4.1E-05	6.3E-04
Adult WB commercial	1.5E-06	2.7E-05	4.7E-04	1.9E-06	2.6E-05	3.3E-04	1.6E-06	2.5E-05	4.5E-04	1.5E-06	2.6E-05	4.5E-04
Adult WB recreational	2.0E-06	3.4E-05	6.4E-04	1.7E-06	3.2E-05	6.4E-04	1.7E-06	3.2E-05	6.3E-04	2.2E-06	3.2E-05	5.2E-04
Child WB commercial	1.4E-06	2.3E-05	3.8E-04	1.6E-06	2.2E-05	3.1E-04	1.3E-06	2.3E-05	3.9E-04	1.5E-06	2.3E-05	4.0E-04
Child WB recreational	1.8E-06	2.8E-05	5.2E-04	1.7E-06	2.8E-05	5.5E-04	1.7E-06	2.9E-05	4.8E-04	1.9E-06	3.0E-05	4.7E-04

a Underlined doses exceed the USEPA RfD for methylmercury (0.0001 mg/kg-d)

Table W-7: Estimated Annual Mercury Doses, Fish Consumers (mg kg^{-1} d^{-1}) [a]

	1974			1975			1976			1977		
	2.5%-ile	**50%-ile**	**97.5%-ile**	**2.5%-ile**	**50%-ile**	**97.5%-ile**	**2.5%-ile**	**50%-ile**	**97.5%-ile**	**2.5%-ile**	**50%-ile**	**97.5%-ile**
CR/PC Category1 (Adult)	1.2E-04	2.6E-04	5.4E-04	1.1E-04	2.5E-04	5.2E-04	1.0E-04	2.4E-04	4.8E-04	9.4E-05	2.2E-04	4.6E-04
CR/PC Category2 (Adult)	4.3E-05	1.0E-04	2.1E-04	3.9E-05	9.4E-05	1.9E-04	3.5E-05	9.0E-05	1.9E-04	3.3E-05	7.8E-05	1.7E-04
CR/PC Category3 (Adult)	6.7E-06	2.8E-05	6.8E-05	6.6E-06	2.5E-05	6.6E-05	5.2E-06	2.5E-05	5.7E-05	5.2E-06	2.2E-05	5.5E-05
WB Category1 (Adult)	4.1E-05	1.3E-04	2.7E-04	3.7E-05	1.3E-04	2.8E-04	3.6E-05	1.2E-04	2.8E-04	3.2E-05	1.1E-04	2.4E-04
WB Category2 (Adult)	1.5E-05	4.7E-05	1.1E-04	1.4E-05	4.6E-05	1.1E-04	1.3E-05	4.4E-05	1.0E-04	1.3E-05	4.0E-05	9.3E-05
WB Category3 (Adult)	2.8E-06	1.2E-05	3.3E-05	2.7E-06	1.2E-05	3.3E-05	2.7E-06	1.2E-05	3.3E-05	2.0E-06	1.1E-05	2.9E-05
EFPC Category3 (Adult)	4.3E-05	1.7E-04	4.0E-04	3.8E-05	1.6E-04	3.7E-04	3.9E-05	1.5E-04	3.2E-04	3.7E-05	1.5E-04	3.4E-04
Adult CR/PC commercial	2.9E-07	5.5E-06	8.2E-05	2.9E-07	5.3E-06	7.5E-05	3.0E-07	5.0E-06	8.3E-05	2.6E-07	4.1E-06	7.2E-05
Adult CR/PC recreational	3.0E-06	4.4E-05	6.3E-04	2.8E-06	4.0E-05	6.8E-04	1.9E-06	4.0E-05	5.7E-04	2.0E-06	3.5E-05	5.5E-04
Child CR/PC commercial	3.2E-07	4.8E-06	7.4E-05	2.8E-07	4.6E-06	7.2E-05	2.7E-07	4.4E-06	7.0E-05	2.5E-07	3.6E-06	6.5E-05
Child CR/PC recreational	2.7E-06	3.8E-05	6.0E-04	2.7E-06	3.5E-05	5.4E-04	1.9E-06	3.4E-05	5.0E-04	1.7E-06	3.1E-05	4.9E-04
Adult WB commercial	1.5E-06	2.9E-05	4.7E-04	1.7E-06	2.9E-05	4.8E-04	1.6E-06	2.6E-05	5.0E-04	1.5E-06	2.3E-05	4.5E-04
Adult WB recreational	2.3E-06	3.5E-05	4.6E-04	2.0E-06	3.5E-05	5.8E-04	1.6E-06	3.2E-05	6.0E-04	1.5E-06	2.8E-05	4.9E-04
Child WB commercial	1.4E-06	2.4E-05	4.1E-04	1.7E-06	2.4E-05	4.8E-04	1.2E-06	2.4E-05	4.8E-04	1.3E-06	2.0E-05	4.1E-04
Child WB recreational	1.9E-06	3.0E-05	4.0E-04	1.7E-06	3.0E-05	4.2E-04	1.7E-06	2.9E-05	5.0E-04	1.4E-06	2.5E-05	4.2E-04

	1978			1979			1980			1981		
	2.5%-ile	**50%-ile**	**97.5%-ile**	**2.5%-ile**	**50%-ile**	**97.5%-ile**	**2.5%-ile**	**50%-ile**	**97.5%-ile**	**2.5%-ile**	**50%-ile**	**97.5%-ile**
CR/PC Category1 (Adult)	8.1E-05	2.0E-04	4.0E-04	7.2E-05	1.9E-04	3.7E-04	7.1E-05	1.7E-04	3.5E-04	5.8E-05	1.6E-04	3.2E-04
CR/PC Category2 (Adult)	2.8E-05	7.5E-05	1.6E-04	2.7E-05	7.0E-05	1.4E-04	2.3E-05	6.5E-05	1.3E-04	2.0E-05	5.8E-05	1.3E-04
CR/PC Category3 (Adult)	5.0E-06	2.1E-05	5.2E-05	4.3E-06	1.9E-05	4.7E-05	3.9E-06	1.7E-05	4.7E-05	3.9E-06	1.6E-05	3.8E-05
WB Category1 (Adult)	3.2E-05	1.1E-04	2.4E-04	3.6E-05	1.2E-04	2.4E-04	3.9E-05	1.2E-04	2.6E-04	3.3E-05	1.1E-04	2.4E-04
WB Category2 (Adult)	1.1E-05	3.9E-05	9.3E-05	1.2E-05	4.2E-05	9.7E-05	1.4E-05	4.6E-05	1.0E-04	1.2E-05	3.9E-05	9.2E-05
WB Category3 (Adult)	2.1E-06	1.1E-05	3.2E-05	2.3E-06	1.2E-05	3.1E-05	2.4E-06	1.2E-05	3.4E-05	2.0E-06	1.1E-05	2.8E-05
EFPC Category3 (Adult)	3.4E-05	1.4E-04	3.1E-04	3.4E-05	1.4E-04	3.0E-04	3.4E-05	1.3E-04	3.0E-04	3.3E-05	1.3E-04	2.8E-04
Adult CR/PC commercial	2.5E-07	3.9E-06	5.9E-05	2.3E-07	3.6E-06	6.1E-05	2.0E-07	3.3E-06	5.6E-05	1.7E-07	3.0E-06	4.6E-05
Adult CR/PC recreational	1.9E-06	3.2E-05	5.4E-04	1.8E-06	3.0E-05	4.7E-04	1.8E-06	2.8E-05	5.0E-04	1.4E-06	2.6E-05	4.7E-04
Child CR/PC commercial	2.1E-07	3.4E-06	5.1E-05	2.1E-07	3.2E-06	5.1E-05	2.0E-07	3.0E-06	4.6E-05	1.6E-07	2.6E-06	4.3E-05
Child CR/PC recreational	1.6E-06	2.8E-05	4.5E-04	1.6E-06	2.6E-05	4.0E-04	1.5E-06	2.5E-05	4.2E-04	1.2E-06	2.2E-05	3.7E-04
Adult WB commercial	1.5E-06	2.3E-05	3.9E-04	1.3E-06	2.3E-05	4.6E-04	1.4E-06	2.7E-05	4.1E-04	1.5E-06	2.4E-05	4.1E-04
Adult WB recreational	1.8E-06	3.0E-05	4.4E-04	1.7E-06	3.2E-05	5.6E-04	2.2E-06	3.3E-05	5.3E-04	1.6E-06	3.3E-05	4.4E-04
Child WB commercial	1.3E-06	2.0E-05	3.5E-04	1.3E-06	2.1E-05	4.1E-04	1.3E-06	2.4E-05	3.3E-04	1.2E-06	2.1E-05	3.4E-04
Child WB recreational	1.6E-06	2.6E-05	4.4E-04	1.5E-06	2.9E-05	4.7E-04	2.0E-06	2.8E-05	4.4E-04	1.5E-06	2.8E-05	4.1E-04

a Underlined doses exceed the USEPA RfD for methylmercury (0.0001 mg/kg-d)

Table W-7: Estimated Annual Mercury Doses, Fish Consumers (mg kg^{-1} d^{-1}) [a]

	1982			1983			1984			1985		
	2.5%-ile	**50%-ile**	**97.5%-ile**	**2.5%-ile**	**50%-ile**	**97.5%-ile**	**2.5%-ile**	**50%-ile**	**97.5%-ile**	**2.5%-ile**	**50%-ile**	**97.5%-ile**
CR/PC Category1 (Adult)	4.5E-05	1.2E-04	2.6E-04	4.4E-05	1.2E-04	2.4E-04	4.5E-05	1.2E-04	2.5E-04	4.9E-05	1.2E-04	2.5E-04
CR/PC Category2 (Adult)	1.7E-05	4.6E-05	1.1E-04	1.7E-05	4.5E-05	9.7E-05	1.6E-05	4.5E-05	9.3E-05	1.7E-05	4.5E-05	1.0E-04
CR/PC Category3 (Adult)	2.8E-06	1.3E-05	3.4E-05	2.8E-06	1.2E-05	3.3E-05	2.0E-06	1.3E-05	3.1E-05	3.0E-06	1.2E-05	3.2E-05
WB Category1 (Adult)	3.2E-05	1.0E-04	2.4E-04	2.6E-05	9.9E-05	2.2E-04	2.3E-05	9.4E-05	2.2E-04	2.5E-05	9.3E-05	2.1E-04
WB Category2 (Adult)	1.0E-05	3.9E-05	9.4E-05	9.5E-06	3.7E-05	8.6E-05	8.8E-06	3.4E-05	8.1E-05	8.8E-06	3.6E-05	8.1E-05
WB Category3 (Adult)	2.1E-06	1.0E-05	2.9E-05	2.0E-06	9.5E-06	2.6E-05	1.8E-06	9.1E-06	2.7E-05	1.8E-06	9.8E-06	2.6E-05
EFPC Category3 (Adult)	3.1E-05	1.3E-04	2.8E-04	2.6E-05	1.1E-04	2.4E-04	2.4E-05	9.8E-05	2.0E-04	2.0E-05	7.3E-05	1.5E-04
Adult CR/PC commercial	1.4E-07	2.5E-06	4.3E-05	1.4E-07	2.5E-06	4.1E-05	1.4E-07	2.7E-06	3.8E-05	1.5E-07	2.5E-06	3.7E-05
Adult CR/PC recreational	1.2E-06	2.0E-05	3.2E-04	1.3E-06	2.0E-05	3.2E-04	1.1E-06	2.0E-05	3.3E-04	1.3E-06	2.0E-05	3.2E-04
Child CR/PC commercial	1.3E-07	2.2E-06	3.9E-05	1.3E-07	2.2E-06	3.6E-05	1.4E-07	2.2E-06	3.4E-05	1.5E-07	2.1E-06	3.0E-05
Child CR/PC recreational	1.1E-06	1.6E-05	2.8E-04	1.2E-06	1.8E-05	3.1E-04	8.4E-07	1.8E-05	2.8E-04	9.5E-07	1.7E-05	2.8E-04
Adult WB commercial	1.3E-06	2.1E-05	3.2E-04	1.1E-06	2.1E-05	3.4E-04	1.1E-06	2.0E-05	3.5E-04	1.0E-06	2.0E-05	3.3E-04
Adult WB recreational	1.5E-06	2.9E-05	5.3E-04	1.5E-06	2.7E-05	5.3E-04	1.4E-06	2.5E-05	4.4E-04	1.5E-06	2.6E-05	4.2E-04
Child WB commercial	1.1E-06	2.0E-05	2.7E-04	1.1E-06	1.8E-05	3.2E-04	1.1E-06	1.7E-05	3.2E-04	8.9E-07	1.7E-05	2.8E-04
Child WB recreational	1.2E-06	2.5E-05	4.7E-04	1.4E-06	2.3E-05	3.8E-04	1.4E-06	2.2E-05	3.9E-04	1.5E-06	2.4E-05	3.8E-04

	1986			1987			1988			1989		
	2.5%-ile	**50%-ile**	**97.5%-ile**	**2.5%-ile**	**50%-ile**	**97.5%-ile**	**2.5%-ile**	**50%-ile**	**97.5%-ile**	**2.5%-ile**	**50%-ile**	**97.5%-ile**
CR/PC Category1 (Adult)	4.5E-05	1.2E-04	2.5E-04	4.5E-05	1.2E-04	2.5E-04	4.7E-05	1.2E-04	2.5E-04	4.9E-05	1.2E-04	2.5E-04
CR/PC Category2 (Adult)	1.6E-05	4.5E-05	9.8E-05	1.6E-05	4.6E-05	9.8E-05	1.5E-05	4.6E-05	9.7E-05	1.4E-05	4.5E-05	9.6E-05
CR/PC Category3 (Adult)	2.6E-06	1.2E-05	3.4E-05	2.7E-06	1.2E-05	3.1E-05	2.6E-06	1.2E-05	3.1E-05	2.7E-06	1.2E-05	3.2E-05
WB Category1 (Adult)	2.5E-05	9.7E-05	2.1E-04	2.4E-05	9.4E-05	2.1E-04	2.6E-05	9.9E-05	2.1E-04	2.7E-05	9.7E-05	2.1E-04
WB Category2 (Adult)	9.8E-06	3.5E-05	8.0E-05	9.6E-06	3.6E-05	8.2E-05	9.5E-06	3.6E-05	8.2E-05	1.1E-05	3.5E-05	8.6E-05
WB Category3 (Adult)	1.4E-06	9.7E-06	2.8E-05	1.8E-06	9.4E-06	2.8E-05	1.8E-06	9.6E-06	2.6E-05	1.6E-06	9.4E-06	2.8E-05
EFPC Category3 (Adult)	1.7E-05	7.5E-05	1.5E-04	1.9E-05	7.4E-05	1.6E-04	1.9E-05	7.5E-05	1.5E-04	1.8E-05	7.3E-05	1.5E-04
Adult CR/PC commercial	1.6E-07	2.5E-06	3.9E-05	1.7E-07	2.5E-06	3.8E-05	2.0E-07	2.4E-06	3.9E-05	1.4E-07	2.4E-06	3.9E-05
Adult CR/PC recreational	1.0E-06	2.1E-05	3.2E-04	1.3E-06	2.1E-05	3.0E-04	1.3E-06	2.1E-05	2.8E-04	1.2E-06	2.0E-05	3.2E-04
Child CR/PC commercial	1.4E-07	2.2E-06	3.5E-05	1.4E-07	2.1E-06	3.3E-05	1.6E-07	2.2E-06	3.4E-05	1.2E-07	2.1E-06	3.3E-05
Child CR/PC recreational	9.2E-07	1.9E-05	2.6E-04	1.2E-06	1.7E-05	2.9E-04	1.1E-06	1.8E-05	2.7E-04	1.2E-06	1.8E-05	2.5E-04
Adult WB commercial	1.3E-06	2.0E-05	3.0E-04	1.4E-06	2.2E-05	3.3E-04	1.2E-06	1.9E-05	3.6E-04	1.1E-06	2.1E-05	3.0E-04
Adult WB recreational	1.7E-06	2.6E-05	4.8E-04	1.3E-06	2.6E-05	3.9E-04	1.5E-06	2.7E-05	3.8E-04	1.3E-06	2.5E-05	5.1E-04
Child WB commercial	1.1E-06	1.8E-05	2.7E-04	1.2E-06	1.9E-05	2.9E-04	1.0E-06	1.7E-05	2.9E-04	9.6E-07	1.8E-05	3.0E-04
Child WB recreational	1.4E-06	2.3E-05	4.1E-04	1.2E-06	2.3E-05	3.8E-04	1.3E-06	2.2E-05	3.7E-04	1.0E-06	2.3E-05	4.4E-04

a Underlined doses exceed the USEPA RfD for methylmercury (0.0001 mg/kg-d)

Table W-7: Estimated Annual Mercury Doses, Fish Consumers (mg kg^{-1} d^{-1}) [a]

	1990		
	2.5%-ile	**50%-ile**	**97.5%-ile**
CR/PC Category1 (Adult)	4.6E-05	1.2E-04	2.6E-04
CR/PC Category2 (Adult)	1.6E-05	4.6E-05	9.5E-05
CR/PC Category3 (Adult)	3.2E-06	1.2E-05	3.0E-05
WB Category1 (Adult)	2.3E-05	9.5E-05	2.1E-04
WB Category2 (Adult)	9.7E-06	3.8E-05	8.2E-05
WB Category3 (Adult)	1.8E-06	9.5E-06	2.7E-05
EFPC Category3 (Adult)	1.9E-05	7.6E-05	1.4E-04
Adult CR/PC commercial	1.8E-07	2.4E-06	4.5E-05
Adult CR/PC recreational	1.5E-06	2.0E-05	3.6E-04
Child CR/PC commercial	1.3E-07	2.1E-06	3.1E-05
Child CR/PC recreational	1.2E-06	1.7E-05	2.9E-04
Adult WB commercial	1.3E-06	2.2E-05	3.2E-04
Adult WB recreational	1.6E-06	2.6E-05	4.9E-04
Child WB commercial	1.0E-06	1.9E-05	3.0E-04
Child WB recreational	1.2E-06	2.2E-05	4.4E-04

a Underlined doses exceed the USEPA RfD for methylmercury (0.0001 mg/kg-d)

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APPENDIX X

COMPARISON OF ESTIMATED DOSES TO REFERENCE DOSES

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APPENDIX X

COMPARISON OF ESTIMATED DOSES TO REFERENCE DOSES

The following tables present:

- Table X-1 presents the estimated elemental (from inhalation), total inorganic (from ingestion and dermal contact pathways), and methylmercury (from fish consumption) doses at the 97.5th percentile (upper confidence limit or "UCL"), 50th percentile ("Central" estimate), and 2.5th percentile (lower confidence limit or "LCL") for each population and year. Doses equal to or greater than the RfD are shaded.

- Table X-2 presents the hazard indices corresponding to each dose presented in Table X-1 — hazard indices equal to or greater than 1.0 are shaded (hazard indices are calculated by dividing the dose by the corresponding RfD).

Please note that doses to Watts Bar Reservoir and Clinch River fish consumers for years before 1953 have likely been overestimated because of the way that methylmercury concentrations in fish were estimated using limited core sample data and an observed relationship between mercury levels in sediment and those in fish (See Sect. 7.5 of the Task 2 report). Estimated fish concentrations were not constrained to be at or near zero in these early years of mercury use.

Table X-1: Summary of Estimated Mercury Doses for Each Population of Interest (mg kg^{-1} d^{-1}) [a]

	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959
	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL
	Central	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**
Reference Population	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL
Wolf Valley Resident (Adult)										
Elemental Mercury (Inhalation)	---	---	---	6.7E-07	1.7E-06	1.0E-05	7.6E-06	2.6E-06	4.6E-06	4.0E-06
	---	**---**	**---**	**7.7E-08**	**1.8E-07**	**1.2E-06**	**8.1E-07**	**3.3E-07**	**4.9E-07**	**4.1E-07**
	---	---	---	8.1E-09	1.7E-08	1.3E-07	8.3E-08	3.3E-08	5.1E-08	5.4E-08
Inorganic Mercury (ingestion, dermal contact)	---	---	---	1.6E-05	5.5E-05	1.7E-04	1.5E-04	6.9E-05	1.0E-04	6.8E-05
	---	**---**	**---**	**6.6E-07**	**1.6E-06**	**1.1E-05**	**7.5E-06**	**3.0E-06**	**4.2E-06**	**3.6E-06**
	---	---	---	3.4E-08	8.1E-08	5.9E-07	2.6E-07	9.0E-08	1.7E-07	1.7E-07
Wolf Valley Resident (Child)										
Elemental Mercury (Inhalation)	---	---	---	1.2E-06	3.1E-06	1.9E-05	1.4E-05	5.1E-06	8.8E-06	8.2E-06
	---	**---**	**---**	**1.5E-07**	**3.5E-07**	**2.3E-06**	**1.4E-06**	**6.0E-07**	**9.8E-07**	**7.7E-07**
	---	---	---	1.4E-08	3.9E-08	2.3E-07	1.4E-07	6.9E-08	1.1E-07	9.0E-08
Inorganic Mercury (ingestion, dermal contact)	---	---	---	3.9E-05	9.6E-05	8.0E-04	2.9E-04	1.2E-04	2.3E-04	2.0E-04
	---	**---**	**---**	**1.2E-06**	**3.0E-06**	**1.9E-05**	**1.3E-05**	**5.6E-06**	**8.6E-06**	**7.0E-06**
	---	---	---	4.4E-08	1.2E-07	9.2E-07	5.2E-07	2.4E-07	3.2E-07	2.9E-07
Scarboro Resident (Adult)										
Elemental Mercury (Inhalation)	1.3E-07	2.5E-07	1.4E-06	8.0E-06	1.0E-05	5.8E-05	4.1E-05	4.0E-05	3.9E-05	2.2E-05
	2.3E-08	**4.4E-08**	**2.3E-07**	**1.9E-06**	**1.9E-06**	**1.1E-05**	**7.2E-06**	**9.4E-06**	**1.0E-05**	**4.6E-06**
	4.7E-09	9.5E-09	4.7E-08	3.9E-07	4.5E-07	2.8E-06	2.0E-06	2.4E-06	2.2E-06	1.1E-06
Inorganic Mercury (ingestion, dermal contact)	2.7E-05	3.7E-05	7.2E-05	2.1E-04	3.4E-04	1.4E-03	1.4E-03	1.0E-03	1.1E-03	6.1E-04
	1.8E-06	**2.3E-06**	**5.9E-06**	**2.9E-05**	**2.8E-05**	**1.4E-04**	**9.1E-05**	**1.4E-04**	**1.4E-04**	**6.1E-05**
	3.1E-07	3.9E-07	9.9E-07	4.5E-06	4.6E-06	1.9E-05	1.2E-05	2.0E-05	2.2E-05	8.9E-06
Methylmercury (Fish consumption)	2.9E-04	2.8E-04	2.9E-04	2.7E-04	3.4E-04	3.4E-04	3.5E-04	3.6E-04	3.2E-04	3.1E-04
	2.0E-05	**2.0E-05**	**2.0E-05**	**2.0E-05**	**2.0E-05**	**2.1E-05**	**2.0E-05**	**2.0E-05**	**2.0E-05**	**2.0E-05**
	1.2E-06	1.2E-06	1.4E-06	1.4E-06	1.1E-06	1.2E-06	1.3E-06	1.3E-06	1.1E-06	1.3E-06
Scarboro Resident (Child)										
Elemental Mercury (Inhalation)	2.4E-07	5.6E-07	3.0E-06	1.8E-05	2.0E-05	1.2E-04	8.1E-05	9.2E-05	9.0E-05	4.9E-05
	4.4E-08	**9.5E-08**	**4.7E-07**	**3.6E-06**	**3.6E-06**	**2.2E-05**	**1.4E-05**	**2.0E-05**	**1.9E-05**	**8.9E-06**
	8.9E-09	1.7E-08	9.3E-08	7.4E-07	9.0E-07	5.0E-06	3.2E-06	4.3E-06	4.0E-06	2.1E-06
Inorganic Mercury (ingestion, dermal contact)	2.1E-04	2.7E-04	2.2E-04	7.2E-04	8.8E-04	4.4E-03	2.4E-03	3.1E-03	4.1E-03	2.1E-03
	7.8E-06	**1.1E-05**	**2.8E-05**	**1.1E-04**	**9.1E-05**	**4.1E-04**	**3.2E-04**	**5.4E-04**	**5.8E-04**	**2.1E-04**
	1.3E-06	1.9E-06	4.2E-06	1.5E-05	1.5E-05	6.4E-05	4.4E-05	7.9E-05	8.0E-05	3.2E-05
Methylmercury (Fish consumption)	3.5E-04	3.0E-04	3.3E-04	3.5E-04	3.6E-04	3.5E-04	3.9E-04	3.8E-04	3.8E-04	3.4E-04
	2.3E-05	**2.3E-05**	**2.3E-05**	**2.4E-05**	**2.3E-05**	**2.3E-05**	**2.4E-05**	**2.4E-05**	**2.2E-05**	**2.2E-05**
	1.3E-06	1.4E-06	1.4E-06	1.6E-06	1.4E-06	1.3E-06	1.4E-06	1.4E-06	1.4E-06	1.7E-06
Robertsville School Student (Child)										
Elemental Mercury (Inhalation)	2.2E-08	4.5E-08	2.2E-07	1.0E-06	5.9E-07	3.0E-06	2.5E-06	6.2E-06	5.5E-06	1.6E-06
	3.9E-09	**7.7E-09**	**3.9E-08**	**1.8E-07**	**1.1E-07**	**5.4E-07**	**4.4E-07**	**1.1E-06**	**9.7E-07**	**2.9E-07**
	7.1E-10	1.4E-09	7.2E-09	3.4E-08	1.9E-08	9.7E-08	8.2E-08	2.0E-07	1.8E-07	5.3E-08
Inorganic Mercury (ingestion, dermal contact)	2.1E-04	2.0E-04	1.9E-04	2.1E-04	1.9E-04	3.2E-04	3.0E-04	2.8E-04	3.3E-04	1.3E-04
(general student)	**2.4E-06**	**2.3E-06**	**2.4E-06**	**2.3E-06**	**2.3E-06**	**3.8E-06**	**3.8E-06**	**4.0E-06**	**3.7E-06**	**1.5E-06**
	3.0E-08	3.0E-08	3.0E-08	3.4E-08	2.8E-08	4.5E-08	5.0E-08	4.6E-08	5.1E-08	1.7E-08
Inorganic Mercury (ingestion, dermal contact)	2.1E-04	2.1E-04	2.1E-04	2.3E-04	2.0E-04	3.8E-04	3.4E-04	4.1E-04	4.8E-04	1.6E-04
(recreational user of EFPC)	**5.3E-06**	**5.2E-06**	**7.3E-06**	**1.4E-05**	**1.0E-05**	**3.1E-05**	**2.6E-05**	**5.1E-05**	**5.7E-05**	**1.7E-05**
	3.0E-07	3.8E-07	7.4E-07	1.5E-06	1.1E-06	3.4E-06	2.9E-06	5.6E-06	6.2E-06	2.0E-06

a Doses that exceed the USEPA RfD are shaded

Table X-1: Summary of Estimated Mercury Doses for Each Population of Interest (mg kg^{-1} d^{-1}) [a]

Reference Population	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL
	Central	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**
	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL
Wolf Valley Resident (Adult)										
Elemental Mercury (Inhalation)	1.8E-06	1.2E-06	1.3E-06	---	---	---	---	---	---	---
	2.0E-07	**1.4E-07**	**1.4E-07**	**---**	**---**	**---**	**---**	**---**	**---**	**---**
	2.2E-08	1.5E-08	1.3E-08	---	---	---	---	---	---	---
Inorganic Mercury (ingestion, dermal contact)	3.2E-05	2.3E-05	3.0E-05	---	---	---	---	---	---	---
	1.8E-06	**1.3E-06**	**1.2E-06**	**---**	**---**	**---**	**---**	**---**	**---**	**---**
	6.7E-08	4.9E-08	5.4E-08	---	---	---	---	---	---	---
Wolf Valley Resident (Child)										
Elemental Mercury (Inhalation)	2.9E-06	2.3E-06	2.4E-06	---	---	---	---	---	---	---
	3.8E-07	**2.7E-07**	**2.7E-07**	**---**	**---**	**---**	**---**	**---**	**---**	**---**
	4.8E-08	2.6E-08	2.3E-08	---	---	---	---	---	---	---
Inorganic Mercury (ingestion, dermal contact)	8.1E-05	8.7E-05	5.2E-05	---	---	---	---	---	---	---
	3.4E-06	**2.3E-06**	**2.5E-06**	**---**	**---**	**---**	**---**	**---**	**---**	**---**
	1.4E-07	8.6E-08	1.1E-07	---	---	---	---	---	---	---
Scarboro Resident (Adult)										
Elemental Mercury (Inhalation)	1.1E-05	8.2E-06	7.0E-06	1.6E-06	5.2E-07	1.2E-06	7.0E-07	4.1E-07	8.1E-08	8.7E-08
	2.1E-06	**1.6E-06**	**1.2E-06**	**2.6E-07**	**1.0E-07**	**2.3E-07**	**1.2E-07**	**7.4E-08**	**1.2E-08**	**1.6E-08**
	4.7E-07	3.9E-07	3.3E-07	5.7E-08	2.0E-08	4.2E-08	2.0E-08	1.3E-08	2.5E-09	3.5E-09
Inorganic Mercury (ingestion, dermal contact)	2.4E-04	2.7E-04	2.4E-04	5.3E-05	2.4E-05	5.2E-05	3.6E-05	2.0E-05	2.4E-05	1.3E-05
	2.7E-05	**2.1E-05**	**1.7E-05**	**6.3E-06**	**3.3E-06**	**5.8E-06**	**3.2E-06**	**2.5E-06**	**1.0E-06**	**1.1E-06**
	4.3E-06	2.9E-06	2.5E-06	1.1E-06	6.3E-07	9.5E-07	6.8E-07	5.7E-07	1.8E-07	2.2E-07
Methylmercury (Fish consumption)	3.0E-04	3.4E-04	3.0E-04	3.3E-04	3.3E-04	3.2E-04	3.3E-04	3.0E-04	2.7E-04	3.3E-04
	2.0E-05	**2.0E-05**	**2.0E-05**	**1.9E-05**	**1.9E-05**	**2.0E-05**	**1.8E-05**	**2.0E-05**	**1.9E-05**	**1.9E-05**
	1.2E-06	1.2E-06	1.2E-06	1.3E-06	1.4E-06	1.4E-06	1.1E-06	1.2E-06	1.1E-06	1.4E-06
Scarboro Resident (Child)										
Elemental Mercury (Inhalation)	2.1E-05	1.7E-05	1.4E-05	3.1E-06	1.2E-06	2.5E-06	1.2E-06	7.9E-07	1.4E-07	1.9E-07
	3.9E-06	**3.1E-06**	**2.5E-06**	**5.2E-07**	**2.0E-07**	**4.5E-07**	**2.4E-07**	**1.5E-07**	**2.4E-08**	**3.2E-08**
	9.3E-07	7.3E-07	6.2E-07	9.9E-08	3.7E-08	8.0E-08	3.9E-08	2.6E-08	4.3E-09	5.7E-09
Inorganic Mercury (ingestion, dermal contact)	9.8E-04	6.2E-04	6.5E-04	2.3E-04	1.3E-04	2.0E-04	1.4E-04	8.3E-05	8.6E-05	1.3E-04
	8.5E-05	**7.4E-05**	**5.6E-05**	**2.7E-05**	**1.5E-05**	**2.6E-05**	**1.5E-05**	**1.3E-05**	**4.9E-06**	**5.2E-06**
	1.6E-05	1.3E-05	8.2E-06	4.7E-06	2.7E-06	4.5E-06	3.0E-06	2.1E-06	7.8E-07	7.6E-07
Methylmercury (Fish consumption)	3.4E-04	4.1E-04	3.5E-04	3.4E-04	3.7E-04	3.4E-04	3.5E-04	3.3E-04	3.2E-04	3.5E-04
	2.2E-05	**2.3E-05**	**2.4E-05**	**2.2E-05**	**2.3E-05**	**2.3E-05**	**2.2E-05**	**2.2E-05**	**2.2E-05**	**2.1E-05**
	1.4E-06	1.5E-06	1.4E-06	1.4E-06	1.6E-06	1.6E-06	1.3E-06	1.3E-06	1.4E-06	1.4E-06
Robertsville School Student (Child)										
Elemental Mercury (Inhalation)	6.1E-07	5.6E-07	3.7E-07	2.6E-07	9.6E-08	2.1E-07	1.2E-07	6.6E-08	1.1E-08	1.6E-08
	1.1E-07	**9.8E-08**	**6.8E-08**	**4.6E-08**	**1.7E-08**	**3.6E-08**	**2.0E-08**	**1.2E-08**	**2.1E-09**	**2.7E-09**
	2.0E-08	1.9E-08	1.3E-08	8.5E-09	3.2E-09	6.6E-09	3.3E-09	2.6E-09	3.6E-10	4.3E-10
Inorganic Mercury (ingestion, dermal contact)	1.2E-04	1.1E-04	1.3E-04	1.3E-04	1.5E-04	1.4E-04	1.3E-04	9.2E-05	1.3E-04	7.0E-05
(general student)	**1.5E-06**	**1.5E-06**	**1.4E-06**	**1.5E-06**	**1.4E-06**	**1.5E-06**	**1.4E-06**	**1.0E-06**	**1.0E-06**	**1.0E-06**
	1.7E-08	1.4E-08	1.8E-08	1.7E-08	1.8E-08	1.9E-08	1.3E-08	1.4E-08	1.1E-08	1.4E-08
Inorganic Mercury (ingestion, dermal contact)	1.4E-04	1.2E-04	1.4E-04	1.4E-04	1.5E-04	1.4E-04	1.5E-04	1.5E-04	8.5E-05	9.8E-05
(recreational user of EFPC)	**8.7E-06**	**8.1E-06**	**6.4E-06**	**5.5E-06**	**4.3E-06**	**5.6E-06**	**4.3E-06**	**2.8E-06**	**2.4E-06**	**2.3E-06**
	1.0E-06	8.9E-07	6.9E-07	6.0E-07	4.3E-07	5.6E-07	4.5E-07	2.9E-07	1.8E-07	1.5E-07

a Doses that exceed the USEPA RfD are shaded

Table X-1: Summary of Estimated Mercury Doses for Each Population of Interest (mg kg^{-1} d^{-1}) [a]

Reference Population	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL
	Central	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**
	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL
Wolf Valley Resident (Adult)										
Elemental Mercury (Inhalation)	---	---	---	---	---	---	---	---	---	---
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Inorganic Mercury (ingestion, dermal contact)	---	---	---	---	---	---	---	---	---	---
	---	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**
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Wolf Valley Resident (Child)										
Elemental Mercury (Inhalation)	---	---	---	---	---	---	---	---	---	---
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	---	---	---	---	---	---	---	---	---	---
Inorganic Mercury (ingestion, dermal contact)	---	---	---	---	---	---	---	---	---	---
	---	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**
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Scarboro Resident (Adult)										
Elemental Mercury (Inhalation)	3.6E-07	8.2E-08	9.4E-09	8.3E-07	1.6E-07	1.1E-08	1.2E-08	2.5E-08	1.1E-08	1.8E-08
	6.2E-08	**1.6E-08**	**1.7E-09**	**1.6E-07**	**3.0E-08**	**1.7E-09**	**2.2E-09**	**4.2E-09**	**1.9E-09**	**3.7E-09**
	1.1E-08	2.9E-09	3.3E-10	2.8E-08	6.0E-09	4.2E-10	4.8E-10	9.2E-10	3.9E-10	7.3E-10
Inorganic Mercury (ingestion, dermal contact)	2.5E-05	9.0E-06	8.1E-06	2.9E-05	1.1E-05	6.1E-06	4.7E-06	5.9E-06	8.7E-06	4.4E-06
	2.2E-06	**8.8E-07**	**4.6E-07**	**3.6E-06**	**1.2E-06**	**4.3E-07**	**4.6E-07**	**4.7E-07**	**4.9E-07**	**4.6E-07**
	4.3E-07	1.7E-07	7.7E-08	6.9E-07	2.4E-07	7.2E-08	7.0E-08	7.9E-08	6.6E-08	7.7E-08
Methylmercury (Fish consumption)	3.0E-04	2.6E-04	2.8E-04	3.3E-04	2.7E-04	2.5E-04	2.3E-04	2.8E-04	2.2E-04	2.4E-04
	1.9E-05	**1.8E-05**	**1.8E-05**	**1.8E-05**	**1.9E-05**	**1.6E-05**	**1.6E-05**	**1.5E-05**	**1.5E-05**	**1.5E-05**
	1.3E-06	1.3E-06	1.0E-06	1.1E-06	1.2E-06	1.0E-06	9.8E-07	8.7E-07	8.9E-07	9.4E-07
Scarboro Resident (Child)										
Elemental Mercury (Inhalation)	6.6E-07	1.5E-07	1.7E-08	1.9E-06	3.0E-07	2.2E-08	2.5E-08	5.3E-08	2.3E-08	3.9E-08
	1.2E-07	**2.9E-08**	**3.4E-09**	**3.1E-07**	**5.9E-08**	**3.6E-09**	**4.4E-09**	**8.6E-09**	**3.7E-09**	**7.8E-09**
	2.4E-08	6.1E-09	6.7E-10	4.5E-08	1.0E-08	7.6E-10	9.0E-10	1.7E-09	7.4E-10	1.3E-09
Inorganic Mercury (ingestion, dermal contact)	1.3E-04	4.8E-05	2.8E-05	8.6E-05	3.7E-05	3.5E-05	2.7E-05	3.2E-05	4.5E-05	3.1E-05
	1.1E-05	**4.0E-06**	**2.4E-06**	**1.5E-05**	**5.8E-06**	**2.1E-06**	**2.2E-06**	**2.5E-06**	**2.1E-06**	**2.0E-06**
	1.9E-05	6.4E-07	3.3E-07	3.0E-06	1.1E-06	2.9E-07	3.3E-07	4.2E-07	2.9E-07	3.5E-07
Methylmercury (Fish consumption)	3.2E-04	3.5E-04	3.7E-04	3.6E-04	3.2E-04	2.7E-04	2.6E-04	2.6E-04	2.5E-04	2.4E-04
	2.2E-05	**2.2E-05**	**2.0E-05**	**2.0E-05**	**2.2E-05**	**1.8E-05**	**1.8E-05**	**1.6E-05**	**1.7E-05**	**1.6E-05**
	1.4E-06	1.4E-06	1.4E-06	1.3E-06	1.4E-06	1.2E-06	1.2E-06	1.1E-06	1.1E-06	1.0E-06
Robertsville School Student (Child)										
Elemental Mercury (Inhalation)	5.6E-08	1.4E-08	1.5E-09	1.3E-07	3.0E-08	1.8E-09	2.0E-09	4.1E-09	1.8E-09	3.9E-09
	1.0E-08	**2.6E-09**	**2.8E-10**	**2.5E-08**	**4.9E-09**	**3.0E-10**	**3.8E-10**	**7.4E-10**	**3.1E-10**	**5.9E-10**
	2.1E-09	4.5E-10	5.1E-11	4.5E-09	8.3E-10	6.6E-11	6.6E-11	1.3E-10	6.8E-11	1.2E-10
Inorganic Mercury (ingestion, dermal contact)	8.1E-05	5.0E-05	4.4E-05	4.2E-05	4.0E-05	2.4E-05	3.1E-05	4.4E-05	2.4E-05	1.4E-05
(general student)	**1.2E-06**	**4.3E-07**	**3.3E-07**	**3.8E-07**	**4.6E-07**	**2.7E-07**	**2.5E-07**	**2.8E-07**	**2.8E-07**	**1.3E-07**
	1.1E-08	4.5E-09	2.8E-09	4.7E-09	3.3E-09	1.5E-09	1.8E-09	1.5E-09	3.0E-09	1.8E-09
Inorganic Mercury (ingestion, dermal contact)	8.6E-05	5.9E-05	4.4E-05	3.4E-05	5.0E-05	2.3E-05	4.5E-05	2.6E-05	2.0E-05	2.6E-05
(recreational user of EFPC)	**2.8E-06**	**9.0E-07**	**9.1E-07**	**2.1E-06**	**1.1E-06**	**5.9E-07**	**5.8E-07**	**6.5E-07**	**6.1E-07**	**3.5E-07**
	2.8E-07	7.1E-08	4.0E-08	2.5E-07	1.1E-07	3.9E-08	3.4E-08	3.8E-08	4.4E-08	2.7E-08

a Doses that exceed the USEPA RfD are shaded

Table X-1: Summary of Estimated Mercury Doses for Each Population of Interest (mg kg^{-1} d^{-1}) [a]

Reference Population	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL
	Central	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**
	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL
Wolf Valley Resident (Adult)											
Elemental Mercury (Inhalation)	---	---	---	---	---	---	---	---	---	---	---
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Inorganic Mercury (ingestion, dermal contact)	---	---	---	---	---	---	---	---	---	---	---
	---	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**
	---	---	---	---	---	---	---	---	---	---	---
Wolf Valley Resident (Child)											
Elemental Mercury (Inhalation)	---	---	---	---	---	---	---	---	---	---	---
	---	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**
	---	---	---	---	---	---	---	---	---	---	---
Inorganic Mercury (ingestion, dermal contact)	---	---	---	---	---	---	---	---	---	---	---
	---	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**
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Scarboro Resident (Adult)											
Elemental Mercury (Inhalation)	2.4E-08	1.5E-08	3.7E-08	2.6E-08	2.1E-08	2.5E-08	3.2E-08	2.9E-08	2.0E-08	1.8E-08	2.0E-08
	4.5E-09	**3.1E-09**	**5.7E-09**	**5.1E-09**	**4.1E-09**	**4.8E-09**	**5.9E-09**	**6.5E-09**	**3.5E-09**	**3.4E-09**	**3.2E-09**
	9.6E-10	6.2E-10	1.2E-09	9.2E-10	8.5E-10	1.0E-09	1.1E-09	1.3E-09	7.9E-10	7.1E-10	6.4E-10
Inorganic Mercury (ingestion, dermal contact)	4.9E-06	4.9E-06	5.1E-06	5.5E-06	5.6E-06	5.0E-06	5.2E-06	4.0E-06	4.0E-06	4.4E-06	3.8E-06
	4.9E-07	**4.4E-07**	**5.3E-07**	**4.7E-07**	**4.2E-07**	**4.3E-07**	**4.6E-07**	**5.0E-07**	**4.3E-07**	**3.9E-07**	**4.2E-07**
	1.0E-07	7.9E-08	9.4E-08	8.6E-08	7.7E-08	9.6E-08	9.1E-08	9.6E-08	6.6E-08	6.7E-08	6.5E-08
Methylmercury (Fish consumption)	2.3E-04	2.1E-04	2.1E-04	1.7E-04	1.5E-04	1.2E-04	1.2E-04	1.2E-04	1.1E-04	1.2E-04	1.3E-04
	1.4E-05	**1.3E-05**	**1.2E-05**	**1.1E-05**	**9.9E-06**	**7.7E-06**	**7.9E-06**	**7.5E-06**	**7.7E-06**	**7.7E-06**	**7.8E-06**
	9.8E-07	8.5E-07	7.8E-07	7.3E-07	6.2E-07	5.2E-07	4.7E-07	5.0E-07	4.9E-07	4.8E-07	4.8E-07
Scarboro Resident (Child)											
Elemental Mercury (Inhalation)	5.5E-08	3.4E-08	6.2E-08	5.7E-08	4.7E-08	5.6E-08	6.7E-08	6.4E-08	4.1E-08	3.6E-08	3.9E-08
	9.5E-09	**5.9E-09**	**1.1E-08**	**1.0E-08**	**7.7E-09**	**9.4E-09**	**1.1E-08**	**1.3E-08**	**6.4E-09**	**6.9E-09**	**6.2E-09**
	1.9E-09	1.3E-09	2.1E-09	1.6E-09	1.6E-09	1.8E-09	2.0E-09	2.7E-09	1.4E-09	1.2E-09	1.3E-09
Inorganic Mercury (ingestion, dermal contact)	2.6E-05	2.1E-05	3.1E-05	2.7E-05	1.8E-05	5.6E-08	6.7E-08	6.4E-08	4.1E-08	3.6E-08	3.9E-08
	2.3E-06	**2.0E-06**	**2.4E-06**	**2.0E-06**	**1.7E-06**	**9.4E-09**	**1.1E-08**	**1.3E-08**	**6.4E-09**	**6.9E-09**	**6.2E-09**
	3.4E-07	3.4E-07	4.0E-07	3.6E-07	3.3E-07	1.8E-09	2.0E-09	2.7E-09	1.4E-09	1.2E-09	1.3E-09
Methylmercury (Fish consumption)	2.3E-04	2.4E-04	2.5E-04	2.0E-04	1.7E-04	1.3E-04	1.3E-04	1.2E-04	1.3E-04	1.3E-04	1.4E-04
	1.6E-05	**1.6E-05**	**1.5E-05**	**1.3E-05**	**1.2E-05**	**8.9E-06**	**8.7E-06**	**8.4E-06**	**8.5E-06**	**8.7E-06**	**8.7E-06**
	1.1E-06	9.3E-07	9.4E-07	8.7E-07	7.3E-07	5.8E-07	5.9E-07	5.6E-07	5.7E-07	5.8E-07	5.9E-07
Robertsville School Student (Child)											
Elemental Mercury (Inhalation)	4.3E-09	2.9E-09	5.5E-09	4.5E-09	4.1E-09	5.3E-09	5.2E-09	5.6E-09	3.3E-09	3.0E-09	3.0E-09
	7.7E-10	**5.1E-10**	**9.5E-10**	**8.6E-10**	**6.7E-10**	**7.3E-10**	**9.6E-10**	**1.1E-09**	**5.8E-10**	**6.0E-10**	**5.5E-10**
	1.5E-10	8.5E-11	1.7E-10	1.4E-10	1.3E-10	1.5E-10	1.8E-10	2.1E-10	1.2E-10	1.1E-10	9.2E-11
Inorganic Mercury (ingestion, dermal contact)	1.5E-05	2.0E-05	1.4E-05	1.5E-05	1.0E-05	1.1E-05	8.5E-06	7.5E-06	1.2E-05	1.1E-05	1.2E-05
(general student)	**1.4E-07**	**1.4E-07**	**1.5E-07**	**9.2E-08**	**7.4E-08**	**8.8E-08**	**8.8E-08**	**9.6E-08**	**7.9E-08**	**9.2E-08**	**8.4E-08**
	1.1E-09	1.4E-09	1.3E-09	5.3E-10	7.4E-10	7.5E-10	7.5E-10	3.2E-10	5.0E-10	7.4E-10	6.6E-10
Inorganic Mercury (ingestion, dermal contact)	2.0E-05	2.4E-05	2.0E-05	1.4E-05	9.9E-06	1.9E-05	8.8E-06	1.4E-05	1.3E-05	1.1E-05	1.7E-05
(recreational user of EFPC)	**3.8E-07**	**3.9E-07**	**3.9E-07**	**2.7E-07**	**2.3E-07**	**2.6E-07**	**2.9E-07**	**2.7E-07**	**2.3E-07**	**2.4E-07**	**2.5E-07**
	3.0E-08	2.9E-08	3.2E-08	1.9E-08	1.8E-08	1.7E-08	2.4E-08	1.8E-08	2.5E-08	1.3E-08	1.2E-08

a Doses that exceed the USEPA RfD are shaded

Table X-1: Summary of Estimated Mercury Doses for Each Population of Interest (mg kg^{-1} d^{-1}) [a]

	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959
	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL
	Central	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**
Reference Population	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL
EFPC Floodplain Farm Family (Adult)										
Elemental Mercury (Inhalation)	1.5E-06	2.7E-06	1.3E-05	5.4E-05	3.9E-05	1.7E-04	1.3E-04	3.8E-04	3.2E-04	9.5E-05
	2.2E-07	**4.7E-07**	**2.4E-06**	**1.1E-05**	**6.3E-06**	**3.3E-05**	**2.7E-05**	**6.5E-05**	**5.9E-05**	**1.7E-05**
	4.1E-08	9.2E-08	4.1E-07	2.2E-06	1.4E-06	6.6E-06	4.9E-06	1.3E-05	1.2E-05	3.7E-06
Inorganic Mercury (ingestion, dermal contact)	1.9E-04	2.5E-04	4.0E-04	1.4E-03	9.4E-04	5.5E-03	3.3E-03	9.4E-03	7.8E-03	2.6E-03
	1.7E-05	**2.1E-05**	**5.2E-05**	**1.7E-04**	**1.0E-04**	**4.8E-04**	**3.7E-04**	**8.1E-04**	**8.4E-04**	**2.5E-04**
	2.4E-06	3.7E-06	1.2E-05	3.4E-05	2.1E-05	8.5E-05	6.6E-05	1.6E-04	1.7E-04	4.9E-05
Methylmercury (Fish consumption)	3.0E-04	3.5E-04	3.5E-04	3.8E-04	2.6E-04	3.2E-04	2.9E-04	3.4E-04	3.5E-04	3.3E-04
	2.0E-05	**1.9E-05**	**2.0E-05**	**1.9E-05**	**2.0E-05**	**2.0E-05**	**1.9E-05**	**2.0E-05**	**1.9E-05**	**2.0E-05**
	1.2E-06	1.3E-06	1.4E-06	1.3E-06	1.2E-06	1.3E-06	1.4E-06	1.3E-06	1.2E-06	1.2E-06
EFPC Floodplain Farm Family (Child)										
Elemental Mercury (Inhalation)	3.8E-06	7.5E-06	3.5E-05	1.6E-04	1.1E-04	4.9E-04	4.1E-04	1.1E-03	8.9E-04	2.1E-04
	6.9E-07	**1.4E-06**	**6.9E-06**	**3.1E-05**	**1.8E-05**	**9.8E-05**	**8.1E-05**	**1.9E-04**	**1.7E-04**	**5.0E-05**
	1.4E-07	2.9E-07	1.4E-06	7.2E-06	4.2E-06	1.8E-05	1.7E-05	3.7E-05	3.2E-05	1.2E-05
Inorganic Mercury (ingestion, dermal contact)	1.3E-03	9.1E-04	1.8E-03	4.8E-03	3.6E-03	1.2E-02	1.0E-02	2.6E-02	2.7E-02	7.1E-03
	6.2E-05	**7.7E-05**	**1.4E-04**	**3.7E-04**	**2.4E-04**	**8.9E-04**	**8.0E-04**	**1.6E-03**	**1.5E-03**	**4.4E-04**
	6.9E-06	9.7E-06	2.4E-05	5.7E-05	4.6E-05	1.7E-04	1.3E-04	2.7E-04	3.1E-04	9.3E-05
Methylmercury (Fish consumption)	3.2E-04	3.9E-04	3.6E-04	3.4E-04	3.6E-04	3.7E-04	3.3E-04	3.5E-04	3.9E-04	4.0E-04
	2.2E-05	**2.2E-05**	**2.2E-05**	**2.2E-05**	**2.3E-05**	**2.3E-05**	**2.3E-05**	**2.3E-05**	**2.1E-05**	**2.3E-05**
	1.4E-06	1.5E-06	1.5E-06	1.5E-06	1.4E-06	1.4E-06	1.6E-06	1.4E-06	1.6E-06	1.5E-06
Community Population 1 (Adult)										
Elemental Mercury (Inhalation)	4.2E-08	8.4E-08	4.0E-07	2.0E-06	1.2E-06	5.8E-06	4.6E-06	1.3E-05	9.4E-06	3.3E-06
	7.7E-09	**1.5E-08**	**7.7E-08**	**3.5E-07**	**2.1E-07**	**1.0E-06**	**9.1E-07**	**2.1E-06**	**1.9E-06**	**5.5E-07**
	1.3E-09	3.3E-09	1.6E-08	7.4E-08	4.2E-08	2.2E-07	1.7E-07	4.1E-07	3.4E-07	1.1E-07
Inorganic Mercury (ingestion, dermal contact)	1.5E-06	2.0E-06	1.1E-05	7.1E-05	3.1E-05	1.3E-04	1.2E-04	2.9E-04	2.3E-04	6.8E-05
	7.0E-08	**1.5E-07**	**6.6E-07**	**3.1E-06**	**2.0E-06**	**9.3E-06**	**7.2E-06**	**2.0E-05**	**1.7E-05**	**4.8E-06**
	3.4E-09	7.8E-09	4.6E-08	1.5E-07	8.2E-08	5.2E-07	5.6E-07	9.2E-07	8.6E-07	3.2E-07
Community Population 1 (Child)										
Elemental Mercury (Inhalation)	8.8E-08	1.8E-07	9.2E-07	4.3E-06	2.5E-06	1.2E-05	1.1E-05	2.6E-05	1.9E-05	6.0E-06
	1.5E-08	**3.1E-08**	**1.6E-07**	**6.6E-07**	**4.1E-07**	**2.1E-06**	**1.7E-06**	**4.0E-06**	**3.8E-06**	**1.1E-06**
	2.5E-09	5.4E-09	3.1E-08	1.3E-07	8.0E-08	4.0E-07	3.6E-07	9.1E-07	7.7E-07	2.0E-07
Inorganic Mercury (ingestion, dermal contact)	2.8E-06	4.4E-06	2.7E-05	1.5E-04	8.4E-05	3.5E-04	2.6E-04	6.2E-04	6.7E-04	1.6E-04
	1.4E-07	**2.9E-07**	**1.2E-06**	**6.1E-06**	**3.5E-06**	**1.8E-05**	**1.5E-05**	**3.4E-05**	**3.0E-05**	**9.8E-06**
	5.8E-09	1.1E-08	7.1E-08	2.0E-07	1.3E-07	7.9E-07	8.3E-07	1.7E-06	1.9E-06	4.3E-07
Community Population 2 (Adult)										
Elemental Mercury (Inhalation)	1.9E-08	4.1E-08	2.0E-07	1.0E-06	5.3E-07	2.3E-06	2.3E-06	5.4E-06	5.2E-06	1.5E-06
	3.9E-09	**7.7E-09**	**3.8E-08**	**1.7E-07**	**1.0E-07**	**5.5E-07**	**4.1E-07**	**1.1E-06**	**9.5E-07**	**2.7E-07**
	7.8E-10	1.7E-09	7.4E-09	3.6E-08	1.9E-08	1.2E-07	8.8E-08	2.2E-07	2.0E-07	5.0E-08
Inorganic Mercury (ingestion, dermal contact)	6.3E-07	1.2E-06	6.5E-06	2.7E-05	1.6E-05	9.5E-05	4.8E-05	1.7E-04	1.5E-04	3.5E-05
	3.1E-08	**6.4E-08**	**3.5E-07**	**1.4E-06**	**9.1E-07**	**4.5E-06**	**3.8E-06**	**9.4E-06**	**7.8E-06**	**2.6E-06**
	2.2E-09	4.1E-09	1.4E-08	1.1E-07	4.8E-08	2.2E-07	2.5E-07	5.7E-07	4.7E-07	1.5E-07
Community Population 2 (Child)										
Elemental Mercury (Inhalation)	3.9E-08	8.1E-08	3.6E-07	2.1E-06	1.2E-06	5.4E-06	4.6E-06	1.1E-05	1.1E-05	3.0E-06
	7.7E-09	**1.5E-08**	**7.1E-08**	**3.3E-07**	**2.0E-07**	**9.8E-07**	**8.5E-07**	**2.0E-06**	**1.9E-06**	**5.6E-07**
	1.4E-09	3.0E-09	1.5E-08	6.2E-08	3.3E-08	2.1E-07	1.8E-07	4.2E-07	4.0E-07	1.1E-07
Inorganic Mercury (ingestion, dermal contact)	1.1E-06	2.2E-06	1.1E-05	5.9E-05	5.1E-05	1.9E-04	1.6E-04	2.7E-04	4.0E-04	1.1E-04
	6.6E-08	**1.2E-07**	**6.9E-07**	**2.9E-06**	**1.6E-06**	**8.4E-06**	**7.4E-06**	**1.8E-05**	**1.6E-05**	**4.7E-06**
	3.7E-09	7.1E-09	2.7E-08	1.5E-07	6.4E-08	4.4E-07	2.5E-07	9.4E-07	5.8E-07	2.1E-07

a Doses that exceed the USEPA RfD are shaded

Table X-1: Summary of Estimated Mercury Doses for Each Population of Interest (mg kg^{-1} d^{-1}) [a]

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL
	Central	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**
Reference Population	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL
EFPC Floodplain Farm Family (Adult)										
Elemental Mercury (Inhalation)	3.4E-05	3.9E-05	2.1E-05	1.5E-05	5.8E-06	1.3E-05	6.2E-06	4.0E-06	6.2E-07	8.3E-07
	6.5E-06	**6.1E-06**	**4.2E-06**	**2.8E-06**	**9.6E-07**	**2.3E-06**	**1.2E-06**	**8.0E-07**	**1.3E-07**	**1.7E-07**
	1.2E-06	1.1E-06	8.0E-07	5.7E-07	2.2E-07	3.7E-07	2.4E-07	1.4E-07	2.6E-08	2.9E-08
Inorganic Mercury (ingestion, dermal contact)	9.5E-04	1.1E-03	7.3E-04	5.4E-04	2.8E-04	4.8E-04	2.9E-04	1.4E-04	8.2E-05	1.1E-04
	9.8E-05	**9.2E-05**	**7.0E-05**	**5.1E-05**	**2.6E-05**	**4.4E-05**	**2.7E-05**	**1.8E-05**	**7.3E-06**	**9.0E-06**
	2.2E-05	1.7E-05	1.2E-05	1.1E-05	5.1E-06	8.4E-06	5.6E-06	2.8E-06	9.5E-07	1.5E-06
Methylmercury (Fish consumption)	3.3E-04	3.0E-04	2.5E-04	3.3E-04	3.4E-04	2.9E-04	2.9E-04	3.3E-04	2.7E-04	2.9E-04
	2.0E-05	**1.9E-05**	**2.0E-05**	**1.9E-05**	**2.0E-05**	**1.8E-05**	**1.9E-05**	**2.0E-05**	**1.9E-05**	**1.9E-05**
	1.1E-06	1.5E-06	1.3E-06	1.3E-06	1.2E-06	1.3E-06	1.2E-06	1.3E-06	1.1E-06	1.2E-06
EFPC Floodplain Farm Family (Child)										
Elemental Mercury (Inhalation)	9.6E-05	1.0E-04	5.9E-05	3.9E-05	1.5E-05	3.2E-05	1.6E-05	1.1E-05	1.7E-06	2.3E-06
	1.9E-05	**1.7E-05**	**1.2E-05**	**8.1E-06**	**2.7E-06**	**6.7E-06**	**3.6E-06**	**2.3E-06**	**3.7E-07**	**4.7E-07**
	4.1E-06	3.4E-06	2.4E-06	2.0E-06	6.3E-07	1.3E-06	7.5E-07	4.5E-07	8.4E-08	1.0E-07
Inorganic Mercury (ingestion, dermal contact)	2.4E-03	2.3E-03	2.1E-03	1.2E-03	7.8E-04	1.4E-03	8.5E-04	5.2E-04	5.3E-04	5.3E-04
	2.1E-04	**2.0E-04**	**1.5E-04**	**1.3E-04**	**7.5E-05**	**1.1E-04**	**7.8E-05**	**5.5E-05**	**2.8E-05**	**2.9E-05**
	3.9E-05	3.7E-05	2.4E-05	2.1E-05	1.2E-05	2.0E-05	1.3E-05	8.8E-06	3.4E-06	3.9E-06
Methylmercury (Fish consumption)	3.9E-04	3.6E-04	3.2E-04	3.4E-04	3.7E-04	3.3E-04	3.4E-04	3.2E-04	3.3E-04	3.1E-04
	2.3E-05	**2.1E-05**	**2.3E-05**	**2.2E-05**	**2.3E-05**	**2.1E-05**	**2.1E-05**	**2.2E-05**	**2.1E-05**	**2.1E-05**
	1.3E-06	1.6E-06	1.5E-06	1.6E-06	1.5E-06	1.6E-06	1.3E-06	1.5E-06	1.3E-06	1.4E-06
Community Population 1 (Adult)										
Elemental Mercury (Inhalation)	1.2E-06	9.3E-07	8.1E-07	5.1E-07	1.7E-07	3.4E-07	2.2E-07	1.6E-07	2.2E-08	2.7E-08
	2.0E-07	**2.1E-07**	**1.4E-07**	**9.2E-08**	**3.4E-08**	**7.4E-08**	**4.0E-08**	**2.4E-08**	**4.2E-09**	**5.5E-09**
	4.3E-08	3.9E-08	2.7E-08	1.7E-08	7.3E-09	1.5E-08	8.5E-09	4.5E-09	7.2E-10	1.1E-09
Inorganic Mercury (ingestion, dermal contact)	3.1E-05	2.4E-05	2.1E-05	1.2E-05	3.7E-06	8.1E-06	5.3E-06	3.2E-06	5.3E-07	6.3E-07
	1.8E-06	**1.7E-06**	**1.2E-06**	**7.9E-07**	**3.1E-07**	**6.1E-07**	**3.6E-07**	**2.4E-07**	**3.6E-08**	**4.6E-08**
	1.2E-07	7.8E-08	7.3E-08	5.7E-08	1.8E-08	5.0E-08	2.3E-08	1.3E-08	2.5E-09	2.3E-09
Community Population 1 (Child)										
Elemental Mercury (Inhalation)	2.7E-06	2.4E-06	1.5E-06	1.1E-06	3.7E-07	7.6E-07	4.3E-07	3.3E-07	4.7E-08	5.6E-08
	4.1E-07	**3.9E-07**	**2.8E-07**	**1.7E-07**	**6.1E-08**	**1.5E-07**	**8.4E-08**	**4.7E-08**	**7.9E-09**	**1.1E-08**
	9.2E-08	7.6E-08	5.5E-08	3.4E-08	1.3E-08	3.1E-08	1.3E-08	9.4E-09	1.6E-09	2.0E-09
Inorganic Mercury (ingestion, dermal contact)	7.5E-05	5.8E-05	4.6E-05	3.7E-05	1.0E-05	1.8E-05	1.8E-05	7.2E-06	1.1E-06	1.7E-06
	3.3E-06	**3.2E-06**	**2.3E-06**	**1.5E-06**	**5.7E-07**	**1.3E-06**	**7.2E-07**	**4.0E-07**	**6.9E-08**	**8.4E-08**
	1.5E-07	1.4E-07	1.1E-07	7.8E-08	2.2E-08	5.8E-08	3.0E-08	2.3E-08	3.6E-09	3.5E-09
Community Population 2 (Adult)										
Elemental Mercury (Inhalation)	5.5E-07	5.5E-07	4.7E-07	2.4E-07	9.3E-08	2.0E-07	1.1E-07	7.0E-08	1.0E-08	1.4E-08
	1.0E-07	**9.3E-08**	**6.4E-08**	**4.6E-08**	**1.7E-08**	**3.6E-08**	**2.0E-08**	**1.2E-08**	**1.9E-09**	**2.7E-09**
	2.0E-08	1.8E-08	1.4E-08	8.9E-09	3.0E-09	5.5E-09	3.8E-09	2.1E-09	3.8E-10	4.3E-10
Inorganic Mercury (ingestion, dermal contact)	1.5E-05	1.3E-05	9.3E-06	6.7E-06	2.0E-06	5.5E-06	2.8E-06	1.3E-06	2.9E-07	3.5E-07
	8.6E-07	**9.2E-07**	**6.1E-07**	**4.2E-07**	**1.5E-07**	**3.0E-07**	**1.7E-07**	**1.2E-07**	**1.7E-08**	**2.1E-08**
	5.6E-08	6.0E-08	3.2E-08	1.9E-08	5.6E-09	1.6E-08	1.1E-08	5.7E-09	1.0E-09	1.3E-09
Community Population 2 (Child)										
Elemental Mercury (Inhalation)	1.1E-06	1.1E-06	9.1E-07	4.8E-07	1.8E-07	3.7E-07	2.2E-07	1.5E-07	2.3E-08	2.8E-08
	2.0E-07	**1.8E-07**	**1.3E-07**	**8.6E-08**	**3.3E-08**	**7.4E-08**	**3.6E-08**	**2.4E-08**	**4.0E-09**	**5.2E-09**
	3.8E-08	4.0E-08	3.0E-08	2.0E-08	5.7E-09	1.4E-08	7.9E-09	4.5E-09	7.4E-10	8.9E-10
Inorganic Mercury (ingestion, dermal contact)	4.1E-05	4.8E-05	2.6E-05	1.7E-05	6.6E-06	1.1E-05	6.6E-06	3.7E-06	5.5E-07	8.2E-07
	1.7E-06	**1.5E-06**	**1.1E-06**	**7.2E-07**	**2.7E-07**	**6.2E-07**	**3.4E-07**	**2.0E-07**	**3.3E-08**	**4.2E-08**
	5.7E-08	8.6E-08	4.4E-08	4.6E-08	1.1E-08	2.7E-08	1.6E-08	7.7E-09	1.4E-09	2.0E-09

a Doses that exceed the USEPA RfD are shaded

Table X-1: Summary of Estimated Mercury Doses for Each Population of Interest (mg kg^{-1} d^{-1}) [a]

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL
	Central	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**
Reference Population	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL
EFPC Floodplain Farm Family (Adult)										
Elemental Mercury (Inhalation)	3.7E-06	8.6E-07	8.5E-08	9.3E-06	1.5E-06	1.1E-07	1.2E-07	2.3E-07	1.1E-07	2.5E-07
	6.1E-07	**1.5E-07**	**1.8E-08**	**1.6E-06**	**3.1E-07**	**1.9E-08**	**2.1E-08**	**4.5E-08**	**2.0E-08**	**3.8E-08**
	1.3E-07	2.8E-08	3.1E-09	2.8E-07	5.5E-08	3.8E-09	4.4E-09	7.5E-09	3.7E-09	6.6E-09
Inorganic Mercury (ingestion, dermal contact)	2.0E-04	5.7E-05	4.4E-05	2.4E-04	6.5E-05	2.5E-05	3.6E-05	3.8E-05	3.7E-05	1.6E-05
	1.7E-05	**5.0E-06**	**2.2E-06**	**2.5E-05**	**7.8E-06**	**1.8E-06**	**1.8E-06**	**2.3E-06**	**1.9E-06**	**1.5E-06**
	3.9E-06	9.5E-07	3.0E-07	5.0E-06	1.3E-06	2.5E-07	2.6E-07	4.0E-07	2.6E-07	2.3E-07
Methylmercury (Fish consumption)	2.9E-04	3.0E-04	2.9E-04	2.5E-04	2.9E-04	2.5E-04	2.6E-04	2.4E-04	2.4E-04	2.5E-04
	1.9E-05	**1.9E-05**	**1.8E-05**	**1.8E-05**	**1.9E-05**	**1.6E-05**	**1.6E-05**	**1.5E-05**	**1.5E-05**	**1.4E-05**
	1.1E-06	1.2E-06	9.7E-07	1.2E-06	1.1E-06	9.3E-07	9.9E-07	9.3E-07	8.9E-07	9.8E-07
EFPC Floodplain Farm Family (Child)										
Elemental Mercury (Inhalation)	9.3E-06	2.4E-06	2.4E-07	3.0E-05	3.9E-06	2.9E-07	3.1E-07	6.3E-07	2.9E-07	6.0E-07
	1.8E-06	**4.3E-07**	**5.1E-08**	**4.4E-06**	**8.9E-07**	**5.6E-08**	**6.5E-08**	**1.3E-07**	**5.7E-08**	**1.1E-07**
	3.2E-07	1.0E-07	1.0E-08	9.0E-07	1.9E-07	1.1E-08	1.3E-08	2.4E-08	1.2E-08	2.3E-08
Inorganic Mercury (ingestion, dermal contact)	6.1E-04	2.5E-04	1.9E-04	5.3E-04	1.9E-04	1.7E-04	1.5E-04	1.3E-04	1.3E-04	7.2E-05
	5.3E-05	**1.5E-05**	**9.5E-06**	**5.8E-05**	**2.1E-05**	**7.1E-06**	**7.1E-06**	**8.1E-06**	**6.5E-06**	**5.2E-06**
	7.3E-06	1.9E-06	8.6E-07	8.5E-06	3.3E-06	6.3E-07	8.6E-07	1.1E-06	7.1E-07	5.5E-07
Methylmercury (Fish consumption)	3.0E-04	3.1E-04	3.4E-04	3.2E-04	3.5E-04	2.7E-04	2.6E-04	2.7E-04	2.9E-04	2.4E-04
	2.1E-05	**2.1E-05**	**2.1E-05**	**2.1E-05**	**2.0E-05**	**1.8E-05**	**1.9E-05**	**1.8E-05**	**1.7E-05**	**1.6E-05**
	1.4E-06	1.6E-06	1.3E-06	1.3E-06	1.3E-06	1.1E-06	1.3E-06	1.1E-06	1.0E-06	1.2E-06
Community Population 1 (Adult)										
Elemental Mercury (Inhalation)	1.1E-07	2.6E-08	3.0E-09	3.1E-07	5.9E-08	3.7E-09	3.8E-09	7.3E-09	3.2E-09	6.3E-09
	2.1E-08	**5.1E-09**	**5.8E-10**	**5.4E-08**	**9.5E-09**	**6.1E-10**	**7.3E-10**	**1.4E-09**	**6.3E-10**	**1.2E-09**
	3.8E-09	9.5E-10	1.2E-10	8.9E-09	2.0E-09	1.1E-10	1.4E-10	2.8E-10	1.3E-10	2.6E-10
Inorganic Mercury (ingestion, dermal contact)	3.3E-06	6.7E-07	7.3E-08	7.3E-06	1.4E-06	6.7E-08	8.6E-08	1.9E-07	9.9E-08	1.4E-07
	1.7E-07	**4.2E-08**	**5.3E-09**	**4.2E-07**	**9.1E-08**	**5.7E-09**	**6.4E-09**	**1.3E-08**	**4.9E-09**	**1.2E-08**
	1.1E-08	2.6E-09	2.9E-10	3.4E-08	4.5E-09	4.4E-10	4.4E-10	8.8E-10	3.4E-10	7.0E-10
Community Population 1 (Child)										
Elemental Mercury (Inhalation)	2.5E-07	5.4E-08	5.9E-09	5.8E-07	1.2E-07	6.6E-09	8.9E-09	1.5E-08	6.6E-09	1.4E-08
	4.0E-08	**1.0E-08**	**1.2E-09**	**1.0E-07**	**1.9E-08**	**1.2E-09**	**1.4E-09**	**2.9E-09**	**1.2E-09**	**2.5E-09**
	7.6E-09	1.6E-09	2.0E-10	1.8E-08	3.4E-09	2.5E-10	2.7E-10	5.2E-10	2.4E-10	4.2E-10
Inorganic Mercury (ingestion, dermal contact)	7.2E-06	1.8E-06	2.1E-07	1.5E-05	3.2E-06	1.9E-07	2.4E-07	4.1E-07	2.1E-07	3.6E-07
	3.4E-07	**7.9E-08**	**1.0E-08**	**8.4E-07**	**1.6E-07**	**9.5E-09**	**1.2E-08**	**2.4E-08**	**1.1E-08**	**2.2E-08**
	1.6E-08	3.3E-09	3.5E-10	4.4E-08	7.2E-09	6.3E-10	6.2E-10	1.1E-09	4.1E-10	8.7E-10
Community Population 2 (Adult)										
Elemental Mercury (Inhalation)	4.9E-08	1.5E-08	1.5E-09	1.5E-07	2.5E-08	1.8E-09	1.9E-09	3.6E-09	1.9E-09	3.3E-09
	9.8E-09	**2.5E-09**	**2.8E-10**	**2.4E-08**	**4.9E-09**	**3.0E-10**	**3.6E-10**	**7.2E-10**	**3.0E-10**	**6.1E-10**
	1.8E-09	5.1E-10	6.2E-11	4.5E-09	8.9E-10	6.2E-11	7.4E-11	1.2E-10	5.9E-11	1.2E-10
Inorganic Mercury (ingestion, dermal contact)	1.3E-06	3.7E-07	3.9E-08	4.0E-06	8.6E-07	5.2E-08	4.6E-08	7.6E-08	4.4E-08	7.4E-08
	8.8E-08	**2.2E-08**	**2.5E-09**	**2.2E-07**	**4.3E-08**	**2.7E-09**	**3.4E-09**	**6.7E-09**	**3.0E-09**	**5.6E-09**
	6.3E-09	1.4E-09	1.7E-10	1.1E-08	2.1E-09	2.1E-10	1.5E-10	3.7E-10	1.4E-10	2.9E-10
Community Population 2 (Child)										
Elemental Mercury (Inhalation)	1.1E-07	2.7E-08	3.0E-09	2.9E-07	5.0E-08	3.5E-09	3.5E-09	8.2E-09	3.3E-09	6.9E-09
	2.0E-08	**4.8E-09**	**5.2E-10**	**4.8E-08**	**9.6E-09**	**5.8E-10**	**7.1E-10**	**1.3E-09**	**6.2E-10**	**1.2E-09**
	3.5E-09	1.0E-09	1.2E-10	1.0E-08	1.4E-09	9.9E-11	1.2E-10	2.8E-10	1.1E-10	2.6E-10
Inorganic Mercury (ingestion, dermal contact)	3.4E-06	1.0E-06	9.2E-08	1.3E-05	2.1E-06	9.7E-08	9.8E-08	2.7E-07	1.0E-07	2.0E-07
	1.6E-07	**3.7E-08**	**4.9E-09**	**4.1E-07**	**8.2E-08**	**4.8E-09**	**6.1E-09**	**1.2E-08**	**5.4E-09**	**9.8E-09**
	9.7E-09	1.6E-09	2.1E-10	2.3E-08	2.8E-09	2.2E-10	2.1E-10	5.5E-10	1.8E-10	3.7E-10

a Doses that exceed the USEPA RfD are shaded

Table X-1: Summary of Estimated Mercury Doses for Each Population of Interest (mg kg^{-1} d^{-1}) [a]

Reference Population	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL
	Central	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**
	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL
EFPC Floodplain Farm Family (Adult)											
Elemental Mercury (Inhalation)	2.7E-07	1.6E-07	3.3E-07	3.1E-07	2.6E-07	2.2E-07	3.1E-07	3.5E-07	1.9E-07	1.8E-07	1.9E-07
	4.6E-08	**2.9E-08**	**5.9E-08**	**5.1E-08**	**4.1E-08**	**5.0E-08**	**5.8E-08**	**6.5E-08**	**3.5E-08**	**3.5E-08**	**3.2E-08**
	9.2E-09	6.0E-09	1.1E-08	1.0E-08	8.5E-09	8.8E-09	1.1E-08	1.2E-08	7.7E-09	6.3E-09	6.3E-09
Inorganic Mercury (ingestion, dermal contact)	1.9E-05	1.8E-05	2.1E-05	1.5E-05	1.5E-05	1.5E-05	2.0E-05	2.4E-05	1.7E-05	1.3E-05	1.6E-05
	1.7E-06	**1.4E-06**	**1.9E-06**	**1.5E-06**	**1.4E-06**	**1.4E-06**	**1.7E-06**	**1.6E-06**	**1.3E-06**	**1.2E-06**	**1.3E-06**
	2.6E-07	2.7E-07	3.3E-07	2.6E-07	2.6E-07	2.5E-07	2.9E-07	3.2E-07	2.5E-07	2.0E-07	2.2E-07
Methylmercury (Fish consumption)	2.2E-04	2.0E-04	2.3E-04	1.7E-04	1.5E-04	1.2E-04	1.3E-04	1.2E-04	1.3E-04	1.2E-04	1.2E-04
	1.4E-05	**1.3E-05**	**1.3E-05**	**1.1E-05**	**1.0E-05**	**7.6E-06**	**7.7E-06**	**7.9E-06**	**7.7E-06**	**8.0E-06**	**7.8E-06**
	9.7E-07	8.0E-07	8.3E-07	6.9E-07	5.9E-07	4.4E-07	5.6E-07	5.2E-07	5.0E-07	5.2E-07	4.9E-07
EFPC Floodplain Farm Family (Child)											
Elemental Mercury (Inhalation)	7.4E-07	4.2E-07	8.7E-07	7.5E-07	7.1E-07	6.9E-07	8.7E-07	1.1E-06	5.9E-07	5.7E-07	4.9E-07
	1.4E-07	**9.0E-08**	**1.7E-07**	**1.5E-07**	**1.2E-07**	**1.5E-07**	**1.7E-07**	**1.8E-07**	**1.0E-07**	**9.8E-08**	**9.2E-08**
	2.8E-08	1.8E-08	3.4E-08	3.1E-08	2.8E-08	2.7E-08	3.1E-08	3.5E-08	2.2E-08	1.9E-08	2.0E-08
Inorganic Mercury (ingestion, dermal contact)	1.0E-04	7.5E-05	8.1E-05	9.9E-05	6.3E-05	6.0E-05	5.2E-05	8.0E-05	8.5E-05	4.9E-05	1.1E-04
	5.3E-06	**4.6E-06**	**6.2E-06**	**4.4E-06**	**3.9E-06**	**4.1E-06**	**4.8E-06**	**5.0E-06**	**3.9E-06**	**3.9E-06**	**3.8E-06**
	8.2E-07	6.4E-07	7.8E-07	5.6E-07	5.4E-07	6.1E-07	7.0E-07	7.4E-07	4.8E-07	4.2E-07	5.6E-07
Methylmercury (Fish consumption)	2.4E-04	2.6E-04	2.4E-04	2.0E-04	1.6E-04	1.4E-04	1.5E-04	1.4E-04	1.3E-04	1.3E-04	1.2E-04
	1.6E-05	**1.5E-05**	**1.5E-05**	**1.3E-05**	**1.2E-05**	**8.6E-06**	**8.8E-06**	**8.6E-06**	**8.9E-06**	**8.8E-06**	**8.6E-06**
	1.1E-06	9.2E-07	9.9E-07	8.2E-07	7.5E-07	5.7E-07	5.6E-07	5.5E-07	5.7E-07	5.5E-07	5.8E-07
Community Population 1 (Adult)											
Elemental Mercury (Inhalation)	9.2E-09	4.8E-09	1.0E-08	8.6E-09	6.7E-09	8.2E-09	9.6E-09	1.2E-08	5.4E-09	5.8E-09	5.4E-09
	1.5E-09	**9.6E-10**	**1.9E-09**	**1.7E-09**	**1.4E-09**	**1.6E-09**	**1.9E-09**	**2.0E-09**	**1.2E-09**	**1.1E-09**	**1.1E-09**
	2.9E-10	2.2E-10	3.6E-10	3.0E-10	2.7E-10	3.1E-10	3.6E-10	4.2E-10	2.4E-10	2.5E-10	1.9E-10
Inorganic Mercury (ingestion, dermal contact)	2.2E-07	1.3E-07	2.2E-07	2.6E-07	1.4E-07	2.4E-07	2.6E-07	3.4E-07	1.5E-07	1.7E-07	1.8E-07
	1.4E-08	**9.2E-09**	**1.7E-08**	**1.4E-08**	**1.2E-08**	**1.3E-08**	**1.8E-08**	**1.7E-08**	**1.0E-08**	**1.1E-08**	**9.4E-09**
	6.0E-10	4.9E-10	1.0E-09	7.6E-10	9.8E-10	7.5E-10	7.1E-10	1.4E-09	4.4E-10	5.3E-10	5.6E-10
Community Population 1 (Child)											
Elemental Mercury (Inhalation)	1.9E-08	1.0E-08	2.2E-08	1.9E-08	1.3E-08	1.8E-08	2.2E-08	2.3E-08	1.2E-08	1.2E-08	1.1E-08
	3.1E-09	**1.9E-09**	**3.6E-09**	**3.5E-09**	**2.6E-09**	**3.3E-09**	**3.8E-09**	**4.1E-09**	**2.3E-09**	**2.2E-09**	**2.2E-09**
	5.3E-10	4.0E-10	7.7E-10	6.1E-10	5.2E-10	5.7E-10	7.3E-10	8.7E-10	3.9E-10	4.5E-10	3.6E-10
Inorganic Mercury (ingestion, dermal contact)	5.7E-07	3.7E-07	5.7E-07	6.8E-07	4.1E-07	5.1E-07	6.3E-07	7.5E-07	6.6E-07	3.9E-07	3.1E-07
	2.5E-08	**1.6E-08**	**3.2E-08**	**2.6E-08**	**2.0E-08**	**2.6E-08**	**3.0E-08**	**3.3E-08**	**1.9E-08**	**2.0E-08**	**1.8E-08**
	1.1E-09	7.5E-10	1.2E-09	1.3E-09	1.4E-09	1.1E-09	1.4E-09	1.5E-09	6.8E-10	9.2E-10	8.4E-10
Community Population 2 (Adult)											
Elemental Mercury (Inhalation)	4.1E-09	2.5E-09	5.6E-09	4.3E-09	3.7E-09	4.2E-09	4.9E-09	5.4E-09	3.4E-09	3.3E-09	2.7E-09
	7.6E-10	**4.9E-10**	**9.0E-10**	**7.9E-10**	**6.7E-10**	**7.9E-10**	**9.4E-10**	**1.1E-09**	**5.8E-10**	**5.8E-10**	**5.2E-10**
	1.5E-10	9.4E-11	1.7E-10	1.5E-10	1.4E-10	1.4E-10	1.8E-10	2.0E-10	1.1E-10	1.0E-10	8.7E-11
Inorganic Mercury (ingestion, dermal contact)	1.1E-07	6.2E-08	1.3E-07	9.3E-08	9.6E-08	1.1E-07	1.5E-07	1.6E-07	8.6E-08	7.3E-08	6.6E-08
	6.7E-09	**4.1E-09**	**7.9E-09**	**7.3E-09**	**5.5E-09**	**6.2E-09**	**7.7E-09**	**8.6E-09**	**4.8E-09**	**5.2E-09**	**4.5E-09**
	2.9E-10	2.2E-10	5.5E-10	4.5E-10	3.0E-10	4.0E-10	4.5E-10	5.0E-10	2.1E-10	3.0E-10	3.4E-10
Community Population 2 (Child)											
Elemental Mercury (Inhalation)	8.5E-09	5.6E-09	1.1E-08	8.8E-09	6.9E-09	9.2E-09	1.2E-08	1.0E-08	6.2E-09	5.6E-09	5.4E-09
	1.5E-09	**9.4E-10**	**1.7E-09**	**1.6E-09**	**1.3E-09**	**1.5E-09**	**1.9E-09**	**2.1E-09**	**1.1E-09**	**1.2E-09**	**1.0E-09**
	3.2E-10	2.0E-10	3.7E-10	2.7E-10	2.3E-10	2.7E-10	3.4E-10	4.3E-10	2.3E-10	1.9E-10	1.8E-10
Inorganic Mercury (ingestion, dermal contact)	2.6E-07	1.4E-07	2.7E-07	2.6E-07	1.8E-07	2.6E-07	2.9E-07	3.0E-07	2.5E-07	2.1E-07	1.7E-07
	1.2E-08	**8.5E-09**	**1.7E-08**	**1.3E-08**	**1.1E-08**	**1.3E-08**	**1.5E-08**	**1.5E-08**	**9.3E-09**	**9.2E-09**	**8.1E-09**
	4.3E-10	3.5E-10	5.3E-10	7.7E-10	5.7E-10	7.1E-10	5.4E-10	8.9E-10	4.4E-10	4.6E-10	3.9E-10

a Doses that exceed the USEPA RfD are shaded

Table X-1: Summary of Estimated Mercury Doses for Each Population of Interest (mg kg^{-1} d^{-1}) [a]

Reference Population	1950 UCL **Central** LCL	1951 UCL **Central** LCL	1952 UCL **Central** LCL	1953 UCL **Central** LCL	1954 UCL **Central** LCL	1955 UCL **Central** LCL	1956 UCL **Central** LCL	1957 UCL **Central** LCL	1958 UCL **Central** LCL	1959 UCL **Central** LCL
Watts Bar Reservoir Commercial Angler (Adult)										
Methylmercury (fish consumption)	3.4E-04	2.5E-04	3.3E-04	3.4E-04	3.9E-04	8.0E-04	1.1E-03	1.5E-03	1.4E-03	1.9E-03
	1.7E-05	**1.7E-05**	**2.1E-05**	**2.2E-05**	**2.6E-05**	**4.7E-05**	**7.8E-05**	**9.8E-05**	**1.2E-04**	**1.0E-04**
	1.0E-06	9.8E-07	1.2E-06	1.4E-06	1.5E-06	3.7E-06	5.0E-06	6.3E-06	7.1E-06	7.2E-06
Watts Bar Reservoir Commerical Angler (Child)										
Methylmercury (fish consumption)	2.6E-04	2.1E-04	2.7E-04	3.2E-04	3.5E-04	6.8E-04	9.4E-04	1.3E-03	1.5E-03	1.6E-03
	1.6E-05	**1.5E-05**	**1.8E-05**	**1.9E-05**	**2.3E-05**	**4.1E-05**	**6.9E-05**	**8.5E-05**	**1.0E-04**	**9.2E-05**
	9.3E-07	9.3E-07	9.7E-07	1.2E-06	1.4E-06	2.9E-06	4.8E-06	5.8E-06	7.1E-06	6.5E-06
Watts Bar Reservoir Recreational Fish Consumer (Adult)										
Methylmercury (fish consumption)	3.5E-04	3.4E-04	3.8E-04	4.2E-04	4.8E-04	9.5E-04	1.4E-03	1.6E-03	2.0E-03	2.4E-03
	2.2E-05	**2.3E-05**	**2.7E-05**	**2.6E-05**	**3.0E-05**	**6.2E-05**	**9.8E-05**	**1.3E-04**	**1.5E-04**	**1.4E-04**
	1.4E-06	1.2E-06	1.4E-06	1.8E-06	1.8E-06	3.9E-06	6.6E-06	8.5E-06	8.8E-06	8.4E-06
Watts Bar Reservoir Recreational Fish Consumer (Child)										
Methylmercury (fish consumption)	2.9E-04	2.9E-04	3.6E-04	3.7E-04	3.7E-04	7.5E-04	1.2E-03	1.6E-03	1.7E-03	2.0E-03
	2.0E-05	**1.9E-05**	**2.4E-05**	**2.3E-05**	**2.7E-05**	**5.4E-05**	**8.3E-05**	**1.1E-04**	**1.2E-04**	**1.3E-04**
	1.2E-06	9.6E-07	1.2E-06	1.6E-06	1.6E-06	3.2E-06	5.8E-06	8.3E-06	7.8E-06	7.9E-06
CR/PC Commercial Angler (Adult)										
Methylmercury (fish consumption)	2.5E-04	2.9E-04	2.4E-04	3.2E-04	2.7E-04	1.8E-04	5.0E-04	7.1E-04	6.3E-04	5.8E-04
	1.6E-05	**1.6E-05**	**1.6E-05**	**2.0E-05**	**1.6E-05**	**1.2E-05**	**3.1E-05**	**3.7E-05**	**3.9E-05**	**3.6E-05**
	1.0E-06	1.1E-06	1.0E-06	1.2E-06	9.5E-07	8.2E-07	2.3E-06	2.2E-06	2.4E-06	2.3E-06
CR/PC Commerical Angler (Child)										
Methylmercury (fish consumption)	2.1E-04	2.4E-04	2.3E-04	2.7E-04	2.4E-04	1.6E-04	4.0E-04	5.4E-04	5.7E-04	5.0E-04
	1.4E-05	**1.4E-05**	**1.4E-05**	**1.7E-05**	**1.4E-05**	**1.1E-05**	**2.7E-05**	**3.5E-05**	**3.4E-05**	**3.2E-05**
	9.3E-07	1.0E-06	9.5E-07	1.1E-06	1.1E-06	7.2E-07	2.1E-06	2.1E-06	2.2E-06	2.2E-06
CR/PC Recreational Fish Consumer (Adult)										
Methylmercury (fish consumption)	2.0E-03	2.1E-03	2.0E-03	2.7E-03	2.0E-03	1.5E-03	4.4E-03	5.0E-03	5.1E-03	5.2E-03
	1.3E-04	**1.3E-04**	**1.4E-04**	**1.6E-04**	**1.3E-04**	**9.7E-05**	**2.9E-04**	**3.3E-04**	**3.1E-04**	**2.9E-04**
	8.1E-06	8.5E-06	7.6E-06	9.4E-06	9.2E-06	6.8E-06	1.7E-05	2.2E-05	1.9E-05	1.8E-05
CR/PC Recreational Fish Consumer (Child)										
Methylmercury (fish consumption)	1.9E-03	1.9E-03	1.7E-03	2.0E-03	1.9E-03	1.2E-03	3.8E-03	4.3E-03	4.7E-03	4.1E-03
	1.1E-04	**1.1E-04**	**1.2E-04**	**1.3E-04**	**1.2E-04**	**8.5E-05**	**2.5E-04**	**2.9E-04**	**2.7E-04**	**2.6E-04**
	7.0E-06	7.8E-06	7.5E-06	8.1E-06	7.1E-06	6.2E-06	1.3E-05	1.8E-05	1.5E-05	1.6E-05

a Doses that exceed the USEPA RfD are shaded

Table X-1: Summary of Estimated Mercury Doses for Each Population of Interest (mg kg^{-1} d^{-1}) [a]

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL
	Central	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**
Reference Population	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL
Watts Bar Reservoir Commercial Angler (Adult)										
Methylmercury (fish consumption)	1.1E-03	7.5E-04	6.3E-04	5.5E-04	5.3E-04	4.8E-04	5.3E-04	4.5E-04	4.9E-04	4.6E-04
	7.9E-05	**4.0E-05**	**4.1E-05**	**3.8E-05**	**3.6E-05**	**3.3E-05**	**3.1E-05**	**3.2E-05**	**3.1E-05**	**2.7E-05**
	4.4E-06	2.4E-06	2.6E-06	2.5E-06	2.1E-06	2.3E-06	1.9E-06	1.7E-06	1.9E-06	1.6E-06
Watts Bar Reservoir Commerical Angler (Child)										
Methylmercury (fish consumption)	9.9E-04	6.7E-04	5.7E-04	5.0E-04	4.4E-04	3.8E-04	4.5E-04	3.7E-04	4.2E-04	4.0E-04
	7.1E-05	**3.6E-05**	**3.6E-05**	**3.3E-05**	**3.1E-05**	**2.9E-05**	**2.7E-05**	**2.8E-05**	**2.6E-05**	**2.3E-05**
	4.3E-06	2.1E-06	2.2E-06	2.1E-06	2.0E-06	2.3E-06	1.6E-06	1.5E-06	1.8E-06	1.4E-06
Watts Bar Reservoir Recreational Fish Consume										
Methylmercury (fish consumption)	1.5E-03	8.0E-04	8.4E-04	7.4E-04	7.3E-04	7.1E-04	5.8E-04	5.0E-04	5.5E-04	5.5E-04
	9.5E-05	**5.0E-05**	**5.0E-05**	**4.8E-05**	**4.1E-05**	**4.4E-05**	**3.7E-05**	**3.7E-05**	**4.0E-05**	**3.4E-05**
	6.1E-06	2.8E-06	3.2E-06	3.1E-06	2.7E-06	2.7E-06	2.7E-06	2.6E-06	2.3E-06	2.3E-06
Watts Bar Reservoir Recreational Fish Consume										
Methylmercury (fish consumption)	1.3E-03	6.6E-04	6.9E-04	5.9E-04	6.0E-04	6.2E-04	4.7E-04	5.2E-04	5.4E-04	4.6E-04
	8.5E-05	**4.6E-05**	**4.2E-05**	**4.0E-05**	**3.6E-05**	**3.8E-05**	**3.3E-05**	**3.3E-05**	**3.5E-05**	**3.0E-05**
	5.9E-06	2.5E-06	2.6E-06	2.5E-06	2.8E-06	2.6E-06	2.3E-06	2.4E-06	1.9E-06	1.8E-06
CR/PC Commercial Angler (Adult)										
Methylmercury (fish consumption)	5.3E-04	5.5E-04	4.4E-04	2.6E-04	2.0E-04	1.8E-04	1.5E-04	1.4E-04	1.1E-04	1.3E-04
	3.3E-05	**2.9E-05**	**2.7E-05**	**1.8E-05**	**1.4E-05**	**1.2E-05**	**9.9E-06**	**7.9E-06**	**6.9E-06**	**7.5E-06**
	1.9E-06	2.3E-06	1.7E-06	1.1E-06	9.4E-07	6.3E-07	6.7E-07	5.6E-07	4.6E-07	4.7E-07
CR/PC Commerical Angler (Child)										
Methylmercury (fish consumption)	4.6E-04	4.8E-04	3.5E-04	2.3E-04	1.7E-04	1.5E-04	1.4E-04	1.2E-04	9.2E-05	1.0E-04
	3.0E-05	**2.7E-05**	**2.4E-05**	**1.6E-05**	**1.2E-05**	**1.0E-05**	**8.6E-06**	**7.0E-06**	**6.3E-06**	**6.5E-06**
	1.8E-06	2.0E-06	1.5E-06	9.6E-07	8.7E-07	5.7E-07	5.1E-07	4.6E-07	4.0E-07	4.1E-07
CR/PC Recreational Fish Consumer (Adult)										
Methylmercury (fish consumption)	4.4E-03	3.6E-03	3.2E-03	2.2E-03	1.9E-03	1.6E-03	1.3E-03	1.1E-03	9.8E-04	9.4E-04
	2.6E-04	**2.4E-04**	**2.2E-04**	**1.4E-04**	**1.2E-04**	**9.3E-05**	**8.0E-05**	**6.9E-05**	**5.7E-05**	**6.0E-05**
	1.7E-05	1.4E-05	1.3E-05	9.2E-06	7.0E-06	5.9E-06	5.0E-06	4.8E-06	2.8E-06	3.9E-06
CR/PC Recreational Fish Consumer (Child)										
Methylmercury (fish consumption)	3.9E-03	3.4E-03	2.9E-03	1.8E-03	1.6E-03	1.4E-03	1.1E-03	9.5E-04	8.4E-04	8.4E-04
	2.3E-04	**2.0E-04**	**2.1E-04**	**1.2E-04**	**9.9E-05**	**8.2E-05**	**7.2E-05**	**6.1E-05**	**5.1E-05**	**5.3E-05**
	1.6E-05	1.3E-05	1.3E-05	7.9E-06	6.1E-06	4.9E-06	4.4E-06	4.0E-06	2.9E-06	3.4E-06

a Doses that exceed the USEPA RfD are shaded

Table X-1: Summary of Estimated Mercury Doses for Each Population of Interest (mg kg^{-1} d^{-1}) [a]

Reference Population	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
	UCL **Central** LCL	UCL **Central** LCL	UCL **Central** LCL	UCL **Central** LCL	UCL **Central** LCL	UCL **Central** LCL	UCL **Central** LCL	UCL **Central** LCL	UCL **Central** LCL	UCL **Central** LCL
Watts Bar Reservoir Commercial Angler (Adult)										
Methylmercury (fish consumption)	4.7E-04	3.3E-04	4.5E-04	4.5E-04	4.7E-04	4.8E-04	5.0E-04	4.5E-04	3.9E-04	4.6E-04
	2.7E-05	**2.6E-05**	**2.5E-05**	**2.6E-05**	**2.9E-05**	**2.9E-05**	**2.6E-05**	**2.3E-05**	**2.3E-05**	**2.3E-05**
	1.5E-06	1.9E-06	1.6E-06	1.5E-06	1.5E-06	1.7E-06	1.6E-06	1.5E-06	1.5E-06	1.3E-06
Watts Bar Reservoir Commerical Angler (Child)										
Methylmercury (fish consumption)	3.8E-04	3.1E-04	3.9E-04	4.0E-04	4.1E-04	4.8E-04	4.8E-04	4.1E-04	3.5E-04	4.1E-04
	2.3E-05	**2.2E-05**	**2.3E-05**	**2.3E-05**	**2.4E-05**	**2.4E-05**	**2.4E-05**	**2.0E-05**	**2.0E-05**	**2.1E-05**
	1.4E-06	1.6E-06	1.3E-06	1.5E-06	1.4E-06	1.7E-06	1.2E-06	1.3E-06	1.3E-06	1.3E-06
Watts Bar Reservoir Recreational Fish Consume										
Methylmercury (fish consumption)	6.4E-04	6.4E-04	6.3E-04	5.2E-04	4.6E-04	5.8E-04	6.0E-04	4.9E-04	4.4E-04	5.6E-04
	3.4E-05	**3.2E-05**	**3.2E-05**	**3.2E-05**	**3.5E-05**	**3.5E-05**	**3.2E-05**	**2.8E-05**	**3.0E-05**	**3.2E-05**
	2.0E-06	1.7E-06	1.7E-06	2.2E-06	2.3E-06	2.0E-06	1.6E-06	1.5E-06	1.8E-06	1.7E-06
Watts Bar Reservoir Recreational Fish Consume										
Methylmercury (fish consumption)	5.2E-04	5.5E-04	4.8E-04	4.7E-04	4.0E-04	4.2E-04	5.0E-04	4.2E-04	4.4E-04	4.7E-04
	2.8E-05	**2.8E-05**	**2.9E-05**	**3.0E-05**	**3.0E-05**	**3.0E-05**	**2.9E-05**	**2.5E-05**	**2.6E-05**	**2.9E-05**
	1.8E-06	1.7E-06	1.7E-06	1.9E-06	1.9E-06	1.7E-06	1.7E-06	1.4E-06	1.6E-06	1.5E-06
CR/PC Commercial Angler (Adult)										
Methylmercury (fish consumption)	1.2E-04	1.3E-04	1.3E-04	1.0E-04	8.2E-05	7.5E-05	8.3E-05	7.2E-05	5.9E-05	6.1E-05
	8.3E-06	**8.5E-06**	**8.9E-06**	**5.8E-06**	**5.5E-06**	**5.3E-06**	**5.0E-06**	**4.1E-06**	**3.9E-06**	**3.6E-06**
	5.1E-07	5.3E-07	5.6E-07	4.1E-07	2.9E-07	2.9E-07	3.0E-07	2.6E-07	2.5E-07	2.3E-07
CR/PC Commerical Angler (Child)										
Methylmercury (fish consumption)	1.0E-04	1.1E-04	1.1E-04	8.7E-05	7.4E-05	7.2E-05	7.0E-05	6.5E-05	5.1E-05	5.1E-05
	7.0E-06	**7.5E-06**	**7.5E-06**	**5.3E-06**	**4.8E-06**	**4.6E-06**	**4.4E-06**	**3.6E-06**	**3.4E-06**	**3.2E-06**
	4.8E-07	4.5E-07	4.9E-07	3.5E-07	3.2E-07	2.8E-07	2.7E-07	2.5E-07	2.1E-07	2.1E-07
CR/PC Recreational Fish Consumer (Adult)										
Methylmercury (fish consumption)	1.1E-03	9.9E-04	1.0E-03	7.6E-04	6.3E-04	6.8E-04	5.7E-04	5.5E-04	5.4E-04	4.7E-04
	6.3E-05	**6.5E-05**	**6.9E-05**	**4.6E-05**	**4.4E-05**	**4.0E-05**	**4.0E-05**	**3.5E-05**	**3.2E-05**	**3.0E-05**
	3.6E-06	4.0E-06	4.0E-06	2.8E-06	3.0E-06	2.8E-06	1.9E-06	2.0E-06	1.9E-06	1.8E-06
CR/PC Recreational Fish Consumer (Child)										
Methylmercury (fish consumption)	9.2E-04	8.7E-04	1.0E-03	6.3E-04	6.0E-04	5.4E-04	5.0E-04	4.9E-04	4.5E-04	4.0E-04
	5.4E-05	**5.6E-05**	**6.1E-05**	**4.1E-05**	**3.8E-05**	**3.5E-05**	**3.4E-05**	**3.1E-05**	**2.8E-05**	**2.6E-05**
	3.6E-06	3.9E-06	3.8E-06	2.6E-06	2.7E-06	2.7E-06	1.9E-06	1.7E-06	1.6E-06	1.6E-06

a Doses that exceed the USEPA RfD are shaded

Table X-1: Summary of Estimated Mercury Doses for Each Population of Interest (mg kg^{-1} d^{-1}) [a]

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL
	Central	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**
Reference Population	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL
Watts Bar Reservoir Commercial Angler (Adult)											
Methylmercury (fish consumption)	4.1E-04	4.1E-04	3.2E-04	3.4E-04	3.5E-04	3.3E-04	3.2E-04	3.0E-04	3.3E-04	3.6E-04	3.0E-04
	2.7E-05	**2.4E-05**	**2.1E-05**	**2.1E-05**	**2.0E-05**	**2.0E-05**	**2.2E-05**	**2.0E-05**	**2.2E-05**	**1.9E-05**	**2.1E-05**
	1.4E-06	1.5E-06	1.3E-06	1.1E-06	1.1E-06	1.0E-06	1.3E-06	1.3E-06	1.4E-06	1.2E-06	1.1E-06
Watts Bar Reservoir Commerical Angler (Child)											
Methylmercury (fish consumption)	3.3E-04	3.4E-04	2.7E-04	3.2E-04	3.2E-04	2.8E-04	3.0E-04	2.7E-04	2.9E-04	2.9E-04	3.0E-04
	2.4E-05	**2.1E-05**	**2.0E-05**	**1.8E-05**	**1.7E-05**	**1.7E-05**	**1.9E-05**	**1.8E-05**	**1.9E-05**	**1.7E-05**	**1.8E-05**
	1.3E-06	1.2E-06	1.1E-06	1.1E-06	1.1E-06	8.9E-07	1.0E-06	1.1E-06	1.2E-06	1.0E-06	9.6E-07
Watts Bar Reservoir Recreational Fish Consume											
Methylmercury (fish consumption)	5.3E-04	4.4E-04	5.3E-04	5.3E-04	4.4E-04	4.2E-04	4.8E-04	3.9E-04	3.8E-04	5.1E-04	4.9E-04
	3.3E-05	**3.3E-05**	**2.9E-05**	**2.7E-05**	**2.5E-05**	**2.6E-05**	**2.6E-05**	**2.6E-05**	**2.7E-05**	**2.5E-05**	**2.6E-05**
	2.2E-06	1.6E-06	1.5E-06	1.5E-06	1.4E-06	1.5E-06	1.7E-06	1.3E-06	1.5E-06	1.3E-06	1.6E-06
Watts Bar Reservoir Recreational Fish Consume											
Methylmercury (fish consumption)	4.4E-04	4.1E-04	4.7E-04	3.8E-04	3.9E-04	3.8E-04	4.4E-04	4.1E-04	3.8E-04	3.7E-04	4.4E-04
	2.8E-05	**2.8E-05**	**2.5E-05**	**2.3E-05**	**2.2E-05**	**2.4E-05**	**2.2E-05**	**2.3E-05**	**2.3E-05**	**2.2E-05**	**2.3E-05**
	2.0E-06	1.5E-06	1.2E-06	1.4E-06	1.4E-06	1.5E-06	1.2E-06	1.4E-06	1.2E-06	1.3E-06	1.0E-06
CR/PC Commercial Angler (Adult)											
Methylmercury (fish consumption)	5.6E-05	4.6E-05	4.3E-05	4.1E-05	3.8E-05	3.7E-05	4.5E-05	3.9E-05	3.8E-05	3.9E-05	3.9E-05
	3.3E-06	**3.0E-06**	**2.5E-06**	**2.5E-06**	**2.7E-06**	**2.5E-06**	**2.4E-06**	**2.5E-06**	**2.5E-06**	**2.4E-06**	**2.4E-06**
	2.0E-07	1.7E-07	1.4E-07	1.4E-07	1.4E-07	1.5E-07	1.8E-07	1.6E-07	1.7E-07	2.0E-07	1.4E-07
CR/PC Commerical Angler (Child)											
Methylmercury (fish consumption)	4.6E-05	4.3E-05	3.9E-05	3.6E-05	3.4E-05	3.0E-05	3.1E-05	3.5E-05	3.3E-05	3.4E-05	3.3E-05
	3.0E-06	**2.6E-06**	**2.2E-06**	**2.2E-06**	**2.2E-06**	**2.1E-06**	**2.1E-06**	**2.2E-06**	**2.1E-06**	**2.2E-06**	**2.1E-06**
	2.0E-07	1.6E-07	1.3E-07	1.3E-07	1.4E-07	1.5E-07	1.3E-07	1.4E-07	1.4E-07	1.6E-07	1.2E-07
CR/PC Recreational Fish Consumer (Adult)											
Methylmercury (fish consumption)	5.0E-04	4.7E-04	3.2E-04	3.2E-04	3.3E-04	3.2E-04	3.6E-04	3.2E-04	3.0E-04	2.8E-04	3.2E-04
	2.8E-05	**2.6E-05**	**2.0E-05**	**2.0E-05**	**2.0E-05**	**2.0E-05**	**2.0E-05**	**2.1E-05**	**2.1E-05**	**2.1E-05**	**2.0E-05**
	1.8E-06	1.4E-06	1.2E-06	1.3E-06	1.1E-06	1.3E-06	1.5E-06	1.0E-06	1.3E-06	1.3E-06	1.2E-06
CR/PC Recreational Fish Consumer (Child)											
Methylmercury (fish consumption)	4.2E-04	3.7E-04	2.8E-04	3.1E-04	2.8E-04	2.8E-04	2.9E-04	2.6E-04	2.9E-04	2.7E-04	2.5E-04
	2.5E-05	**2.2E-05**	**1.6E-05**	**1.8E-05**	**1.8E-05**	**1.7E-05**	**1.7E-05**	**1.9E-05**	**1.7E-05**	**1.8E-05**	**1.8E-05**
	1.5E-06	1.2E-06	1.1E-06	1.2E-06	8.4E-07	9.5E-07	1.2E-06	9.2E-07	1.2E-06	1.1E-06	1.2E-06

a Doses that exceed the USEPA RfD are shaded

Table X-1: Summary of Estimated Mercury Doses for Each Population of Interest (mg kg^{-1} d^{-1}) [a]

Reference Population	1950 UCL **Central** LCL	1951 UCL **Central** LCL	1952 UCL **Central** LCL	1953 UCL **Central** LCL	1954 UCL **Central** LCL	1955 UCL **Central** LCL	1956 UCL **Central** LCL	1957 UCL **Central** LCL	1958 UCL **Central** LCL	1959 UCL **Central** LCL
Watts Bar Reservoir Category 1 (Adult)										
Methylmercury (fish consumption)	1.8E-04	1.9E-04	2.1E-04	2.2E-04	2.5E-04	4.3E-04	6.7E-04	8.7E-04	9.9E-04	9.7E-04
	8.4E-05	**8.2E-05**	**9.6E-05**	**1.0E-04**	**1.2E-04**	**2.2E-04**	**3.4E-04**	**4.5E-04**	**4.9E-04**	**5.0E-04**
	1.7E-05	2.0E-05	2.0E-05	2.9E-05	3.1E-05	8.9E-05	1.6E-04	2.0E-04	2.5E-04	2.4E-04
Watts Bar Reservoir Category 2 (Adult)										
Methylmercury (fish consumption)	7.2E-05	7.0E-05	7.9E-05	8.4E-05	1.0E-04	1.7E-04	2.6E-04	3.2E-04	3.9E-04	3.7E-04
	3.0E-05	**3.1E-05**	**3.5E-05**	**3.7E-05**	**4.3E-05**	**8.2E-05**	**1.3E-04**	**1.6E-04**	**1.8E-04**	**1.9E-04**
	7.5E-06	7.1E-06	8.4E-06	9.4E-06	1.1E-05	3.2E-05	5.4E-05	7.4E-05	8.0E-05	8.3E-05
Watts Bar Reservoir Category 3 (Adult)										
Methylmercury (fish consumption)	2.2E-05	2.5E-05	2.7E-05	3.0E-05	3.2E-05	6.0E-05	8.5E-05	1.2E-04	1.3E-04	1.2E-04
	8.2E-06	**7.9E-06**	**9.9E-06**	**1.0E-05**	**1.1E-05**	**2.3E-05**	**3.7E-05**	**4.5E-05**	**5.0E-05**	**5.3E-05**
	1.4E-06	1.3E-06	1.5E-06	1.8E-06	2.0E-06	5.0E-06	8.2E-06	1.1E-05	1.3E-05	1.3E-05
Clinch River/ Poplar Creek Category 1 (Adult)										
Methylmercury (fish consumption)	1.6E-03	1.5E-03	1.5E-03	1.7E-03	1.6E-03	1.1E-03	3.4E-03	4.2E-03	3.8E-03	3.6E-03
	7.8E-04	**7.7E-04**	**8.0E-04**	**9.4E-04**	**7.9E-04**	**6.0E-04**	**1.6E-03**	**2.0E-03**	**1.8E-03**	**1.7E-03**
	3.8E-04	3.8E-04	3.4E-04	4.2E-04	3.6E-04	2.7E-04	6.6E-04	7.9E-04	8.2E-04	7.4E-04
Clinch River/ Poplar Creek Category 2 (Adult)										
Methylmercury (fish consumption)	6.0E-04	5.8E-04	6.0E-04	7.0E-04	5.8E-04	4.4E-04	1.3E-03	1.6E-03	1.4E-03	1.4E-03
	3.0E-04	**2.9E-04**	**3.0E-04**	**3.6E-04**	**3.0E-04**	**2.3E-04**	**6.1E-04**	**7.0E-04**	**7.0E-04**	**6.5E-04**
	1.3E-04	1.2E-04	1.3E-04	1.5E-04	1.3E-04	9.3E-05	2.2E-04	2.8E-04	2.7E-04	2.8E-04
Clinch River/ Poplar Creek Category 3 (Adult)										
Methylmercury (fish consumption)	2.0E-04	1.9E-04	1.9E-04	2.2E-04	1.9E-04	1.4E-04	4.4E-04	5.0E-04	4.6E-04	4.6E-04
	8.3E-05	**8.3E-05**	**8.2E-05**	**9.8E-05**	**8.0E-05**	**6.1E-05**	**1.6E-04**	**2.0E-04**	**1.9E-04**	**1.8E-04**
	1.8E-05	2.0E-05	2.0E-05	2.6E-05	2.1E-05	1.6E-05	3.6E-05	4.9E-05	4.7E-05	4.0E-05
EFPC Category 3 (Adult)										
Methylmercury (fish consumption)	4.4E-04	4.5E-04	4.6E-04	4.6E-04	4.4E-04	4.6E-04	4.5E-04	4.4E-04	4.6E-04	4.5E-04
	1.9E-04	**1.9E-04**	**1.9E-04**	**1.9E-04**	**1.8E-04**	**1.8E-04**	**1.9E-04**	**1.9E-04**	**1.9E-04**	**1.9E-04**
	4.3E-05	4.6E-05	4.4E-05	4.4E-05	4.6E-05	4.8E-05	4.5E-05	4.5E-05	4.5E-05	4.9E-05

a Doses that exceed the USEPA RfD are shaded

Table X-1: Summary of Estimated Mercury Doses for Each Population of Interest (mg kg^{-1} d^{-1}) [a]

	1960	**1961**	**1962**	**1963**	**1964**	**1965**	**1966**	**1967**	**1968**	**1969**
	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL
	Central	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**
Reference Population	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL
Watts Bar Reservoir Category 1 (Adult)										
Methylmercury (fish consumption)	6.9E-04	4.0E-04	3.6E-04	3.5E-04	3.2E-04	3.1E-04	3.0E-04	3.1E-04	3.0E-04	2.6E-04
	3.5E-04	**1.9E-04**	**1.8E-04**	**1.7E-04**	**1.5E-04**	**1.6E-04**	**1.4E-04**	**1.4E-04**	**1.4E-04**	**1.3E-04**
	1.5E-04	6.8E-05	8.1E-05	5.7E-05	5.5E-05	5.4E-05	5.7E-05	4.5E-05	4.7E-05	4.1E-05
Watts Bar Reservoir Category 2 (Adult)										
Methylmercury (fish consumption)	2.5E-04	1.5E-04	1.4E-04	1.4E-04	1.3E-04	1.1E-04	1.2E-04	1.1E-04	1.2E-04	1.1E-04
	1.3E-04	**6.9E-05**	**6.9E-05**	**6.2E-05**	**5.6E-05**	**5.7E-05**	**5.3E-05**	**5.1E-05**	**5.1E-05**	**4.4E-05**
	5.3E-05	2.7E-05	2.7E-05	2.1E-05	1.8E-05	2.1E-05	1.9E-05	1.8E-05	1.7E-05	1.5E-05
Watts Bar Reservoir Category 3 (Adult)										
Methylmercury (fish consumption)	8.4E-05	4.8E-05	4.4E-05	4.2E-05	4.0E-05	3.9E-05	4.1E-05	3.6E-05	3.5E-05	3.4E-05
	3.7E-05	**1.9E-05**	**1.9E-05**	**1.7E-05**	**1.5E-05**	**1.6E-05**	**1.4E-05**	**1.4E-05**	**1.4E-05**	**1.3E-05**
	8.4E-06	4.0E-06	4.9E-06	4.0E-06	3.8E-06	3.4E-06	3.4E-06	2.7E-06	2.7E-06	2.3E-06
Clinch River/ Poplar Creek Category 1 (Adult)										
Methylmercury (fish consumption)	3.4E-03	3.5E-03	2.7E-03	1.7E-03	1.3E-03	1.1E-03	9.5E-04	8.1E-04	6.7E-04	7.4E-04
	1.6E-03	**1.4E-03**	**1.3E-03**	**8.5E-04**	**6.7E-04**	**5.7E-04**	**5.0E-04**	**4.3E-04**	**3.4E-04**	**3.7E-04**
	6.7E-04	6.0E-04	5.2E-04	3.8E-04	3.2E-04	2.5E-04	2.3E-04	1.9E-04	1.6E-04	1.7E-04
Clinch River/ Poplar Creek Category 2 (Adult)										
Methylmercury (fish consumption)	1.4E-03	1.3E-03	1.1E-03	6.4E-04	5.2E-04	4.2E-04	3.8E-04	3.2E-04	2.7E-04	2.9E-04
	6.1E-04	**5.6E-04**	**5.0E-04**	**3.2E-04**	**2.5E-04**	**2.2E-04**	**1.9E-04**	**1.6E-04**	**1.3E-04**	**1.4E-04**
	2.4E-04	2.2E-04	2.0E-04	1.4E-04	1.1E-04	8.6E-05	8.2E-05	6.5E-05	5.5E-05	6.4E-05
Clinch River/ Poplar Creek Category 3 (Adult)										
Methylmercury (fish consumption)	4.3E-04	4.2E-04	3.5E-04	2.0E-04	1.7E-04	1.3E-04	1.1E-04	9.8E-05	8.3E-05	8.7E-05
	1.7E-04	**1.6E-04**	**1.4E-04**	**9.1E-05**	**6.9E-05**	**5.6E-05**	**5.2E-05**	**4.4E-05**	**3.5E-05**	**3.9E-05**
	4.1E-05	3.2E-05	2.9E-05	2.2E-05	1.7E-05	1.5E-05	1.2E-05	1.0E-05	8.7E-06	9.0E-06
EFPC Category 3 (Adult)										
Methylmercury (fish consumption)	4.6E-04	4.4E-04	4.4E-04	4.5E-04	4.4E-04	3.9E-04	4.1E-04	4.0E-04	4.0E-04	4.0E-04
	1.9E-04	**1.9E-04**	**1.9E-04**	**1.9E-04**	**1.9E-04**	**1.8E-04**	**1.8E-04**	**1.9E-04**	**1.8E-04**	**1.8E-04**
	4.4E-05	4.7E-05	4.7E-05	5.0E-05	4.6E-05	4.5E-05	4.1E-05	4.2E-05	4.5E-05	4.1E-05

a Doses that exceed the USEPA RfD are shaded

Table X-1: Summary of Estimated Mercury Doses for Each Population of Interest (mg kg^{-1} d^{-1}) [a]

Reference Population	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL
	Central	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**
	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL
Watts Bar Reservoir Category 1 (Adult)										
Methylmercury (fish consumption)	2.6E-04	2.6E-04	2.7E-04	2.7E-04	2.7E-04	2.8E-04	2.8E-04	2.4E-04	2.4E-04	2.4E-04
	1.2E-04	**1.2E-04**	**1.2E-04**	**1.2E-04**	**1.3E-04**	**1.3E-04**	**1.2E-04**	**1.1E-04**	**1.1E-04**	**1.2E-04**
	4.3E-05	3.8E-05	3.6E-05	4.0E-05	4.1E-05	3.7E-05	3.6E-05	3.2E-05	3.2E-05	3.6E-05
Watts Bar Reservoir Category 2 (Adult)										
Methylmercury (fish consumption)	1.1E-04	9.6E-05	1.0E-04	1.0E-04	1.1E-04	1.1E-04	1.0E-04	9.3E-05	9.3E-05	9.7E-05
	4.5E-05	**4.5E-05**	**4.3E-05**	**4.5E-05**	**4.7E-05**	**4.6E-05**	**4.4E-05**	**4.0E-05**	**3.9E-05**	**4.2E-05**
	1.3E-05	1.3E-05	1.5E-05	1.5E-05	1.5E-05	1.4E-05	1.3E-05	1.3E-05	1.1E-05	1.2E-05
Watts Bar Reservoir Category 3 (Adult)										
Methylmercury (fish consumption)	3.4E-05	3.1E-05	2.9E-05	3.2E-05	3.3E-05	3.3E-05	3.3E-05	2.9E-05	3.2E-05	3.1E-05
	1.1E-05	**1.2E-05**	**1.1E-05**	**1.2E-05**	**1.2E-05**	**1.2E-05**	**1.2E-05**	**1.1E-05**	**1.1E-05**	**1.2E-05**
	2.1E-06	2.4E-06	2.6E-06	2.8E-06	2.8E-06	2.7E-06	2.7E-06	2.0E-06	2.1E-06	2.3E-06
Clinch River/ Poplar Creek Category 1 (Adult)										
Methylmercury (fish consumption)	7.1E-04	8.4E-04	8.5E-04	5.8E-04	5.4E-04	5.2E-04	4.8E-04	4.6E-04	4.0E-04	3.7E-04
	3.9E-04	**4.0E-04**	**4.2E-04**	**2.8E-04**	**2.6E-04**	**2.5E-04**	**2.4E-04**	**2.2E-04**	**2.0E-04**	**1.9E-04**
	1.8E-04	1.9E-04	2.1E-04	1.1E-04	1.2E-04	1.1E-04	1.0E-04	9.4E-05	8.1E-05	7.2E-05
Clinch River/ Poplar Creek Category 2 (Adult)										
Methylmercury (fish consumption)	2.9E-04	3.2E-04	3.3E-04	2.3E-04	2.1E-04	1.9E-04	1.9E-04	1.7E-04	1.6E-04	1.4E-04
	1.4E-04	**1.5E-04**	**1.6E-04**	**1.0E-04**	**1.0E-04**	**9.4E-05**	**9.0E-05**	**7.8E-05**	**7.5E-05**	**7.0E-05**
	5.8E-05	6.4E-05	6.7E-05	4.4E-05	4.3E-05	3.9E-05	3.5E-05	3.3E-05	2.8E-05	2.7E-05
Clinch River/ Poplar Creek Category 3 (Adult)										
Methylmercury (fish consumption)	9.5E-05	1.0E-04	1.0E-04	7.1E-05	6.8E-05	6.6E-05	5.7E-05	5.5E-05	5.2E-05	4.7E-05
	4.0E-05	**4.2E-05**	**4.4E-05**	**2.9E-05**	**2.8E-05**	**2.5E-05**	**2.5E-05**	**2.2E-05**	**2.1E-05**	**1.9E-05**
	9.3E-06	1.0E-05	1.1E-05	7.2E-06	6.7E-06	6.6E-06	5.2E-06	5.2E-06	5.0E-06	4.3E-06
EFPC Category 3 (Adult)										
Methylmercury (fish consumption)	4.1E-04	3.8E-04	3.9E-04	3.9E-04	4.0E-04	3.7E-04	3.2E-04	3.4E-04	3.1E-04	3.0E-04
	1.8E-04	**1.8E-04**	**1.8E-04**	**1.7E-04**	**1.7E-04**	**1.6E-04**	**1.5E-04**	**1.5E-04**	**1.4E-04**	**1.4E-04**
	4.6E-05	4.5E-05	4.1E-05	4.4E-05	4.3E-05	3.8E-05	3.9E-05	3.7E-05	3.4E-05	3.4E-05

a Doses that exceed the USEPA RfD are shaded

Table X-1: Summary of Estimated Mercury Doses for Each Population of Interest (mg kg^{-1} d^{-1}) [a]

Reference Population	1980 UCL **Central** LCL	1981 UCL **Central** LCL	1982 UCL **Central** LCL	1983 UCL **Central** LCL	1984 UCL **Central** LCL	1985 UCL **Central** LCL	1986 UCL **Central** LCL	1987 UCL **Central** LCL	1988 UCL **Central** LCL	1989 UCL **Central** LCL	1990 UCL **Central** LCL
Watts Bar Reservoir Category 1 (Adult)											
Methylmercury (fish consumption)	2.6E-04	2.4E-04	2.4E-04	2.2E-04	2.2E-04	2.1E-04	2.1E-04	2.1E-04	2.1E-04	2.1E-04	2.1E-04
	1.2E-04	**1.1E-04**	**1.0E-04**	**9.9E-05**	**9.4E-05**	**9.3E-05**	**9.7E-05**	**9.4E-05**	**9.9E-05**	**9.7E-05**	**9.5E-05**
	3.9E-05	3.3E-05	3.2E-05	2.6E-05	2.3E-05	2.5E-05	2.5E-05	2.4E-05	2.6E-05	2.7E-05	2.3E-05
Watts Bar Reservoir Category 2 (Adult)											
Methylmercury (fish consumption)	1.0E-04	9.2E-05	9.4E-05	8.6E-05	8.1E-05	8.1E-05	8.0E-05	8.2E-05	8.2E-05	8.6E-05	8.2E-05
	4.6E-05	**3.9E-05**	**3.9E-05**	**3.7E-05**	**3.4E-05**	**3.6E-05**	**3.5E-05**	**3.6E-05**	**3.6E-05**	**3.5E-05**	**3.8E-05**
	1.4E-05	1.2E-05	1.0E-05	9.5E-06	8.8E-06	8.8E-06	9.8E-06	9.6E-06	9.5E-06	1.1E-05	9.7E-06
Watts Bar Reservoir Category 3 (Adult)											
Methylmercury (fish consumption)	3.4E-05	2.8E-05	2.9E-05	2.6E-05	2.7E-05	2.6E-05	2.8E-05	2.8E-05	2.6E-05	2.8E-05	2.7E-05
	1.2E-05	**1.1E-05**	**1.0E-05**	**9.5E-06**	**9.1E-06**	**9.8E-06**	**9.7E-06**	**9.4E-06**	**9.6E-06**	**9.4E-06**	**9.5E-06**
	2.4E-06	2.0E-06	2.1E-06	2.0E-06	1.8E-06	1.8E-06	1.4E-06	1.8E-06	1.8E-06	1.6E-06	1.8E-06
Clinch River/ Poplar Creek Category 1 (Adult)											
Methylmercury (fish consumption)	3.5E-04	3.2E-04	2.6E-04	2.4E-04	2.5E-04	2.5E-04	2.5E-04	2.5E-04	2.5E-04	2.5E-04	2.6E-04
	1.7E-04	**1.6E-04**	**1.2E-04**	**1.2E-04**	**1.2E-04**	**1.2E-04**	**1.2E-04**	**1.2E-04**	**1.2E-04**	**1.2E-04**	**1.2E-04**
	7.1E-05	5.8E-05	4.5E-05	4.4E-05	4.5E-05	4.9E-05	4.5E-05	4.5E-05	4.7E-05	4.9E-05	4.6E-05
Clinch River/ Poplar Creek Category 2 (Adult)											
Methylmercury (fish consumption)	1.3E-04	1.3E-04	1.1E-04	9.7E-05	9.3E-05	1.0E-04	9.8E-05	9.8E-05	9.7E-05	9.6E-05	9.5E-05
	6.5E-05	**5.8E-05**	**4.6E-05**	**4.5E-05**	**4.5E-05**	**4.5E-05**	**4.5E-05**	**4.6E-05**	**4.6E-05**	**4.5E-05**	**4.6E-05**
	2.3E-05	2.0E-05	1.7E-05	1.7E-05	1.6E-05	1.7E-05	1.6E-05	1.6E-05	1.5E-05	1.4E-05	1.6E-05
Clinch River/ Poplar Creek Category 3 (Adult)											
Methylmercury (fish consumption)	4.7E-05	3.8E-05	3.4E-05	3.3E-05	3.1E-05	3.2E-05	3.4E-05	3.1E-05	3.1E-05	3.2E-05	3.0E-05
	1.7E-05	**1.6E-05**	**1.3E-05**	**1.2E-05**	**1.3E-05**	**1.2E-05**	**1.2E-05**	**1.2E-05**	**1.2E-05**	**1.2E-05**	**1.2E-05**
	3.9E-06	3.9E-06	2.8E-06	2.8E-06	2.0E-06	3.0E-06	2.6E-06	2.7E-06	2.6E-06	2.7E-06	3.2E-06
EFPC Category 3 (Adult)											
Methylmercury (fish consumption)	3.0E-04	2.8E-04	2.8E-04	2.4E-04	2.0E-04	1.5E-04	1.5E-04	1.6E-04	1.5E-04	1.5E-04	1.4E-04
	1.3E-04	**1.3E-04**	**1.3E-04**	**1.1E-04**	**9.8E-05**	**7.3E-05**	**7.5E-05**	**7.4E-05**	**7.5E-05**	**7.3E-05**	**7.6E-05**
	3.4E-05	3.3E-05	3.1E-05	2.6E-05	2.4E-05	2.0E-05	1.7E-05	1.9E-05	1.9E-05	1.8E-05	1.9E-05

a Doses that exceed the USEPA RfD are shaded

Table X-2: Summary of Hazard Indices Associated with Estimated Mercury Doses for Each Population of Interest (Equivalent to the Estimated Dose/ USEPA Reference Dose) [a, b]

Reference Population	1950 UCL **Central** LCL	1951 UCL **Central** LCL	1952 UCL **Central** LCL	1953 UCL **Central** LCL	1954 UCL **Central** LCL	1955 UCL **Central** LCL	1956 UCL **Central** LCL	1957 UCL **Central** LCL	1958 UCL **Central** LCL	1959 UCL **Central** LCL
Wolf Valley Resident (Adult)										
Elemental Mercury (Inhalation)	---	---	---	0.0078	0.020	0.12	0.088	0.030	0.053	0.047
	---	**---**	**---**	**0.00090**	**0.0021**	**0.014**	**0.0094**	**0.0038**	**0.0057**	**0.0048**
	---	---	---	0.000094	0.00020	0.0015	0.0010	0.00038	0.00059	0.00063
Inorganic Mercury (ingestion, dermal contact)	---	---	---	0.053	0.18	0.57	0.50	0.23	0.33	0.23
	---	**---**	**---**	0.0022	0.0053	0.037	0.025	0.010	0.014	0.012
	---	---	---	0.00011	0.00027	0.00197	0.00087	0.00030	0.00057	0.00057
Wolf Valley Resident (Child)										
Elemental Mercury (Inhalation)	---	---	---	0.014	0.036	0.22	0.16	0.059	0.10	0.095
	---	**---**	**---**	**0.0017**	**0.0041**	**0.027**	**0.016**	**0.0070**	**0.011**	**0.0090**
	---	---	---	0.00016	0.00045	0.0027	0.0016	0.00080	0.0013	0.0010
Inorganic Mercury (ingestion, dermal contact)	---	---	---	0.13	0.32	2.7	0.97	0.40	0.77	0.67
	---	**---**	**---**	0.0040	0.010	0.063	0.043	0.019	0.029	0.023
	---	---	---	0.00015	0.00040	0.0031	0.0017	0.00080	0.00107	0.00097
Scarboro Resident (Adult)										
Elemental Mercury (Inhalation)	0.0015	0.0029	0.016	0.093	0.12	0.67	0.48	0.47	0.45	0.26
	0.00027	**0.00051**	**0.0027**	**0.022**	**0.022**	**0.13**	**0.084**	**0.11**	**0.12**	**0.053**
	0.000055	0.00011	0.00055	0.0045	0.0052	0.033	0.023	0.028	0.026	0.013
Inorganic Mercury (ingestion, dermal contact)	0.090	0.12	0.24	0.70	1.1	4.7	4.7	3.3	3.7	2.0
	0.0060	**0.0077**	**0.020**	**0.097**	**0.093**	**0.47**	**0.30**	**0.47**	**0.47**	**0.20**
	0.0010	0.0013	0.0033	0.015	0.015	0.063	0.040	0.067	0.073	0.030
Methylmercury (Fish consumption)	2.9	2.8	2.9	2.7	3.4	3.4	3.5	3.6	3.2	3.1
(compared to in utero RfD)	**0.20**	**0.20**	**0.20**	**0.20**	**0.20**	**0.21**	**0.20**	**0.20**	**0.20**	**0.20**
	0.012	0.012	0.014	0.014	0.011	0.012	0.013	0.013	0.011	0.013
	0.97	0.93	0.97	0.90	1.1	1.1	1.2	1.2	1.1	1.0
(compared to adult RfD)	**0.067**	**0.067**	**0.067**	**0.067**	**0.067**	**0.070**	**0.067**	**0.067**	**0.067**	**0.067**
	0.0040	0.0040	0.0047	0.0047	0.0037	0.0040	0.0043	0.0043	0.0037	0.0043
Scarboro Resident (Child)										
Elemental Mercury (Inhalation)	0.0028	0.0065	0.035	0.21	0.23	1.4	0.94	1.1	1.0	0.57
	0.00051	**0.0011**	**0.0055**	**0.042**	**0.042**	**0.26**	**0.16**	**0.23**	**0.22**	**0.10**
	0.00010	0.00020	0.0011	0.0086	0.010	0.058	0.037	0.050	0.047	0.024
Inorganic Mercury (ingestion, dermal contact)	0.70	0.90	0.73	2.4	2.9	15	8.0	10	14	7.0
	0.026	**0.037**	**0.093**	**0.37**	**0.30**	**1.4**	**1.1**	**1.8**	**1.9**	**0.70**
	0.0043	0.0063	0.014	0.050	0.050	0.21	0.15	0.26	0.27	0.11
Methylmercury (Fish consumption)	3.5	3.0	3.3	3.5	3.6	3.5	3.9	3.8	3.8	3.4
	0.23	**0.23**	**0.23**	**0.24**	**0.23**	**0.23**	**0.24**	**0.24**	**0.22**	**0.22**
	0.013	0.014	0.014	0.016	0.014	0.013	0.014	0.014	0.014	0.017
Robertsville School Student (Child)										
Elemental Mercury (Inhalation)	0.00026	0.00052	0.0026	0.012	0.0069	0.035	0.029	0.072	0.064	0.019
	0.000045	**0.000090**	**0.00045**	**0.0021**	**0.0013**	**0.0063**	**0.0051**	**0.013**	**0.011**	**0.0034**
	0.0000083	0.000016	0.000084	0.00040	0.00022	0.0011	0.00095	0.0023	0.0021	0.00062
Inorganic Mercury (ingestion, dermal contact)	0.70	0.67	0.63	0.70	0.63	1.1	1.0	0.93	1.1	0.43
(general student)	**0.0080**	**0.0077**	**0.0080**	**0.0077**	**0.0077**	**0.013**	**0.013**	**0.013**	**0.012**	**0.0050**
	0.00010	0.000100	0.000100	0.00011	0.000093	0.00015	0.00017	0.00015	0.00017	0.000057
Inorganic Mercury (ingestion, dermal contact)	0.70	0.70	0.70	0.77	0.67	1.3	1.1	1.4	1.6	0.53
(recreational user of EFPC)	**0.018**	**0.017**	**0.024**	**0.047**	**0.033**	**0.10**	**0.087**	**0.17**	**0.19**	**0.057**
	0.0010	0.0013	0.0025	0.0050	0.0037	0.011	0.0097	0.019	0.021	0.0067

Table X-2: Summary of Hazard Indices Associated with Estimated Mercury Doses for Each Population of Interest (Equivalent to the Estimated Dose/ USEPA Reference Dose) [a, b]

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL
	Central	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**
Reference Population	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL
Wolf Valley Resident (Adult)										
Elemental Mercury (Inhalation)	0.021	0.014	0.015	---	---	---	---	---	---	---
	0.0023	**0.0016**	**0.0016**	**---**	**---**	**---**	**---**	**---**	**---**	**---**
	0.00026	0.00017	0.00015	---	---	---	---	---	---	---
Inorganic Mercury (ingestion, dermal contact)	0.11	0.077	0.10	---	---	---	---	---	---	---
	0.0060	0.0043	0.0040	**---**	**---**	**---**	**---**	**---**	**---**	**---**
	0.00022	0.00016	0.00018	---	---	---	---	---	---	---
Wolf Valley Resident (Child)										
Elemental Mercury (Inhalation)	0.034	0.027	0.028	---	---	---	---	---	---	---
	0.0044	**0.0031**	**0.0031**	**---**	**---**	**---**	**---**	**---**	**---**	**---**
	0.00056	0.00030	0.00027	---	---	---	---	---	---	---
Inorganic Mercury (ingestion, dermal contact)	0.27	0.29	0.17	---	---	---	---	---	---	---
	0.011	0.0077	0.0083	**---**	**---**	**---**	**---**	**---**	**---**	**---**
	0.00047	0.00029	0.00037	---	---	---	---	---	---	---
Scarboro Resident (Adult)										
Elemental Mercury (Inhalation)	0.13	0.095	0.081	0.019	0.0060	0.014	0.0081	0.0048	0.0009	0.0010
	0.024	**0.019**	**0.014**	**0.0030**	**0.0012**	**0.0027**	**0.0014**	**0.00086**	**0.00014**	**0.00019**
	0.0055	0.0045	0.0038	0.00066	0.00023	0.00049	0.00023	0.00015	0.000029	0.000041
Inorganic Mercury (ingestion, dermal contact)	0.80	0.90	0.80	0.18	0.080	0.17	0.12	0.067	0.080	0.043
	0.090	**0.070**	**0.057**	**0.021**	**0.011**	**0.019**	**0.011**	**0.0083**	**0.0033**	**0.0037**
	0.014	0.0097	0.0083	0.0037	0.0021	0.0032	0.0023	0.0019	0.00060	0.00073
Methylmercury (Fish consumption)	3.0	3.4	3.0	3.3	3.3	3.2	3.3	3.0	2.7	3.3
(compared to in utero RfD)	**0.20**	**0.20**	**0.20**	**0.19**	**0.19**	**0.20**	**0.18**	**0.20**	**0.19**	**0.19**
	0.012	0.012	0.012	0.013	0.014	0.014	0.011	0.012	0.011	0.014
	1.0	1.1	1.0	1.1	1.1	1.1	1.1	1.0	0.90	1.1
(compared to adult RfD)	**0.067**	**0.067**	**0.067**	**0.063**	**0.063**	**0.067**	**0.060**	**0.067**	**0.063**	**0.063**
	0.0040	0.0040	0.0040	0.0043	0.0047	0.0047	0.0037	0.0040	0.0037	0.0047
Scarboro Resident (Child)										
Elemental Mercury (Inhalation)	0.24	0.20	0.16	0.036	0.014	0.029	0.014	0.0092	0.0016	0.0022
	0.045	**0.036**	**0.029**	**0.0060**	**0.0023**	**0.0052**	**0.0028**	**0.0017**	**0.00028**	**0.00037**
	0.011	0.0085	0.0072	0.0012	0.00043	0.00093	0.00045	0.00030	0.000050	0.000066
Inorganic Mercury (ingestion, dermal contact)	3.3	2.1	2.2	0.77	0.43	0.67	0.47	0.28	0.29	0.43
	0.28	**0.25**	**0.19**	**0.090**	**0.050**	**0.087**	**0.050**	**0.043**	**0.016**	**0.017**
	0.053	0.043	0.027	0.016	0.0090	0.015	0.010	0.0070	0.0026	0.0025
Methylmercury (Fish consumption)	3.4	4.1	3.5	3.4	3.7	3.4	3.5	3.3	3.2	3.5
	0.22	**0.23**	**0.24**	**0.22**	**0.23**	**0.23**	**0.22**	**0.22**	**0.22**	**0.21**
	0.014	0.015	0.014	0.014	0.016	0.016	0.013	0.013	0.014	0.014
Robertsville School Student (Child)										
Elemental Mercury (Inhalation)	0.0071	0.0065	0.0043	0.0030	0.0011	0.0024	0.0014	0.00077	0.00013	0.00019
	0.0013	**0.0011**	**0.00079**	**0.00053**	**0.00020**	**0.00042**	**0.00023**	**0.00014**	**0.000024**	**0.000031**
	0.00023	0.00022	0.000151	0.000099	0.000037	0.000077	0.000038	0.000030	0.0000042	0.0000050
Inorganic Mercury (ingestion, dermal contact)	0.40	0.37	0.43	0.433	0.500	0.467	0.433	0.307	0.433	0.233
(general student)	**0.0050**	**0.0050**	**0.0047**	**0.0050**	**0.0047**	**0.0050**	**0.0047**	**0.0033**	**0.0033**	**0.0033**
	0.000057	0.000047	0.000060	0.000057	0.000060	0.000063	0.000043	0.000047	0.000037	0.000047
Inorganic Mercury (ingestion, dermal contact)	0.47	0.40	0.47	0.467	0.500	0.467	0.500	0.500	0.283	0.327
(recreational user of EFPC)	**0.029**	**0.027**	**0.021**	**0.018**	**0.014**	**0.019**	**0.014**	**0.0093**	**0.0080**	**0.0077**
	0.0033	0.0030	0.0023	0.0020	0.0014	0.0019	0.0015	0.0010	0.00060	0.00050

Table X-2: Summary of Hazard Indices Associated with Estimated Mercury Doses for Each Population of Interest (Equivalent to the Estimated Dose/ USEPA Reference Dose) [a, b]

Reference Population	1970 UCL **Central** LCL	1971 UCL **Central** LCL	1972 UCL **Central** LCL	1973 UCL **Central** LCL	1974 UCL **Central** LCL	1975 UCL **Central** LCL	1976 UCL **Central** LCL	1977 UCL **Central** LCL	1978 UCL **Central** LCL	1979 UCL **Central** LCL
Wolf Valley Resident (Adult)										
Elemental Mercury (Inhalation)	---	---	---	---	---	---	---	---	---	---
	---	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**
	---	---	---	---	---	---	---	---	---	---
Inorganic Mercury (ingestion, dermal contact)	---	---	---	---	---	---	---	---	---	---
	---	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**
	---	---	---	---	---	---	---	---	---	---
Wolf Valley Resident (Child)										
Elemental Mercury (Inhalation)	---	---	---	---	---	---	---	---	---	---
	---	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**
	---	---	---	---	---	---	---	---	---	---
Inorganic Mercury (ingestion, dermal contact)	---	---	---	---	---	---	---	---	---	---
	---	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**
	---	---	---	---	---	---	---	---	---	---
Scarboro Resident (Adult)										
Elemental Mercury (Inhalation)	0.0042	0.0010	0.00011	0.0097	0.0019	0.00013	0.00014	0.00029	0.00013	0.00021
	0.00072	**0.00019**	**0.000020**	**0.0019**	**0.000349**	**0.000020**	**0.000026**	**0.000049**	**0.000022**	**0.000043**
	0.00013	0.000034	0.0000038	0.00033	0.000070	0.0000049	0.0000056	0.000011	0.0000045	0.0000085
Inorganic Mercury (ingestion, dermal contact)	0.083	0.030	0.027	0.097	0.037	0.020	0.016	0.020	0.029	0.015
	0.0073	**0.0029**	**0.0015**	**0.012**	**0.0040**	**0.0014**	**0.0015**	**0.0016**	**0.0016**	**0.0015**
	0.0014	0.00057	0.00026	0.0023	0.00080	0.00024	0.00023	0.00026	0.00022	0.00026
Methylmercury (Fish consumption)	3.0	2.6	2.8	3.3	2.7	2.5	2.3	2.8	2.2	2.4
(compared to in utero RfD)	**0.19**	**0.18**	**0.18**	**0.18**	**0.19**	**0.16**	**0.16**	**0.15**	**0.15**	**0.15**
	0.013	0.013	0.010	0.011	0.012	0.010	0.0098	0.0087	0.0089	0.0094
	1.0	0.87	0.93	1.1	0.90	0.83	0.77	0.93	0.73	0.80
(compared to adult RfD)	**0.063**	**0.060**	**0.060**	**0.060**	**0.063**	**0.053**	**0.053**	**0.050**	**0.050**	**0.050**
	0.0043	0.0043	0.0033	0.0037	0.0040	0.0033	0.0033	0.0029	0.0030	0.0031
Scarboro Resident (Child)										
Elemental Mercury (Inhalation)	0.0077	0.0017	0.00020	0.022	0.0035	0.00026	0.00029	0.00062	0.00027	0.00045
	0.0014	**0.00034**	**0.000040**	**0.0036**	**0.00069**	**0.000042**	**0.000051**	**0.00010**	**0.000043**	**0.000091**
	0.00028	0.000071	0.0000078	0.00052	0.00012	0.000009	0.000010	0.000020	0.0000086	0.000015
Inorganic Mercury (ingestion, dermal contact)	0.43	0.16	0.093	0.29	0.12	0.12	0.090	0.11	0.15	0.10
	0.037	**0.013**	**0.0080**	**0.050**	**0.019**	**0.0070**	**0.0073**	**0.0083**	**0.0070**	**0.0067**
	0.0633	0.0021	0.0011	0.010	0.0037	0.00097	0.0011	0.0014	0.00097	0.0012
Methylmercury (Fish consumption)	3.2	3.5	3.7	3.6	3.2	2.7	2.6	2.6	2.5	2.4
	0.22	**0.22**	**0.20**	**0.20**	**0.22**	**0.18**	**0.18**	**0.16**	**0.17**	**0.16**
	0.014	0.014	0.014	0.013	0.014	0.012	0.012	0.011	0.011	0.010
Robertsville School Student (Child)										
Elemental Mercury (Inhalation)	0.00065	0.00016	0.000017	0.0015	0.00035	0.000021	0.000023	0.000048	0.000021	0.000045
	0.00012	**0.000030**	**0.0000033**	**0.00029**	**0.000057**	**0.0000035**	**0.0000044**	**0.0000086**	**0.0000036**	**0.0000069**
	0.000024	0.0000052	0.00000059	0.000052	0.0000097	0.00000077	0.00000077	0.0000015	0.00000079	0.0000014
Inorganic Mercury (ingestion, dermal contact)	0.270	0.167	0.15	0.14	0.13	0.080	0.10	0.15	0.080	0.047
(general student)	**0.0040**	**0.0014**	**0.0011**	**0.0013**	**0.0015**	**0.00090**	**0.00083**	**0.00093**	**0.00093**	**0.00043**
	0.000037	0.000015	0.0000093	0.000016	0.000011	0.0000050	0.0000060	0.0000050	0.000010	0.0000060
Inorganic Mercury (ingestion, dermal contact)	0.287	0.197	0.15	0.11	0.17	0.077	0.15	0.087	0.067	0.087
(recreational user of EFPC)	**0.0093**	**0.0030**	**0.0030**	**0.0070**	**0.0037**	**0.0020**	**0.0019**	**0.0022**	**0.0020**	**0.0012**
	0.00093	0.00024	0.00013	0.00083	0.00037	0.00013	0.00011	0.00013	0.00015	0.000090

Table X-2: Summary of Hazard Indices Associated with Estimated Mercury Doses for Each Population of Interest (Equivalent to the Estimated Dose/ USEPA Reference Dose) [a, b]

Reference Population	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL
	Central	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**
	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL
Wolf Valley Resident (Adult)											
Elemental Mercury (Inhalation)	---	---	---	---	---	---	---	---	---	---	---
	---	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**
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Inorganic Mercury (ingestion, dermal contact)	---	---	---	---	---	---	---	---	---	---	---
	---	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**
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Wolf Valley Resident (Child)											
Elemental Mercury (Inhalation)	---	---	---	---	---	---	---	---	---	---	---
	---	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**
	---	---	---	---	---	---	---	---	---	---	---
Inorganic Mercury (ingestion, dermal contact)	---	---	---	---	---	---	---	---	---	---	---
	---	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**
	---	---	---	---	---	---	---	---	---	---	---
Scarboro Resident (Adult)											
Elemental Mercury (Inhalation)	0.00028	0.00017	0.00043	0.00030	0.00024	0.00029	0.00037	0.00034	0.00023	0.00021	0.00023
	0.000052	**0.000036**	**0.000066**	**0.000059**	**0.000048**	**0.000056**	**0.000069**	**0.000076**	**0.000041**	**0.000040**	**0.000037**
	0.000011	0.0000072	0.000014	0.000011	0.000010	0.000012	0.000013	0.000015	0.0000092	0.0000083	0.0000074
Inorganic Mercury (ingestion, dermal contact)	0.016	0.016	0.017	0.018	0.019	0.017	0.017	0.013	0.013	0.015	0.013
	0.0016	**0.0015**	**0.0018**	**0.0016**	**0.0014**	**0.0014**	**0.0015**	**0.0017**	**0.0014**	**0.0013**	**0.0014**
	0.00033	0.00026	0.00031	0.00029	0.00026	0.00032	0.00030	0.00032	0.00022	0.00022	0.00022
Methylmercury (Fish consumption)	2.3	2.1	2.1	1.7	1.5	1.2	1.2	1.2	1.1	1.2	1.3
(compared to in utero RfD)	**0.14**	**0.13**	**0.12**	**0.11**	**0.10**	**0.077**	**0.079**	**0.075**	**0.077**	**0.077**	**0.078**
	0.0098	0.0085	0.0078	0.0073	0.0062	0.0052	0.0047	0.0050	0.0049	0.0048	0.0048
	0.77	0.70	0.70	0.57	0.50	0.40	0.40	0.40	0.37	0.40	0.43
(compared to adult RfD)	**0.047**	**0.043**	**0.040**	**0.037**	**0.033**	**0.026**	**0.026**	**0.025**	**0.026**	**0.026**	**0.026**
	0.0033	0.0028	0.0026	0.0024	0.0021	0.0017	0.0016	0.0017	0.0016	0.0016	0.0016
Scarboro Resident (Child)											
Elemental Mercury (Inhalation)	0.00064	0.00040	0.00072	0.00066	0.00055	0.00065	0.00078	0.00074	0.00048	0.00042	0.00045
	0.00011	**0.000069**	**0.00013**	**0.00012**	**0.000090**	**0.00011**	**0.00013**	**0.00015**	**0.000074**	**0.000080**	**0.000072**
	0.000022	0.000015	0.000024	0.000019	0.000019	0.000021	0.000023	0.000031	0.000016	0.000014	0.000015
Inorganic Mercury (ingestion, dermal contact)	0.087	0.070	0.10	0.090	0.060	0.00019	0.00022	0.00021	0.00014	0.00012	0.00013
	0.0077	**0.0067**	**0.0080**	**0.0067**	**0.0057**	**0.000031**	**0.000037**	**0.000043**	**0.000021**	**0.000023**	**0.000021**
	0.0011	0.0011	0.0013	0.0012	0.0011	0.0000060	0.0000067	0.0000090	0.0000047	0.0000040	0.0000043
Methylmercury (Fish consumption)	2.3	2.4	2.5	2.0	1.7	1.3	1.3	1.2	1.3	1.3	1.4
	0.16	**0.16**	**0.15**	**0.13**	**0.12**	**0.089**	**0.087**	**0.084**	**0.085**	**0.087**	**0.087**
	0.011	0.0093	0.0094	0.0087	0.0073	0.0058	0.0059	0.0056	0.0057	0.0058	0.0059
Robertsville School Student (Child)											
Elemental Mercury (Inhalation)	0.000050	0.000034	0.000064	0.000052	0.000048	0.000062	0.000060	0.000065	0.000038	0.000035	0.000035
	0.0000090	**0.0000059**	**0.000011**	**0.000010**	**0.0000078**	**0.0000085**	**0.000011**	**0.000013**	**0.0000067**	**0.0000070**	**0.0000064**
	0.0000017	0.0000010	0.0000020	0.0000016	0.0000015	0.0000017	0.0000021	0.0000024	0.0000014	0.0000013	0.0000011
Inorganic Mercury (ingestion, dermal contact)	0.050	0.067	0.047	0.050	0.033	0.037	0.028	0.025	0.040	0.037	0.040
(general student)	**0.00047**	**0.00047**	**0.00050**	**0.00031**	**0.00025**	**0.00029**	**0.00029**	**0.00032**	**0.00026**	**0.00031**	**0.00028**
	0.0000037	0.0000047	0.0000043	0.0000018	0.0000025	0.0000025	0.0000025	0.0000011	0.0000017	0.0000025	0.0000022
Inorganic Mercury (ingestion, dermal contact)	0.067	0.080	0.067	0.047	0.033	0.063	0.029	0.047	0.043	0.037	0.057
(recreational user of EFPC)	**0.0013**	**0.0013**	**0.0013**	**0.00090**	**0.00077**	**0.00087**	**0.00097**	**0.00090**	**0.00077**	**0.00080**	**0.00083**
	0.00010	0.00010	0.00011	0.000063	0.000060	0.000057	0.000080	0.000060	0.000083	0.000043	0.000040

Table X-2: Summary of Hazard Indices Associated with Estimated Mercury Doses for Each Population of Interest (Equivalent to the Estimated Dose/ USEPA Reference Dose) [a, b]

Reference Population	1950 UCL **Central** LCL	1951 UCL **Central** LCL	1952 UCL **Central** LCL	1953 UCL **Central** LCL	1954 UCL **Central** LCL	1955 UCL **Central** LCL	1956 UCL **Central** LCL	1957 UCL **Central** LCL	1958 UCL **Central** LCL	1959 UCL **Central** LCL
EFPC Floodplain Farm Family (Adult)										
Elemental Mercury (Inhalation)	0.017	0.031	0.15	0.63	0.45	2.0	1.5	4.4	3.7	1.1
	0.0026	**0.0055**	**0.028**	**0.13**	**0.073**	**0.38**	**0.31**	**0.76**	**0.69**	**0.20**
	0.00048	0.0011	0.0048	0.026	0.016	0.077	0.057	0.15	0.14	0.043
Inorganic Mercury (ingestion, dermal contact)	0.63	0.83	1.3	4.7	3.1	18	11	31	26	8.7
	0.057	**0.070**	**0.17**	**0.57**	**0.33**	**1.6**	**1.2**	**2.7**	**2.8**	**0.83**
	0.0080	0.012	0.040	0.11	0.070	0.28	0.22	0.53	0.57	0.16
Methylmercury (Fish consumption)	3.0	3.5	3.5	3.8	2.6	3.2	2.9	3.4	3.5	3.3
(compared to in utero RfD)	**0.20**	**0.19**	**0.20**	**0.19**	**0.20**	**0.20**	**0.19**	**0.20**	**0.19**	**0.20**
	0.012	0.013	0.014	0.013	0.012	0.013	0.014	0.013	0.012	0.012
	1.0	1.2	1.2	1.3	0.87	1.1	0.97	1.1	1.2	1.1
(compared to adult RfD)	**0.067**	**0.063**	**0.067**	**0.063**	**0.067**	**0.067**	**0.063**	**0.067**	**0.063**	**0.067**
	0.0040	0.0043	0.0047	0.0043	0.0040	0.0043	0.0047	0.0043	0.0040	0.0040
EFPC Floodplain Farm Family (Child)										
Elemental Mercury (Inhalation)	0.044	0.087	0.41	1.9	1.3	5.7	4.8	13	10	2.4
	0.0080	**0.016**	**0.080**	**0.36**	**0.21**	**1.1**	**0.94**	**2.2**	**2.0**	**0.58**
	0.0016	0.0034	0.016	0.084	0.049	0.21	0.20	0.43	0.37	0.14
Inorganic Mercury (ingestion, dermal contact)	4.3	3.0	6.0	16	12	40	33	87	90	24
	0.21	**0.26**	**0.47**	**1.2**	**0.80**	**3.0**	**2.7**	**5.3**	**5.0**	**1.5**
	0.023	0.032	0.080	0.19	0.15	0.57	0.43	0.90	1.0	0.31
Methylmercury (Fish consumption)	3.2	3.9	3.6	3.4	3.6	3.7	3.3	3.5	3.9	4.0
	0.22	**0.22**	**0.22**	**0.22**	**0.23**	**0.23**	**0.23**	**0.23**	**0.21**	**0.23**
	0.014	0.015	0.015	0.015	0.014	0.014	0.016	0.014	0.016	0.015
Community Population 1 (Adult)										
Elemental Mercury (Inhalation)	0.00049	0.00098	0.0047	0.023	0.014	0.067	0.053	0.15	0.11	0.038
	0.000090	**0.00017**	**0.00090**	**0.0041**	**0.0024**	**0.012**	**0.011**	**0.024**	**0.022**	**0.0064**
	0.000015	0.000038	0.00019	0.00086	0.00049	0.0026	0.0020	0.0048	0.0040	0.0013
Inorganic Mercury (ingestion, dermal contact)	0.0050	0.0067	0.037	0.24	0.10	0.43	0.40	0.97	0.77	0.23
	0.00023	**0.00050**	**0.0022**	**0.010**	**0.0067**	**0.031**	**0.024**	**0.067**	**0.057**	**0.016**
	0.000011	0.000026	0.00015	0.00050	0.00027	0.0017	0.0019	0.0031	0.0029	0.0011
Community Population 1 (Child)										
Elemental Mercury (Inhalation)	0.0010	0.0021	0.011	0.050	0.029	0.14	0.13	0.30	0.22	0.070
	0.00017	**0.00036**	**0.0019**	**0.0077**	**0.0048**	**0.024**	**0.020**	**0.047**	**0.044**	**0.013**
	0.000029	0.000063	0.00036	0.0015	0.00093	0.0047	0.0042	0.011	0.0090	0.0023
Inorganic Mercury (ingestion, dermal contact)	0.0093	0.015	0.090	0.50	0.28	1.2	0.87	2.1	2.2	0.53
	0.00047	**0.00097**	**0.0040**	**0.020**	**0.012**	**0.060**	**0.050**	**0.11**	**0.10**	**0.033**
	0.000019	0.000037	0.00024	0.00067	0.00043	0.0026	0.0028	0.0057	0.0063	0.0014
Community Population 2 (Adult)										
Elemental Mercury (Inhalation)	0.00022	0.00048	0.0023	0.012	0.0062	0.027	0.027	0.063	0.060	0.017
	0.000045	**0.000090**	**0.00044**	**0.0020**	**0.0012**	**0.0064**	**0.0048**	**0.013**	**0.011**	**0.0031**
	0.0000091	0.000020	0.000086	0.00042	0.00022	0.0014	0.0010	0.0026	0.0023	0.00058
Inorganic Mercury (ingestion, dermal contact)	0.0021	0.0040	0.022	0.090	0.053	0.32	0.16	0.57	0.50	0.12
	0.00010	**0.00021**	**0.0012**	**0.0047**	**0.0030**	**0.015**	**0.013**	**0.031**	**0.026**	**0.0087**
	0.0000073	0.000014	0.00005	0.00037	0.00016	0.00073	0.00083	0.0019	0.0016	0.00050
Community Population 2 (Child)										
Elemental Mercury (Inhalation)	0.00045	0.00094	0.0042	0.024	0.014	0.063	0.053	0.13	0.13	0.035
	0.000090	**0.00017**	**0.00083**	**0.0038**	**0.0023**	**0.011**	**0.010**	**0.023**	**0.022**	**0.0065**
	0.000016	0.000035	0.00017	0.00072	0.00038	0.0024	0.0021	0.0049	0.0047	0.0013
Inorganic Mercury (ingestion, dermal contact)	0.0037	0.0073	0.037	0.20	0.17	0.63	0.53	0.90	1.3	0.37
	0.00022	**0.00040**	**0.0023**	**0.0097**	**0.0053**	**0.028**	**0.025**	**0.060**	**0.053**	**0.016**
	0.000012	0.000024	0.000090	0.00050	0.00021	0.0015	0.00083	0.0031	0.0019	0.00070

Table X-2: Summary of Hazard Indices Associated with Estimated Mercury Doses for Each Population of Interest (Equivalent to the Estimated Dose/ USEPA Reference Dose) [a, b]

Reference Population	1960 UCL **Central** LCL	1961 UCL **Central** LCL	1962 UCL **Central** LCL	1963 UCL **Central** LCL	1964 UCL **Central** LCL	1965 UCL **Central** LCL	1966 UCL **Central** LCL	1967 UCL **Central** LCL	1968 UCL **Central** LCL	1969 UCL **Central** LCL
EFPC Floodplain Farm Family (Adult)										
Elemental Mercury (Inhalation)	0.40	0.45	0.24	0.17	0.067	0.15	0.072	0.047	0.0072	0.0097
	0.076	**0.071**	**0.049**	**0.033**	**0.011**	**0.027**	**0.014**	**0.0093**	**0.0015**	**0.0020**
	0.014	0.013	0.0093	0.0066	0.0026	0.0043	0.0028	0.0016	0.00030	0.00034
Inorganic Mercury (ingestion, dermal contact)	3.2	3.7	2.4	1.80	0.93	1.6	0.97	0.47	0.27	0.37
	0.33	**0.31**	**0.23**	**0.17**	**0.087**	**0.15**	**0.090**	**0.060**	**0.024**	**0.030**
	0.073	0.057	0.040	0.037	0.017	0.028	0.019	0.0093	0.0032	0.0050
Methylmercury (Fish consumption)	3.3	3.0	2.5	3.3	3.4	2.9	2.9	3.3	2.7	2.9
(compared to in utero RfD)	**0.20**	**0.19**	**0.20**	**0.19**	**0.20**	**0.18**	**0.19**	**0.20**	**0.19**	**0.19**
	0.011	0.015	0.013	0.013	0.012	0.013	0.012	0.013	0.011	0.012
	1.1	1.0	0.83	1.1	1.1	0.97	0.97	1.1	0.90	0.97
(compared to adult RfD)	**0.067**	**0.063**	**0.067**	**0.063**	**0.067**	**0.060**	**0.063**	**0.067**	**0.063**	**0.063**
	0.0037	0.0050	0.0043	0.0043	0.0040	0.0043	0.0040	0.0043	0.0037	0.0040
EFPC Floodplain Farm Family (Child)										
Elemental Mercury (Inhalation)	1.1	1.2	0.69	0.45	0.17	0.37	0.19	0.13	0.020	0.027
	0.22	**0.20**	**0.14**	**0.094**	**0.031**	**0.078**	**0.042**	**0.027**	**0.0043**	**0.0055**
	0.048	0.040	0.028	0.023	0.0073	0.015	0.0087	0.0052	0.0010	0.0012
Inorganic Mercury (ingestion, dermal contact)	8.0	7.7	7.0	4.0	2.6	4.7	2.8	1.7	1.8	1.8
	0.70	**0.67**	**0.50**	**0.43**	**0.25**	**0.37**	**0.26**	**0.18**	**0.093**	**0.10**
	0.13	0.12	0.080	0.070	0.040	0.067	0.043	0.029	0.011	0.013
Methylmercury (Fish consumption)	3.9	3.6	3.2	3.4	3.7	3.3	3.4	3.2	3.3	3.1
	0.23	**0.21**	**0.23**	**0.22**	**0.23**	**0.21**	**0.21**	**0.22**	**0.21**	**0.21**
	0.013	0.016	0.015	0.016	0.015	0.016	0.013	0.015	0.013	0.014
Community Population 1 (Adult)										
Elemental Mercury (Inhalation)	0.014	0.011	0.0094	0.0059	0.0020	0.0040	0.0026	0.0019	0.00026	0.00031
	0.0023	**0.0024**	**0.0016**	**0.0011**	**0.00040**	**0.00086**	**0.00047**	**0.00028**	**0.000049**	**0.000064**
	0.00050	0.00045	0.00031	0.00020	0.000085	0.00017	0.000099	0.000052	0.0000084	0.000013
Inorganic Mercury (ingestion, dermal contact)	0.10	0.080	0.070	0.040	0.012	0.027	0.018	0.011	0.0018	0.0021
	0.0060	**0.0057**	**0.0040**	**0.0026**	**0.0010**	**0.0020**	**0.0012**	**0.00080**	**0.00012**	**0.00015**
	0.00040	0.00026	0.00024	0.00019	0.000060	0.00017	0.000077	0.000043	0.0000083	0.0000077
Community Population 1 (Child)										
Elemental Mercury (Inhalation)	0.031	0.028	0.017	0.013	0.0043	0.0088	0.0050	0.0038	0.00055	0.00065
	0.0048	**0.0045**	**0.0033**	**0.0020**	**0.00071**	**0.0017**	**0.00098**	**0.00055**	**0.000092**	**0.00013**
	0.0011	0.00088	0.00064	0.00040	0.00015	0.00036	0.00015	0.00011	0.000019	0.000023
Inorganic Mercury (ingestion, dermal contact)	0.25	0.19	0.15	0.12	0.033	0.060	0.060	0.024	0.0037	0.0057
	0.011	**0.011**	**0.0077**	**0.0050**	**0.0019**	**0.0043**	**0.0024**	**0.0013**	**0.00023**	**0.00028**
	0.00050	0.00047	0.00037	0.00026	0.000073	0.00019	0.00010	0.000077	0.000012	0.000012
Community Population 2 (Adult)										
Elemental Mercury (Inhalation)	0.0064	0.0064	0.0055	0.0028	0.0011	0.0023	0.0013	0.0008	0.00012	0.00016
	0.0012	**0.0011**	**0.00074**	**0.00053**	**0.00020**	**0.00042**	**0.00023**	**0.00014**	**0.000022**	**0.000031**
	0.00023	0.00021	0.00016	0.00010	0.000035	0.000064	0.000044	0.000024	0.0000044	0.0000050
Inorganic Mercury (ingestion, dermal contact)	0.050	0.043	0.031	0.022	0.0067	0.018	0.0093	0.0043	0.0010	0.0012
	0.0029	**0.0031**	**0.0020**	**0.0014**	**0.00050**	**0.0010**	**0.00057**	**0.00040**	**0.000057**	**0.000070**
	0.00019	0.00020	0.00011	0.000063	0.000019	0.000053	0.000037	0.000019	0.0000033	0.0000043
Community Population 2 (Child)										
Elemental Mercury (Inhalation)	0.013	0.013	0.011	0.0056	0.0021	0.0043	0.0026	0.0017	0.00027	0.00033
	0.0023	**0.0021**	**0.0015**	**0.0010**	**0.00038**	**0.00086**	**0.00042**	**0.00028**	**0.000047**	**0.000060**
	0.00044	0.00047	0.00035	0.00023	0.000066	0.00016	0.000092	0.000052	0.0000086	0.000010
Inorganic Mercury (ingestion, dermal contact)	0.14	0.16	0.087	0.057	0.022	0.037	0.022	0.012	0.0018	0.0027
	0.0057	**0.0050**	**0.0037**	**0.0024**	**0.00090**	**0.0021**	**0.0011**	**0.00067**	**0.00011**	**0.00014**
	0.00019	0.00029	0.00015	0.00015	0.000037	0.000090	0.000053	0.000026	0.0000047	0.0000067

Table X-2: Summary of Hazard Indices Associated with Estimated Mercury Doses for Each Population of Interest (Equivalent to the Estimated Dose/ USEPA Reference Dose) [a, b]

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL
	Central	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**
Reference Population	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL
EFPC Floodplain Farm Family (Adult)										
Elemental Mercury (Inhalation)	0.043	0.010	0.0010	0.11	0.017	0.0013	0.0014	0.0027	0.0013	0.0029
	0.0071	**0.0017**	**0.00021**	**0.019**	**0.0036**	**0.00022**	**0.00024**	**0.00052**	**0.00023**	**0.00044**
	0.0015	0.00033	0.000036	0.0033	0.00064	0.000044	0.000051	0.000087	0.000043	0.000077
Inorganic Mercury (ingestion, dermal contact)	0.67	0.19	0.15	0.80	0.22	0.083	0.12	0.13	0.12	0.053
	0.057	**0.017**	**0.0073**	**0.083**	**0.026**	**0.0060**	**0.0060**	**0.0077**	**0.0063**	**0.0050**
	0.013	0.0032	0.0010	0.017	0.0043	0.00083	0.00087	0.0013	0.00087	0.00077
Methylmercury (Fish consumption)	2.9	3.0	2.9	2.5	2.9	2.5	2.6	2.4	2.4	2.5
(compared to in utero RfD)	**0.19**	**0.19**	**0.18**	**0.18**	**0.19**	**0.16**	**0.16**	**0.15**	**0.15**	**0.14**
	0.011	0.012	0.010	0.012	0.011	0.009	0.010	0.0093	0.0089	0.0098
	0.97	1.0	0.97	0.83	0.97	0.83	0.87	0.80	0.80	0.83
(compared to adult RfD)	**0.063**	**0.063**	**0.060**	**0.060**	**0.063**	**0.053**	**0.053**	**0.050**	**0.050**	**0.047**
	0.0037	0.0040	0.0032	0.0040	0.0037	0.0031	0.0033	0.0031	0.0030	0.0033
EFPC Floodplain Farm Family (Child)										
Elemental Mercury (Inhalation)	0.11	0.028	0.0028	0.35	0.045	0.0034	0.0036	0.0073	0.0034	0.0070
	0.021	**0.0050**	**0.00059**	**0.051**	**0.010**	**0.00065**	**0.00076**	**0.0015**	**0.00066**	**0.0013**
	0.0037	0.0012	0.00012	0.010	0.0022	0.00013	0.00015	0.00028	0.00014	0.00027
Inorganic Mercury (ingestion, dermal contact)	2.0	0.833	0.63	1.8	0.63	0.57	0.50	0.43	0.43	0.24
	0.18	**0.050**	**0.032**	**0.19**	**0.070**	**0.024**	**0.024**	**0.027**	**0.022**	**0.017**
	0.024	0.006	0.0029	0.028	0.011	0.0021	0.0029	0.0037	0.0024	0.0018
Methylmercury (Fish consumption)	3.0	3.1	3.4	3.2	3.5	2.7	2.6	2.7	2.9	2.4
	0.21	**0.21**	**0.21**	**0.21**	**0.20**	**0.18**	**0.19**	**0.18**	**0.17**	**0.16**
	0.014	0.016	0.013	0.013	0.013	0.011	0.013	0.011	0.010	0.012
Community Population 1 (Adult)										
Elemental Mercury (Inhalation)	0.0013	0.00030	0.000035	0.0036	0.00069	0.000043	0.000044	0.000085	0.000037	0.000073
	0.00024	**0.000059**	**0.0000067**	**0.00063**	**0.00011**	**0.0000071**	**0.0000085**	**0.000016**	**0.0000073**	**0.000014**
	0.000044	0.000011	0.0000014	0.00010	0.000023	0.0000013	0.0000016	0.0000033	0.0000015	0.0000030
Inorganic Mercury (ingestion, dermal contact)	0.011	0.0022	0.00024	0.024	0.0047	0.00022	0.00029	0.00063	0.00033	0.00047
	0.00057	**0.00014**	**0.000018**	**0.0014**	**0.00030**	**0.000019**	**0.000021**	**0.000043**	**0.000016**	**0.000040**
	0.000037	0.0000087	0.0000010	0.00011	0.000015	0.0000015	0.0000015	0.0000029	0.0000011	0.0000023
Community Population 1 (Child)										
Elemental Mercury (Inhalation)	0.0029	0.00063	0.000069	0.0067	0.0014	0.000077	0.00010	0.00017	0.000077	0.00016
	0.00047	**0.00012**	**0.000014**	**0.0012**	**0.00022**	**0.000014**	**0.000016**	**0.000034**	**0.000014**	**0.000029**
	0.000088	0.000019	0.0000023	0.00021	0.000040	0.0000029	0.0000031	0.0000060	0.0000028	0.0000049
Inorganic Mercury (ingestion, dermal contact)	0.024	0.0060	0.00070	0.050	0.011	0.00063	0.00080	0.0014	0.00070	0.0012
	0.0011	**0.00026**	**0.000033**	**0.0028**	**0.00053**	**0.000032**	**0.000040**	**0.000080**	**0.000037**	**0.000073**
	0.000053	0.000011	0.0000012	0.00015	0.000024	0.0000021	0.0000021	0.0000037	0.0000014	0.0000029
Community Population 2 (Adult)										
Elemental Mercury (Inhalation)	0.00057	0.00017	0.000017	0.0017	0.00029	0.000021	0.000022	0.000042	0.000022	0.000038
	0.00011	**0.000029**	**0.0000033**	**0.00028**	**0.000057**	**0.0000035**	**0.0000042**	**0.0000084**	**0.0000035**	**0.0000071**
	0.000021	0.0000059	0.00000072	0.000052	0.000010	0.00000072	0.00000086	0.0000014	0.00000069	0.0000014
Inorganic Mercury (ingestion, dermal contact)	0.0043	0.0012	0.00013	0.013	0.0029	0.00017	0.00015	0.00025	0.00015	0.00025
	0.00029	**0.000073**	**0.0000083**	**0.00073**	**0.00014**	**0.0000090**	**0.000011**	**0.000022**	**0.000010**	**0.000019**
	0.000021	0.0000047	0.00000057	0.000037	0.0000070	0.00000070	0.00000050	0.0000012	0.00000047	0.0000010
Community Population 2 (Child)										
Elemental Mercury (Inhalation)	0.0013	0.00031	0.000035	0.0034	0.00058	0.000041	0.00004	0.00010	0.000038	0.000080
	0.00023	**0.000056**	**0.0000060**	**0.00056**	**0.00011**	**0.0000067**	**0.0000083**	**0.000015**	**0.0000072**	**0.000014**
	0.000041	0.000012	0.0000014	0.00012	0.000016	0.0000012	0.0000014	0.0000033	0.0000013	0.0000030
Inorganic Mercury (ingestion, dermal contact)	0.011	0.0033	0.00031	0.043	0.0070	0.00032	0.00033	0.00090	0.00033	0.0007
	0.00053	**0.00012**	**0.000016**	**0.0014**	**0.00027**	**0.000016**	**0.000020**	**0.000040**	**0.000018**	**0.000033**
	0.000032	0.0000053	0.00000070	0.000077	0.0000093	0.00000073	0.00000070	0.0000018	0.00000060	0.0000012

Table X-2: Summary of Hazard Indices Associated with Estimated Mercury Doses for Each Population of Interest (Equivalent to the Estimated Dose/ USEPA Reference Dose) [a, b]

Reference Population	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL
	Central	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**
	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL
EFPC Floodplain Farm Family (Adult)											
Elemental Mercury (Inhalation)	0.0031	0.0019	0.0038	0.0036	0.0030	0.0026	0.0036	0.0041	0.0022	0.0021	0.0022
	0.00053	**0.00034**	**0.00069**	**0.00059**	**0.00048**	**0.00058**	**0.00067**	**0.00076**	**0.00041**	**0.00041**	**0.00037**
	0.00011	0.000070	0.00013	0.00012	0.000099	0.00010	0.00013	0.00014	0.000090	0.000073	0.000073
Inorganic Mercury (ingestion, dermal contact)	0.063	0.060	0.070	0.050	0.050	0.050	0.067	0.080	0.057	0.043	0.053
	0.0057	**0.0047**	**0.0063**	**0.0050**	**0.0047**	**0.0047**	**0.0057**	**0.0053**	**0.0043**	**0.0040**	**0.0043**
	0.00087	0.00090	0.0011	0.00087	0.00087	0.00083	0.0010	0.0011	0.00083	0.00067	0.00073
Methylmercury (Fish consumption)	2.2	2.0	2.3	1.7	1.5	1.2	1.3	1.2	1.3	1.2	1.2
(compared to in utero RfD)	**0.14**	**0.13**	**0.13**	**0.11**	**0.10**	**0.076**	**0.077**	**0.079**	**0.077**	**0.080**	**0.078**
	0.0097	0.0080	0.0083	0.0069	0.0059	0.0044	0.0056	0.0052	0.0050	0.0052	0.0049
	0.73	0.67	0.77	0.57	0.50	0.40	0.43	0.40	0.43	0.40	0.40
(compared to adult RfD)	**0.047**	**0.043**	**0.043**	**0.037**	**0.033**	**0.025**	**0.026**	**0.026**	**0.026**	**0.027**	**0.026**
	0.0032	0.0027	0.0028	0.0023	0.0020	0.0015	0.0019	0.0017	0.0017	0.0017	0.0016
EFPC Floodplain Farm Family (Child)											
Elemental Mercury (Inhalation)	0.0086	0.0049	0.010	0.0087	0.0083	0.0080	0.0101	0.0128	0.0069	0.0066	0.0057
	0.0016	**0.0010**	**0.0020**	**0.0017**	**0.0014**	**0.0017**	**0.0020**	**0.0021**	**0.0012**	**0.0011**	**0.0011**
	0.00033	0.00021	0.00040	0.00036	0.00033	0.00031	0.0004	0.0004	0.0003	0.0002	0.0002
Inorganic Mercury (ingestion, dermal contact)	0.33	0.25	0.27	0.33	0.21	0.20	0.17	0.27	0.28	0.16	0.37
	0.018	**0.015**	**0.021**	**0.015**	**0.013**	**0.014**	**0.016**	**0.017**	**0.013**	**0.013**	**0.013**
	0.0027	0.0021	0.0026	0.0019	0.0018	0.0020	0.0023	0.0025	0.0016	0.0014	0.0019
Methylmercury (Fish consumption)	2.4	2.6	2.4	2.0	1.6	1.4	1.5	1.4	1.3	1.3	1.2
	0.16	**0.15**	**0.15**	**0.13**	**0.12**	**0.086**	**0.088**	**0.086**	**0.089**	**0.088**	**0.086**
	0.011	0.0092	0.010	0.0082	0.0075	0.0057	0.0056	0.0055	0.0057	0.0055	0.0058
Community Population 1 (Adult)											
Elemental Mercury (Inhalation)	0.00011	0.000056	0.00012	0.00010	0.000078	0.00010	0.00011	0.00014	0.000063	0.000067	0.000063
	0.000017	**0.000011**	**0.000022**	**0.000020**	**0.000016**	**0.000019**	**0.000022**	**0.000023**	**0.000014**	**0.000013**	**0.000013**
	0.0000034	0.0000026	0.0000042	0.0000035	0.0000031	0.0000036	0.0000042	0.0000049	0.0000028	0.0000029	0.0000022
Inorganic Mercury (ingestion, dermal contact)	0.00073	0.00043	0.00073	0.00087	0.00047	0.00080	0.00087	0.0011	0.00050	0.00057	0.00060
	0.000047	**0.000031**	**0.000057**	**0.000047**	**0.000040**	**0.000043**	**0.000060**	**0.000057**	**0.000033**	**0.000037**	**0.000031**
	0.0000020	0.0000016	0.0000033	0.0000025	0.0000033	0.0000025	0.0000024	0.0000047	0.0000015	0.0000018	0.0000019
Community Population 1 (Child)											
Elemental Mercury (Inhalation)	0.00022	0.00012	0.00026	0.00022	0.00015	0.00021	0.00026	0.00027	0.00014	0.00014	0.00013
	0.000036	**0.000022**	**0.000042**	**0.000041**	**0.000030**	**0.000038**	**0.000044**	**0.000048**	**0.000027**	**0.000026**	**0.000026**
	0.0000062	0.0000047	0.0000090	0.0000071	0.0000060	0.0000066	0.0000085	0.000010	0.0000045	0.0000052	0.0000042
Inorganic Mercury (ingestion, dermal contact)	0.0019	0.0012	0.0019	0.0023	0.0014	0.0017	0.0021	0.0025	0.0022	0.0013	0.0010
	0.000083	**0.000053**	**0.00011**	**0.000087**	**0.000067**	**0.000087**	**0.00010**	**0.00011**	**0.000063**	**0.000067**	**0.000060**
	0.0000037	0.0000025	0.0000040	0.0000043	0.0000047	0.0000037	0.0000047	0.0000050	0.0000023	0.0000031	0.0000028
Community Population 2 (Adult)											
Elemental Mercury (Inhalation)	0.00005	0.000029	0.00007	0.000050	0.000043	0.00005	0.00006	0.00006	0.000040	0.000038	0.000031
	0.0000088	**0.0000057**	**0.000010**	**0.0000092**	**0.0000078**	**0.0000092**	**0.000011**	**0.000013**	**0.000007**	**0.000007**	**0.000006**
	0.0000017	0.0000011	0.0000020	0.0000017	0.0000016	0.0000016	0.0000021	0.0000023	0.0000013	0.0000012	0.0000010
Inorganic Mercury (ingestion, dermal contact)	0.00037	0.00021	0.00043	0.00031	0.00032	0.00037	0.00050	0.00053	0.00029	0.00024	0.00022
	0.000022	**0.000014**	**0.000026**	**0.000024**	**0.000018**	**0.000021**	**0.000026**	**0.000029**	**0.000016**	**0.000017**	**0.000015**
	0.0000010	0.00000073	0.0000018	0.0000015	0.0000010	0.0000013	0.0000015	0.0000017	0.0000007	0.0000010	0.0000011
Community Population 2 (Child)											
Elemental Mercury (Inhalation)	0.00010	0.000065	0.00013	0.00010	0.000080	0.00011	0.00014	0.00012	0.000072	0.000065	0.000063
	0.000017	**0.000011**	**0.000020**	**0.000019**	**0.000015**	**0.000017**	**0.000022**	**0.000024**	**0.000013**	**0.000014**	**0.000012**
	0.0000037	0.0000023	0.0000043	0.0000031	0.0000027	0.0000031	0.0000040	0.0000050	0.0000027	0.0000022	0.0000021
Inorganic Mercury (ingestion, dermal contact)	0.00087	0.00047	0.00090	0.00087	0.00060	0.00087	0.0010	0.0010	0.00083	0.00070	0.00057
	0.000040	**0.000028**	**0.000057**	**0.000043**	**0.000037**	**0.000043**	**0.000050**	**0.000050**	**0.000031**	**0.000031**	**0.000027**
	0.0000014	0.0000012	0.0000018	0.0000026	0.0000019	0.0000024	0.0000018	0.0000030	0.0000015	0.0000015	0.0000013

Table X-2: Summary of Hazard Indices Associated with Estimated Mercury Doses for Each Population of Interest (Equivalent to the Estimated Dose/ USEPA Reference Dose) [a, b]

Reference Population	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959
	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL
	Central	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**
	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL
Watts Bar Reservoir Commercial Angler (Adult)										
Methylmercury (fish consumption)	3.4	2.5	3.3	3.4	3.9	8.0	11	15	14	19
(compared to in utero RfD)	0.17	0.17	0.21	0.22	0.26	0.47	0.78	0.98	1.2	1.0
	0.010	0.010	0.012	0.014	0.015	0.037	0.050	0.063	0.071	0.072
	1.1	0.83	1.1	1.1	1.3	2.7	3.7	5.0	4.7	6.4
(compared to adult RfD)	0.058	0.056	0.068	0.075	0.086	0.16	0.26	0.33	0.40	0.35
	0.0035	0.0033	0.0039	0.0045	0.0049	0.012	0.017	0.021	0.024	0.024
Watts Bar Reservoir Commerical Angler (Child)										
Methylmercury (fish consumption)	2.6	2.1	2.7	3.2	3.5	6.8	9.4	13	15	16
(compared to in utero RfD)	0.16	0.15	0.18	0.19	0.23	0.41	0.69	0.85	1.0	0.92
	0.0093	0.0093	0.0097	0.012	0.014	0.029	0.048	0.058	0.071	0.065
Watts Bar Reservoir Recreational Fish Consumer (Adult)										
Methylmercury (fish consumption)	3.5	3.4	3.8	4.2	4.8	9.5	14	16	20	24
(compared to in utero RfD)	0.22	0.23	0.27	0.26	0.30	0.62	0.98	1.3	1.5	1.4
	0.014	0.012	0.014	0.018	0.018	0.039	0.066	0.085	0.088	0.084
	1.2	1.1	1.3	1.4	1.6	3.2	4.8	5.4	6.8	7.9
(compared to adult RfD)	0.073	0.076	0.091	0.088	0.10	0.21	0.33	0.42	0.49	0.46
	0.0047	0.0039	0.0045	0.0060	0.0062	0.013	0.022	0.028	0.029	0.028
Watts Bar Reservoir Recreational Fish Consumer (Child)										
Methylmercury (fish consumption)	2.9	2.9	3.6	3.7	3.7	7.5	12	16	17	20
(compared to in utero RfD)	0.20	0.19	0.24	0.23	0.27	0.54	0.83	1.1	1.2	1.3
	0.012	0.010	0.012	0.016	0.016	0.032	0.058	0.083	0.078	0.079
CR/PC Commercial Angler (Adult)										
Methylmercury (fish consumption)	2.5	2.9	2.4	3.2	2.7	1.8	5.0	7.1	6.3	5.8
(compared to in utero RfD)	0.16	0.16	0.16	0.20	0.16	0.12	0.31	0.37	0.39	0.36
	0.010	0.011	0.010	0.012	0.0095	0.0082	0.023	0.022	0.024	0.023
	0.84	0.98	0.79	1.08	0.90	0.59	1.7	2.4	2.1	1.9
(compared to adult RfD)	0.054	0.054	0.053	0.066	0.054	0.041	0.10	0.12	0.13	0.12
	0.0034	0.0038	0.0033	0.0039	0.0032	0.0027	0.0076	0.0074	0.0081	0.0077
CR/PC Commerical Angler (Child)										
Methylmercury (fish consumption)	2.1	2.4	2.3	2.7	2.4	1.6	4.0	5.4	5.7	5.0
(compared to in utero RfD)	0.14	0.14	0.14	0.17	0.14	0.11	0.27	0.35	0.34	0.32
	0.0093	0.010	0.0095	0.011	0.011	0.0072	0.021	0.021	0.022	0.022
CR/PC Recreational Fish Consumer (Adult)										
Methylmercury (fish consumption)	20	21	20	27	20	15	44	50	51	52
(compared to in utero RfD)	1.3	1.3	1.4	1.6	1.3	0.97	2.9	3.3	3.1	2.9
	0.081	0.085	0.076	0.094	0.092	0.068	0.17	0.22	0.19	0.18
	6.7	6.9	6.6	8.9	6.8	5.1	15	17	17	17
(compared to adult RfD)	0.42	0.44	0.46	0.52	0.43	0.32	0.97	1.1	1.0	0.97
	0.027	0.028	0.025	0.031	0.031	0.023	0.055	0.073	0.063	0.061
CR/PC Recreational Fish Consumer (Child)										
Methylmercury (fish consumption)	19	19	17	20	19	12	38	43	47	41
(compared to in utero RfD)	1.1	1.1	1.2	1.3	1.2	0.85	2.5	2.9	2.7	2.6
	0.070	0.078	0.075	0.081	0.071	0.062	0.13	0.18	0.15	0.16

Table X-2: Summary of Hazard Indices Associated with Estimated Mercury Doses for Each Population of Interest (Equivalent to the Estimated Dose/ USEPA Reference Dose) [a, b]

Reference Population	1960 UCL **Central** LCL	1961 UCL **Central** LCL	1962 UCL **Central** LCL	1963 UCL **Central** LCL	1964 UCL **Central** LCL	1965 UCL **Central** LCL	1966 UCL **Central** LCL	1967 UCL **Central** LCL	1968 UCL **Central** LCL	1969 UCL **Central** LCL
Watts Bar Reservoir Commercial Angler (Adult)										
Methylmercury (fish consumption)	11	7.5	6.3	5.5	5.3	4.8	5.3	4.5	4.9	4.6
(compared to in utero RfD)	0.79	0.40	0.41	0.38	0.36	0.33	0.31	0.32	0.31	0.27
	0.044	0.024	0.026	0.025	0.021	0.023	0.019	0.017	0.019	0.016
	3.8	2.5	2.1	1.8	1.8	1.6	1.8	1.5	1.6	1.5
(compared to adult RfD)	0.26	0.13	0.14	0.13	0.12	0.11	0.10	0.11	0.10	0.091
	0.015	0.0080	0.0086	0.0082	0.0070	0.0075	0.0062	0.0056	0.0063	0.0054
Watts Bar Reservoir Commerical Angler (Child)										
Methylmercury (fish consumption)	9.9	6.7	5.7	5.0	4.4	3.8	4.5	3.7	4.2	4.0
(compared to in utero RfD)	0.71	0.36	0.36	0.33	0.31	0.29	0.27	0.28	0.26	0.23
	0.043	0.021	0.022	0.021	0.020	0.023	0.016	0.015	0.018	0.014
Watts Bar Reservoir Recreational Fish Consumer										
Methylmercury (fish consumption)	15	8.0	8.4	7.4	7.3	7.1	5.8	5.0	5.5	5.5
(compared to in utero RfD)	0.95	0.50	0.50	0.48	0.41	0.44	0.37	0.37	0.40	0.34
	0.061	0.028	0.032	0.031	0.027	0.027	0.027	0.026	0.023	0.023
	4.9	2.7	2.8	2.5	2.4	2.4	1.9	1.7	1.8	1.8
(compared to adult RfD)	0.32	0.17	0.17	0.16	0.14	0.15	0.12	0.12	0.13	0.11
	0.020	0.0094	0.011	0.010	0.0090	0.0090	0.0091	0.0087	0.0075	0.0076
Watts Bar Reservoir Recreational Fish Consumer										
Methylmercury (fish consumption)	13	6.6	6.9	5.9	6.0	6.2	4.7	5.2	5.4	4.6
(compared to in utero RfD)	0.85	0.46	0.42	0.40	0.36	0.38	0.33	0.33	0.35	0.30
	0.059	0.025	0.026	0.025	0.028	0.026	0.023	0.024	0.019	0.018
CR/PC Commercial Angler (Adult)										
Methylmercury (fish consumption)	5.3	5.5	4.4	2.6	2.0	1.8	1.5	1.4	1.1	1.3
(compared to in utero RfD)	0.33	0.29	0.27	0.18	0.14	0.12	0.10	0.079	0.069	0.075
	0.019	0.023	0.017	0.011	0.0094	0.0063	0.0067	0.0056	0.0046	0.0047
	1.8	1.8	1.5	0.87	0.66	0.60	0.49	0.46	0.35	0.42
(compared to adult RfD)	0.11	0.098	0.090	0.061	0.047	0.039	0.033	0.026	0.023	0.025
	0.0063	0.0078	0.0055	0.0035	0.0031	0.0021	0.0022	0.0019	0.0015	0.0016
CR/PC Commerical Angler (Child)										
Methylmercury (fish consumption)	4.6	4.8	3.5	2.3	1.7	1.5	1.4	1.2	0.92	1.0
(compared to in utero RfD)	0.30	0.27	0.24	0.16	0.12	0.10	0.086	0.070	0.063	0.065
	0.018	0.020	0.015	0.0096	0.0087	0.0057	0.0051	0.0046	0.0040	0.0041
CR/PC Recreational Fish Consumer (Adult)										
Methylmercury (fish consumption)	44	36	32	22	19	16	13	11	9.8	9.4
(compared to in utero RfD)	2.6	2.4	2.2	1.4	1.2	0.93	0.80	0.69	0.57	0.60
	0.17	0.14	0.13	0.092	0.070	0.059	0.050	0.048	0.028	0.039
	15	12	11	7.2	6.2	5.4	4.5	3.8	3.3	3.1
(compared to adult RfD)	0.86	0.79	0.73	0.47	0.38	0.31	0.27	0.23	0.19	0.20
	0.056	0.047	0.045	0.031	0.023	0.020	0.017	0.016	0.0094	0.013
CR/PC Recreational Fish Consumer (Child)										
Methylmercury (fish consumption)	39	34	29	18	16	14	11	9.5	8.4	8.4
(compared to in utero RfD)	2.3	2.0	2.1	1.2	0.99	0.82	0.72	0.61	0.51	0.53
	0.16	0.13	0.13	0.079	0.061	0.049	0.044	0.040	0.029	0.034

Table X-2: Summary of Hazard Indices Associated with Estimated Mercury Doses for Each Population of Interest (Equivalent to the Estimated Dose/ USEPA Reference Dose) [a, b]

	1970	**1971**	**1972**	**1973**	**1974**	**1975**	**1976**	**1977**	**1978**	**1979**
	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL
	Central	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**
Reference Population	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL
Watts Bar Reservoir Commercial Angler (Adult)										
Methylmercury (fish consumption)	4.7	3.3	4.5	4.5	4.7	4.8	5.0	4.5	3.9	4.6
(compared to in utero RfD)	0.27	0.26	0.25	0.26	0.29	0.29	0.26	0.23	0.23	0.23
	0.015	0.019	0.016	0.015	0.015	0.017	0.016	0.015	0.015	0.013
	1.6	1.1	1.5	1.5	1.6	1.6	1.7	1.5	1.3	1.5
(compared to adult RfD)	0.089	0.086	0.083	0.086	0.095	0.097	0.087	0.077	0.077	0.077
	0.0050	0.0062	0.0055	0.0051	0.0050	0.0057	0.0052	0.0049	0.0052	0.0043
Watts Bar Reservoir Commerical Angler (Child)										
Methylmercury (fish consumption)	3.8	3.1	3.9	4.0	4.1	4.8	4.8	4.1	3.5	4.1
(compared to in utero RfD)	0.23	0.22	0.23	0.23	0.24	0.24	0.24	0.20	0.20	0.21
	0.014	0.016	0.013	0.015	0.014	0.017	0.012	0.013	0.013	0.013
Watts Bar Reservoir Recreational Fish Consumer										
Methylmercury (fish consumption)	6.4	6.4	6.3	5.2	4.6	5.8	6.0	4.9	4.4	5.6
(compared to in utero RfD)	0.34	0.32	0.32	0.32	0.35	0.35	0.32	0.28	0.30	0.32
	0.020	0.017	0.017	0.022	0.023	0.020	0.016	0.015	0.018	0.017
	2.1	2.1	2.1	1.7	1.5	1.9	2.0	1.6	1.5	1.9
(compared to adult RfD)	0.11	0.11	0.11	0.11	0.12	0.12	0.11	0.093	0.10	0.11
	0.0066	0.0057	0.0056	0.0074	0.0077	0.0068	0.0055	0.0050	0.0059	0.0055
Watts Bar Reservoir Recreational Fish Consumer										
Methylmercury (fish consumption)	5.2	5.5	4.8	4.7	4.0	4.2	5.0	4.2	4.4	4.7
(compared to in utero RfD)	0.28	0.28	0.29	0.30	0.30	0.30	0.29	0.25	0.26	0.29
	0.018	0.017	0.017	0.019	0.019	0.017	0.017	0.014	0.016	0.015
CR/PC Commercial Angler (Adult)										
Methylmercury (fish consumption)	1.2	1.3	1.3	1.0	0.82	0.75	0.83	0.72	0.59	0.61
(compared to in utero RfD)	0.083	0.085	0.089	0.058	0.055	0.053	0.050	0.041	0.039	0.036
	0.0051	0.0053	0.0056	0.0041	0.0029	0.0029	0.0030	0.0026	0.0025	0.0023
	0.40	0.44	0.44	0.35	0.27	0.25	0.28	0.24	0.20	0.20
(compared to adult RfD)	0.028	0.028	0.030	0.019	0.018	0.018	0.017	0.014	0.013	0.012
	0.0017	0.0018	0.0019	0.0014	0.0010	0.0010	0.0010	0.00086	0.00082	0.00075
CR/PC Commerical Angler (Child)										
Methylmercury (fish consumption)	1.0	1.1	1.1	0.87	0.74	0.72	0.70	0.65	0.51	0.51
(compared to in utero RfD)	0.070	0.075	0.075	0.053	0.048	0.046	0.044	0.036	0.034	0.032
	0.0048	0.0045	0.0049	0.0035	0.0032	0.0028	0.0027	0.0025	0.0021	0.0021
CR/PC Recreational Fish Consumer (Adult)										
Methylmercury (fish consumption)	11.3	9.9	10	7.6	6.3	6.8	5.7	5.5	5.4	4.7
(compared to in utero RfD)	0.63	0.65	0.69	0.46	0.44	0.40	0.40	0.35	0.32	0.30
	0.036	0.040	0.040	0.028	0.030	0.028	0.019	0.020	0.019	0.018
	3.8	3.3	3.5	2.5	2.1	2.3	1.9	1.8	1.8	1.6
(compared to adult RfD)	0.21	0.22	0.23	0.15	0.15	0.13	0.13	0.12	0.11	0.10
	0.012	0.013	0.013	0.0092	0.010	0.0092	0.0065	0.0068	0.0062	0.0061
CR/PC Recreational Fish Consumer (Child)										
Methylmercury (fish consumption)	9.2	8.7	10.2	6.3	6.0	5.4	5.0	4.9	4.5	4.0
(compared to in utero RfD)	0.54	0.56	0.61	0.41	0.38	0.35	0.34	0.31	0.28	0.26
	0.036	0.039	0.038	0.026	0.027	0.027	0.019	0.017	0.016	0.016

Table X-2: Summary of Hazard Indices Associated with Estimated Mercury Doses for Each Population of Interest (Equivalent to the Estimated Dose/ USEPA Reference Dose) [a, b]

Reference Population	1980 UCL **Central** LCL	1981 UCL **Central** LCL	1982 UCL **Central** LCL	1983 UCL **Central** LCL	1984 UCL **Central** LCL	1985 UCL **Central** LCL	1986 UCL **Central** LCL	1987 UCL **Central** LCL	1988 UCL **Central** LCL	1989 UCL **Central** LCL	1990 UCL **Central** LCL
Watts Bar Reservoir Commercial Angler (Adult)											
Methylmercury (fish consumption)	4.1	4.1	3.2	3.4	3.5	3.3	3.2	3.0	3.3	3.6	3.0
(compared to in utero RfD)	0.27	0.24	0.21	0.21	0.20	0.20	0.22	0.20	0.22	0.19	0.21
	0.014	0.015	0.013	0.011	0.011	0.010	0.013	0.013	0.014	0.012	0.011
	1.4	1.4	1.1	1.1	1.2	1.1	1.1	1.0	1.1	1.2	1.0
(compared to adult RfD)	0.090	0.082	0.071	0.069	0.068	0.065	0.072	0.066	0.072	0.065	0.070
	0.0047	0.0050	0.0044	0.0037	0.0037	0.0034	0.0043	0.0045	0.0046	0.0038	0.0037
Watts Bar Reservoir Commerical Angler (Child)											
Methylmercury (fish consumption)	3.3	3.4	2.7	3.2	3.2	2.8	3.0	2.7	2.9	2.9	3.0
(compared to in utero RfD)	0.24	0.21	0.20	0.18	0.17	0.17	0.19	0.18	0.19	0.17	0.18
	0.013	0.012	0.011	0.011	0.011	0.009	0.010	0.011	0.012	0.010	0.0096
Watts Bar Reservoir Recreational Fish Consumer											
Methylmercury (fish consumption)	5.3	4.4	5.3	5.3	4.4	4.2	4.8	3.9	3.8	5.1	4.9
(compared to in utero RfD)	0.33	0.33	0.29	0.27	0.25	0.26	0.26	0.26	0.27	0.25	0.26
	0.022	0.016	0.015	0.015	0.014	0.015	0.017	0.013	0.015	0.013	0.016
	1.8	1.5	1.8	1.8	1.5	1.4	1.6	1.3	1.3	1.7	1.6
(compared to adult RfD)	0.11	0.11	0.095	0.092	0.084	0.086	0.085	0.088	0.089	0.084	0.088
	0.0075	0.0054	0.0049	0.0050	0.0048	0.0052	0.0055	0.0042	0.0051	0.0043	0.0052
Watts Bar Reservoir Recreational Fish Consumer											
Methylmercury (fish consumption)	4.4	4.1	4.7	3.8	3.9	3.8	4.4	4.1	3.8	3.7	4.4
(compared to in utero RfD)	0.28	0.28	0.25	0.23	0.22	0.24	0.22	0.23	0.23	0.22	0.23
	0.020	0.015	0.012	0.014	0.014	0.015	0.012	0.014	0.012	0.013	0.010
CR/PC Commercial Angler (Adult)											
Methylmercury (fish consumption)	0.56	0.46	0.43	0.41	0.38	0.37	0.45	0.39	0.38	0.39	0.39
(compared to in utero RfD)	0.033	0.030	0.025	0.025	0.027	0.025	0.024	0.025	0.025	0.024	0.024
	0.0020	0.0017	0.0014	0.0014	0.0014	0.0015	0.0018	0.0016	0.0017	0.0020	0.0014
	0.19	0.15	0.14	0.14	0.13	0.12	0.15	0.13	0.13	0.13	0.13
(compared to adult RfD)	0.011	0.010	0.0082	0.0085	0.0089	0.0083	0.0079	0.0082	0.0083	0.0078	0.0079
	0.00068	0.00058	0.00046	0.00045	0.00048	0.00049	0.00059	0.00055	0.00058	0.00067	0.00048
CR/PC Commerical Angler (Child)											
Methylmercury (fish consumption)	0.46	0.43	0.39	0.36	0.34	0.30	0.31	0.35	0.33	0.34	0.33
(compared to in utero RfD)	0.030	0.026	0.022	0.022	0.022	0.021	0.021	0.022	0.021	0.022	0.021
	0.0020	0.0016	0.0013	0.0013	0.0014	0.0015	0.0013	0.0014	0.0014	0.0016	0.0012
CR/PC Recreational Fish Consumer (Adult)											
Methylmercury (fish consumption)	5.0	4.7	3.2	3.2	3.3	3.2	3.6	3.2	3.0	2.8	3.2
(compared to in utero RfD)	0.28	0.26	0.20	0.20	0.20	0.20	0.20	0.21	0.21	0.21	0.20
	0.018	0.014	0.012	0.013	0.011	0.013	0.015	0.010	0.013	0.013	0.012
	1.7	1.6	1.1	1.1	1.1	1.1	1.2	1.1	1.0	0.95	1.1
(compared to adult RfD)	0.095	0.086	0.066	0.066	0.068	0.068	0.065	0.070	0.069	0.071	0.068
	0.0058	0.0048	0.0040	0.0045	0.0035	0.0042	0.0049	0.0035	0.0042	0.0043	0.0041
CR/PC Recreational Fish Consumer (Child)											
Methylmercury (fish consumption)	4.2	3.7	2.8	3.1	2.8	2.8	2.9	2.6	2.9	2.7	2.5
(compared to in utero RfD)	0.25	0.22	0.16	0.18	0.18	0.17	0.17	0.19	0.17	0.18	0.18
	0.015	0.012	0.011	0.012	0.0084	0.0095	0.0122	0.0092	0.012	0.011	0.012

Table X-2: Summary of Hazard Indices Associated with Estimated Mercury Doses for Each Population of Interest (Equivalent to the Estimated Dose/ USEPA Reference Dose) [a, b]

Reference Population	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959
	UCL **Central** LCL	UCL **Central** LCL	UCL **Central** LCL	UCL **Central** LCL	UCL **Central** LCL	UCL **Central** LCL	UCL **Central** LCL	UCL **Central** LCL	UCL **Central** LCL	UCL **Central** LCL
Watts Bar Reservoir Category 1 (Adult)										
Methylmercury (fish consumption)	1.8	1.9	2.1	2.2	2.5	4.3	6.7	8.7	9.9	9.7
(compared to in utero RfD)	**0.84**	**0.82**	**0.96**	**1.0**	**1.2**	**2.2**	**3.4**	**4.5**	**4.9**	**5.0**
	0.17	0.20	0.20	0.29	0.31	0.89	1.6	2.0	2.5	2.4
	0.60	0.64	0.71	0.75	0.83	1.4	2.2	2.9	3.3	3.2
(compared to adult RfD)	**0.28**	**0.27**	**0.32**	**0.34**	**0.40**	**0.73**	**1.1**	**1.5**	**1.6**	**1.7**
	0.057	0.068	0.067	0.10	0.10	0.30	0.54	0.68	0.82	0.79
Watts Bar Reservoir Category 2 (Adult)										
Methylmercury (fish consumption)	0.72	0.70	0.79	0.84	1.0	1.7	2.6	3.2	3.9	3.7
(compared to in utero RfD)	**0.30**	**0.31**	**0.35**	**0.37**	**0.43**	**0.82**	**1.3**	**1.6**	**1.8**	**1.9**
	0.075	0.071	0.084	0.094	0.11	0.32	0.54	0.74	0.80	0.83
	0.24	0.23	0.26	0.28	0.34	0.58	0.86	1.1	1.3	1.2
(compared to adult RfD)	**0.10**	**0.10**	**0.12**	**0.12**	**0.14**	**0.27**	**0.44**	**0.55**	**0.61**	**0.63**
	0.025	0.024	0.028	0.031	0.037	0.11	0.18	0.25	0.27	0.28
Watts Bar Reservoir Category 3 (Adult)										
Methylmercury (fish consumption)	0.22	0.25	0.27	0.30	0.32	0.60	0.85	1.2	1.3	1.2
(compared to in utero RfD)	**0.082**	**0.079**	**0.099**	**0.10**	**0.11**	**0.23**	**0.37**	**0.45**	**0.50**	**0.53**
	0.014	0.013	0.015	0.018	0.020	0.050	0.082	0.11	0.13	0.13
	0.074	0.085	0.090	0.099	0.11	0.20	0.28	0.39	0.43	0.40
(compared to adult RfD)	**0.027**	**0.026**	**0.033**	**0.034**	**0.038**	**0.075**	**0.12**	**0.15**	**0.17**	**0.18**
	0.0047	0.0044	0.0051	0.0060	0.0068	0.017	0.027	0.037	0.042	0.042
Clinch River/ Poplar Creek Category 1 (Adult)										
Methylmercury (fish consumption)	16	15	15	17	16	11	34	42	38	36
(compared to in utero RfD)	**7.8**	**7.7**	**8.0**	**9.4**	**7.9**	**6.0**	**16**	**20**	**18**	**17**
	3.8	3.8	3.4	4.2	3.6	2.7	6.6	7.9	8.2	7.4
	5.3	5.0	5.1	5.8	5.3	3.6	11	14	13	12
(compared to adult RfD)	**2.6**	**2.6**	**2.7**	**3.1**	**2.6**	**2.0**	**5.3**	**6.5**	**6.0**	**5.8**
	1.3	1.3	1.1	1.4	1.2	0.90	2.2	2.6	2.7	2.5
Clinch River/ Poplar Creek Category 2 (Adult)										
Methylmercury (fish consumption)	6.0	5.8	6.0	7.0	5.8	4.4	13	16	14	14
(compared to in utero RfD)	**3.0**	**2.9**	**3.0**	**3.6**	**3.0**	**2.3**	**6.1**	**7.0**	**7.0**	**6.5**
	1.3	1.2	1.3	1.5	1.3	0.93	2.2	2.8	2.7	2.8
	2.0	1.9	2.0	2.3	1.9	1.5	4.3	5.4	4.8	4.6
(compared to adult RfD)	**1.0**	**0.98**	**0.98**	**1.2**	**1.0**	**0.75**	**2.0**	**2.3**	**2.3**	**2.2**
	0.43	0.41	0.43	0.51	0.44	0.31	0.73	0.92	0.91	0.92
Clinch River/ Poplar Creek Category 3 (Adult)										
Methylmercury (fish consumption)	2.0	1.9	1.9	2.2	1.9	1.4	4.4	5.0	4.6	4.6
(compared to in utero RfD)	**0.83**	**0.83**	**0.82**	**0.98**	**0.80**	**0.61**	**1.6**	**2.0**	**1.9**	**1.8**
	0.18	0.20	0.20	0.26	0.21	0.16	0.36	0.49	0.47	0.40
	0.67	0.64	0.63	0.74	0.63	0.47	1.5	1.7	1.5	1.5
(compared to adult RfD)	**0.28**	**0.28**	**0.27**	**0.33**	**0.27**	**0.20**	**0.55**	**0.67**	**0.62**	**0.60**
	0.061	0.067	0.065	0.085	0.071	0.052	0.12	0.16	0.16	0.13
EFPC Category 3 (Adult)										
Methylmercury (fish consumption)	4.4	4.5	4.6	4.6	4.4	4.6	4.5	4.4	4.6	4.5
(compared to in utero RfD)	**1.9**	**1.9**	**1.9**	**1.9**	**1.8**	**1.8**	**1.9**	**1.9**	**1.9**	**1.9**
	0.43	0.46	0.44	0.44	0.46	0.48	0.45	0.45	0.45	0.49
	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
(compared to adult RfD)	**0.64**	**0.62**	**0.63**	**0.63**	**0.61**	**0.61**	**0.63**	**0.62**	**0.64**	**0.64**
	0.14	0.15	0.15	0.15	0.15	0.16	0.15	0.15	0.15	0.16

Table X-2: Summary of Hazard Indices Associated with Estimated Mercury Doses for Each Population of Interest (Equivalent to the Estimated Dose/ USEPA Reference Dose) [a, b]

Reference Population	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL	UCL
	Central	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**	**Central**
	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL	LCL
Watts Bar Reservoir Category 1 (Adult)										
Methylmercury (fish consumption)	6.9	4.0	3.6	3.5	3.2	3.1	3.0	3.1	3.0	2.6
(compared to in utero RfD)	**3.5**	**1.9**	**1.8**	**1.7**	**1.5**	**1.6**	**1.4**	**1.4**	**1.4**	**1.3**
	1.5	0.68	0.81	0.57	0.55	0.54	0.57	0.45	0.47	0.41
	2.3	1.3	1.2	1.2	1.1	1.0	1.0	1.0	0.98	0.85
(compared to adult RfD)	**1.2**	**0.63**	**0.60**	**0.57**	**0.51**	**0.53**	**0.48**	**0.45**	**0.46**	**0.42**
	0.50	0.23	0.27	0.19	0.18	0.18	0.19	0.15	0.16	0.14
Watts Bar Reservoir Category 2 (Adult)										
Methylmercury (fish consumption)	2.5	1.5	1.4	1.4	1.3	1.1	1.2	1.1	1.2	1.1
(compared to in utero RfD)	**1.3**	**0.69**	**0.69**	**0.62**	**0.56**	**0.57**	**0.53**	**0.51**	**0.51**	**0.44**
	0.53	0.27	0.27	0.21	0.18	0.21	0.19	0.18	0.17	0.15
	0.85	0.49	0.48	0.45	0.42	0.38	0.39	0.37	0.38	0.36
(compared to adult RfD)	**0.43**	**0.23**	**0.23**	**0.21**	**0.19**	**0.19**	**0.18**	**0.17**	**0.17**	**0.15**
	0.18	0.088	0.092	0.069	0.061	0.071	0.063	0.059	0.057	0.051
Watts Bar Reservoir Category 3 (Adult)										
Methylmercury (fish consumption)	0.84	0.48	0.44	0.42	0.40	0.39	0.41	0.36	0.35	0.34
(compared to in utero RfD)	**0.37**	**0.19**	**0.19**	**0.17**	**0.15**	**0.16**	**0.14**	**0.14**	**0.14**	**0.13**
	0.084	0.040	0.049	0.040	0.038	0.034	0.034	0.027	0.027	0.023
	0.28	0.16	0.15	0.14	0.13	0.13	0.14	0.12	0.12	0.11
(compared to adult RfD)	**0.12**	**0.063**	**0.064**	**0.056**	**0.050**	**0.053**	**0.048**	**0.046**	**0.046**	**0.042**
	0.028	0.013	0.016	0.013	0.013	0.011	0.011	0.0091	0.0090	0.0077
Clinch River/ Poplar Creek Category 1 (Adult)										
Methylmercury (fish consumption)	34	35	27	17	13	11	9.5	8.1	6.7	7.4
(compared to in utero RfD)	**16**	**14**	**13**	**8.5**	**6.7**	**5.7**	**5.0**	**4.3**	**3.4**	**3.7**
	6.7	6.0	5.2	3.8	3.2	2.5	2.3	1.9	1.6	1.7
	11	12	9.2	5.5	4.5	3.6	3.2	2.7	2.2	2.5
(compared to adult RfD)	**5.5**	**4.8**	**4.5**	**2.8**	**2.2**	**1.9**	**1.7**	**1.4**	**1.1**	**1.2**
	2.2	2.0	1.7	1.3	1.1	0.84	0.76	0.62	0.53	0.56
Clinch River/ Poplar Creek Category 2 (Adult)										
Methylmercury (fish consumption)	14	13	11.0	6.4	5.2	4.2	3.8	3.2	2.7	2.9
(compared to in utero RfD)	**6.1**	**5.6**	**5.0**	**3.2**	**2.5**	**2.2**	**1.9**	**1.6**	**1.3**	**1.4**
	2.4	2.2	2.0	1.4	1.1	0.86	0.82	0.65	0.55	0.64
	4.6	4.2	3.7	2.1	1.7	1.4	1.3	1.1	0.89	0.97
(compared to adult RfD)	**2.0**	**1.9**	**1.7**	**1.1**	**0.83**	**0.72**	**0.62**	**0.54**	**0.43**	**0.47**
	0.81	0.72	0.66	0.46	0.36	0.29	0.27	0.22	0.18	0.21
Clinch River/ Poplar Creek Category 3 (Adult)										
Methylmercury (fish consumption)	4.3	4.2	3.5	2.0	1.7	1.3	1.1	0.98	0.83	0.87
(compared to in utero RfD)	**1.7**	**1.6**	**1.4**	**0.91**	**0.69**	**0.56**	**0.52**	**0.44**	**0.35**	**0.39**
	0.41	0.32	0.29	0.22	0.17	0.15	0.12	0.10	0.087	0.090
	1.4	1.4	1.15	0.66	0.55	0.44	0.38	0.33	0.28	0.29
(compared to adult RfD)	**0.55**	**0.52**	**0.46**	**0.30**	**0.23**	**0.19**	**0.17**	**0.15**	**0.12**	**0.13**
	0.14	0.11	0.096	0.072	0.056	0.050	0.042	0.034	0.029	0.030
EFPC Category 3 (Adult)										
Methylmercury (fish consumption)	4.6	4.4	4.4	4.5	4.4	3.9	4.1	4.0	4.0	4.0
(compared to in utero RfD)	**1.9**	**1.9**	**1.9**	**1.9**	**1.9**	**1.8**	**1.8**	**1.9**	**1.8**	**1.8**
	0.44	0.47	0.47	0.50	0.46	0.45	0.41	0.42	0.45	0.41
	1.5	1.5	1.5	1.5	1.5	1.3	1.4	1.3	1.3	1.3
(compared to adult RfD)	**0.64**	**0.62**	**0.64**	**0.62**	**0.63**	**0.61**	**0.61**	**0.62**	**0.60**	**0.61**
	0.15	0.16	0.16	0.17	0.15	0.15	0.14	0.14	0.15	0.14

Table X-2: Summary of Hazard Indices Associated with Estimated Mercury Doses for Each Population of Interest (Equivalent to the Estimated Dose/ USEPA Reference Dose) [a, b]

Reference Population	1970 UCL **Central** LCL	1971 UCL **Central** LCL	1972 UCL **Central** LCL	1973 UCL **Central** LCL	1974 UCL **Central** LCL	1975 UCL **Central** LCL	1976 UCL **Central** LCL	1977 UCL **Central** LCL	1978 UCL **Central** LCL	1979 UCL **Central** LCL
Watts Bar Reservoir Category 1 (Adult)										
Methylmercury (fish consumption)	2.6	2.6	2.7	2.7	2.7	2.8	2.8	2.4	2.4	2.4
(compared to in utero RfD)	**1.2**	**1.2**	**1.2**	**1.2**	**1.3**	**1.3**	**1.2**	**1.1**	**1.1**	**1.2**
	0.43	0.38	0.36	0.40	0.41	0.37	0.36	0.32	0.32	0.36
	0.85	0.85	0.89	0.90	0.89	0.93	0.93	0.82	0.82	0.81
(compared to adult RfD)	**0.38**	**0.40**	**0.40**	**0.40**	**0.42**	**0.42**	**0.40**	**0.37**	**0.37**	**0.39**
	0.14	0.13	0.12	0.13	0.14	0.12	0.12	0.11	0.11	0.12
Watts Bar Reservoir Category 2 (Adult)										
Methylmercury (fish consumption)	1.1	0.96	1.0	1.0	1.1	1.1	1.0	0.93	0.93	0.97
(compared to in utero RfD)	**0.45**	**0.45**	**0.43**	**0.45**	**0.47**	**0.46**	**0.44**	**0.40**	**0.39**	**0.42**
	0.13	0.13	0.15	0.15	0.15	0.14	0.13	0.13	0.11	0.12
	0.35	0.32	0.34	0.33	0.36	0.36	0.35	0.31	0.31	0.32
(compared to adult RfD)	**0.15**	**0.15**	**0.14**	**0.15**	**0.16**	**0.15**	**0.15**	**0.13**	**0.13**	**0.14**
	0.044	0.042	0.049	0.051	0.049	0.047	0.044	0.042	0.037	0.038
Watts Bar Reservoir Category 3 (Adult)										
Methylmercury (fish consumption)	0.34	0.31	0.29	0.32	0.33	0.33	0.33	0.29	0.32	0.31
(compared to in utero RfD)	**0.11**	**0.12**	**0.11**	**0.12**	**0.12**	**0.12**	**0.12**	**0.11**	**0.11**	**0.12**
	0.021	0.024	0.026	0.028	0.028	0.027	0.027	0.020	0.021	0.023
	0.11	0.10	0.097	0.11	0.11	0.11	0.11	0.096	0.105	0.103
(compared to adult RfD)	**0.038**	**0.039**	**0.038**	**0.040**	**0.041**	**0.040**	**0.041**	**0.036**	**0.037**	**0.039**
	0.0071	0.0081	0.0086	0.0092	0.0094	0.0089	0.0089	0.0068	0.0069	0.0078
Clinch River/ Poplar Creek Category 1 (Adult)										
Methylmercury (fish consumption)	7.1	8.4	8.5	5.8	5.4	5.2	4.8	4.6	4.0	3.7
(compared to in utero RfD)	**3.9**	**4.0**	**4.2**	**2.8**	**2.6**	**2.5**	**2.4**	**2.2**	**2.0**	**1.9**
	1.8	1.9	2.1	1.1	1.2	1.1	1.0	0.94	0.81	0.72
	2.4	2.8	2.8	1.9	1.8	1.7	1.6	1.5	1.3	1.2
(compared to adult RfD)	**1.3**	**1.3**	**1.4**	**0.95**	**0.88**	**0.84**	**0.80**	**0.72**	**0.66**	**0.63**
	0.59	0.63	0.68	0.38	0.39	0.37	0.34	0.31	0.27	0.24
Clinch River/ Poplar Creek Category 2 (Adult)										
Methylmercury (fish consumption)	2.9	3.2	3.3	2.3	2.1	1.9	1.9	1.7	1.6	1.4
(compared to in utero RfD)	**1.4**	**1.5**	**1.6**	**1.0**	**1.0**	**0.94**	**0.90**	**0.78**	**0.75**	**0.70**
	0.58	0.64	0.67	0.44	0.43	0.39	0.35	0.33	0.28	0.27
	0.97	1.1	1.1	0.75	0.70	0.65	0.62	0.58	0.53	0.48
(compared to adult RfD)	**0.48**	**0.50**	**0.53**	**0.34**	**0.33**	**0.31**	**0.30**	**0.26**	**0.25**	**0.23**
	0.19	0.214	0.223	0.147	0.142	0.131	0.118	0.110	0.094	0.091
Clinch River/ Poplar Creek Category 3 (Adult)										
Methylmercury (fish consumption)	0.95	1.01	1.01	0.71	0.68	0.66	0.57	0.55	0.52	0.47
(compared to in utero RfD)	**0.40**	**0.42**	**0.44**	**0.29**	**0.28**	**0.25**	**0.25**	**0.22**	**0.21**	**0.19**
	0.093	0.10	0.11	0.072	0.067	0.066	0.052	0.052	0.050	0.043
	0.32	0.34	0.34	0.24	0.23	0.22	0.19	0.18	0.17	0.16
(compared to adult RfD)	**0.13**	**0.14**	**0.15**	**0.10**	**0.094**	**0.084**	**0.083**	**0.074**	**0.071**	**0.064**
	0.031	0.034	0.036	0.024	0.022	0.022	0.017	0.017	0.017	0.014
EFPC Category 3 (Adult)										
Methylmercury (fish consumption)	4.1	3.8	3.9	3.9	4.0	3.7	3.2	3.4	3.1	3.0
(compared to in utero RfD)	**1.8**	**1.8**	**1.8**	**1.7**	**1.7**	**1.6**	**1.5**	**1.5**	**1.4**	**1.4**
	0.46	0.45	0.41	0.44	0.43	0.38	0.39	0.37	0.34	0.34
	1.4	1.3	1.3	1.3	1.3	1.2	1.1	1.1	1.0	1.0
(compared to adult RfD)	**0.59**	**0.61**	**0.59**	**0.57**	**0.58**	**0.52**	**0.51**	**0.49**	**0.47**	**0.46**
	0.15	0.15	0.14	0.15	0.14	0.13	0.13	0.12	0.11	0.11

Table X-2: Summary of Hazard Indices Associated with Estimated Mercury Doses for Each Population of Interest (Equivalent to the Estimated Dose/ USEPA Reference Dose) [a, b]

Reference Population	1980 UCL **Central** LCL	1981 UCL **Central** LCL	1982 UCL **Central** LCL	1983 UCL **Central** LCL	1984 UCL **Central** LCL	1985 UCL **Central** LCL	1986 UCL **Central** LCL	1987 UCL **Central** LCL	1988 UCL **Central** LCL	1989 UCL **Central** LCL	1990 UCL **Central** LCL
Watts Bar Reservoir Category 1 (Adult)											
Methylmercury (fish consumption)	2.6	2.4	2.4	2.2	2.2	2.1	2.1	2.1	2.1	2.1	2.1
(compared to in utero RfD)	**1.2**	**1.1**	**1.0**	**0.99**	**0.94**	**0.93**	**0.97**	**0.94**	**0.99**	**0.97**	**0.95**
	0.39	0.33	0.32	0.26	0.23	0.25	0.25	0.24	0.26	0.27	0.23
	0.85	0.80	0.79	0.73	0.73	0.71	0.72	0.71	0.71	0.70	0.70
(compared to adult RfD)	**0.40**	**0.37**	**0.34**	**0.33**	**0.31**	**0.31**	**0.32**	**0.31**	**0.33**	**0.32**	**0.32**
	0.13	0.11	0.11	0.087	0.078	0.085	0.082	0.081	0.087	0.091	0.076
Watts Bar Reservoir Category 2 (Adult)											
Methylmercury (fish consumption)	1.0	0.92	0.94	0.86	0.81	0.81	0.80	0.82	0.82	0.86	0.82
(compared to in utero RfD)	**0.46**	**0.39**	**0.39**	**0.37**	**0.34**	**0.36**	**0.35**	**0.36**	**0.36**	**0.35**	**0.38**
	0.14	0.12	0.10	0.095	0.088	0.088	0.10	0.10	0.10	0.11	0.10
	0.34	0.31	0.31	0.29	0.27	0.27	0.27	0.27	0.27	0.29	0.27
(compared to adult RfD)	**0.15**	**0.13**	**0.13**	**0.12**	**0.11**	**0.12**	**0.12**	**0.12**	**0.12**	**0.12**	**0.13**
	0.045	0.041	0.034	0.032	0.029	0.029	0.033	0.032	0.032	0.035	0.032
Watts Bar Reservoir Category 3 (Adult)											
Methylmercury (fish consumption)	0.34	0.28	0.29	0.26	0.27	0.26	0.28	0.28	0.26	0.28	0.27
(compared to in utero RfD)	**0.12**	**0.11**	**0.10**	**0.095**	**0.091**	**0.098**	**0.097**	**0.094**	**0.096**	**0.094**	**0.095**
	0.024	0.020	0.021	0.020	0.018	0.018	0.014	0.018	0.018	0.016	0.018
	0.113	0.094	0.096	0.088	0.089	0.086	0.092	0.095	0.088	0.094	0.091
(compared to adult RfD)	**0.040**	**0.038**	**0.035**	**0.032**	**0.030**	**0.033**	**0.032**	**0.031**	**0.032**	**0.031**	**0.032**
	0.0080	0.0066	0.0070	0.0066	0.0058	0.0061	0.0048	0.0060	0.0060	0.0055	0.0060
Clinch River/ Poplar Creek Category 1 (Adult)											
Methylmercury (fish consumption)	3.5	3.2	2.6	2.4	2.5	2.5	2.5	2.5	2.5	2.5	2.6
(compared to in utero RfD)	**1.7**	**1.6**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**
	0.71	0.58	0.45	0.44	0.45	0.49	0.45	0.45	0.47	0.49	0.46
	1.2	1.1	0.85	0.79	0.83	0.85	0.85	0.85	0.84	0.82	0.86
(compared to adult RfD)	**0.58**	**0.53**	**0.41**	**0.41**	**0.41**	**0.40**	**0.41**	**0.40**	**0.42**	**0.40**	**0.42**
	0.24	0.19	0.15	0.15	0.15	0.16	0.15	0.15	0.16	0.16	0.15
Clinch River/ Poplar Creek Category 2 (Adult)											
Methylmercury (fish consumption)	1.3	1.3	1.1	0.97	0.93	1.0	0.98	0.98	0.97	0.96	0.95
(compared to in utero RfD)	**0.65**	**0.58**	**0.46**	**0.45**	**0.45**	**0.45**	**0.45**	**0.46**	**0.46**	**0.45**	**0.46**
	0.23	0.20	0.17	0.17	0.16	0.17	0.16	0.16	0.15	0.14	0.16
	0.44	0.43	0.35	0.32	0.31	0.34	0.33	0.33	0.32	0.32	0.32
(compared to adult RfD)	**0.22**	**0.19**	**0.15**	**0.15**	**0.15**	**0.15**	**0.15**	**0.15**	**0.15**	**0.15**	**0.15**
	0.076	0.068	0.055	0.055	0.055	0.056	0.055	0.053	0.050	0.048	0.053
Clinch River/ Poplar Creek Category 3 (Adult)											
Methylmercury (fish consumption)	0.47	0.38	0.34	0.33	0.31	0.32	0.34	0.31	0.31	0.32	0.30
(compared to in utero RfD)	**0.17**	**0.16**	**0.13**	**0.12**	**0.13**	**0.12**	**0.12**	**0.12**	**0.12**	**0.12**	**0.12**
	0.039	0.039	0.028	0.028	0.020	0.030	0.026	0.027	0.026	0.027	0.032
	0.16	0.13	0.11	0.11	0.10	0.11	0.11	0.10	0.10	0.11	0.10
(compared to adult RfD)	**0.057**	**0.053**	**0.042**	**0.040**	**0.042**	**0.041**	**0.041**	**0.041**	**0.042**	**0.041**	**0.041**
	0.013	0.013	0.0095	0.0094	0.0068	0.010	0.0086	0.0091	0.0086	0.0091	0.011
EFPC Category 3 (Adult)											
Methylmercury (fish consumption)	3.0	2.8	2.8	2.4	2.0	1.5	1.5	1.6	1.5	1.5	1.4
(compared to in utero RfD)	**1.3**	**1.3**	**1.3**	**1.1**	**0.98**	**0.73**	**0.75**	**0.74**	**0.75**	**0.73**	**0.76**
	0.34	0.33	0.31	0.26	0.24	0.20	0.17	0.19	0.19	0.18	0.19
	0.99	0.93	0.92	0.80	0.68	0.49	0.51	0.53	0.49	0.50	0.48
(compared to adult RfD)	**0.43**	**0.43**	**0.43**	**0.37**	**0.33**	**0.24**	**0.25**	**0.25**	**0.25**	**0.24**	**0.25**
	0.11	0.11	0.10	0.086	0.078	0.065	0.056	0.063	0.063	0.060	0.064

[a] RfD for Elemental Merc. = 0.000086 mg kg-1 d-1; RfD for Inorganic Merc. = 0.0003 mg kg-1 d-1; RfD for Methylmerc. (in utero) = 0.0001 mg kg-1 d-1; RfD for Methylmerc. (adult) = 0.0003 mg kg-1 d-1.

[b] Hazard Indices greater than 1 are shaded (that it, the estimated dose exceeds the USEPA RfD).

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APPENDIX Y

RESULTS OF SENSITIVITY ANALYSES
FOR IMPORTANT PATHWAYS

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APPENDIX Y

RESULTS OF SENSITIVITY ANALYSES FOR IMPORTANT PATHWAYS

The following tables present the results of sensitivity analyses conducted using the Crystal Ball software (v. 4.0) for pathways shown to contribute significantly to exposure. For each population evaluated, sensitivity analyses were run for the years of highest estimated exposures. The results of this analysis show which assumptions in the dose calculations had the greatest impact on the resulting distributions of dose.

Contribution to Total Variance

EFPC Floodplain Farm Family

EFPC Farm Family
Child Inhalation (1957)

	Contribution to Total Variance (%)
Air concentration	68%
Air model Uncertainty	14%
Indoor-to-outdoor ratio	9%
Inhalation rate	5%
Body weight	4%
Fraction of time outdoors while at home	0%
Fraction of time at home	0%
Sum	100%

EFPC Farm Family
Child- Fruit and Vegetable consumption (air-to-veg) (1958)

Parameter	Contribution to Total Variance (%)
Ingestion rate	42%
Air concentration	18%
Inverse of biomass yield (for dry deposition)	13%
Mass interception factor (for wet deposition)	12%
Dry deposition velocity	4%
Air Model Uncertainty	4%
Fraction remaining after washing	2%
Weathering rate	2%
Body weight	2%
Oral relative bioavailability factor	1%
Exposure period of standing crop biomass	0%
Washout ratio (wet deposition)	0%
Precipitation rate	0%
Sum	100%

EFPC Farm Family
Child Incidental EFPC Water Ingestion (1958)

	Contribution to Total Variance (%)
Ingestion rate	48%
Exposure time to surface water	35%
Exposure frequency to surface water	13%
Body weight	2.3%
Water concentration	1.2%
Relative bioavailability factor	0.2%
Fraction of water ingested that was contaminated	0.2%
Sum	100%

EFPC Farm Family
Child Skin Contact with EFPC Water (1958)

	Contribution to Total Variance (%)
Exposure time to surface water	38%
Surface area of exposed skin	30%
Permeability constant	22%
Exposure frequency to surface water	8.4%
Water concentration	0.8%
Fraction of water contacted that was contaminated	0.3%
Body weight	0.0%
Sum	100%

EFPC Farm Family
Child Skin Contact with Soil (1958)

	Contribution to Total Variance (%)
Soil concentration	47%
Soil loading rate	26%
Soil concentration adjustment factor	21%
Relative bioavailability factor	5.8%
Surface area	0.5%
Fraction of soil contacted that was contaminated	0.0%
Body weight	0.0%
Sum	100%

Scarboro Community Resident

Scarboro Community
Child Inhalation (1955)

	Contribution to Total Variance (%)
X/Q	60%
Air concentration (EFPC contribution)	13%
Indoor-to-outdoor ratio	10%
Body weight	5.6%
Inhalation rate	5.3%
Y-12 release rate to air	3.8%
Air model Uncertainty	2.2%
Fraction of time outdoors while at home	0.2%
Fraction of time at home	0.1%
Binh	0.0%
Sum	100%

Scarboro Community
Child- Fruit and Vegetable consumption (air-to-veg) (1955)

Parameter	Contribution to Total Variance (%)
Ingestion rate	44%
x/Q	15%
Inverse of biomass yield (for dry deposition)	14%
Mass interception factor (for wet deposition)	13%
Dry deposition velocity	4.7%
Air concentration (EFPC contribution)	2.5%
Weathering rate	1.8%
Fraction remaining after washing	1.7%
Body weight	1.2%
Y-12 release rate to air	1.1%
Air Model Uncertainty	0.5%
Oral relative bioavailability factor	0.5%
Exposure period of standing crop biomass	0.2%
Washout ratio (wet deposition)	0.1%
Precipitation rate	0.0%
Sum	100%

Scarboro Community
Child Incidental Water Ingestion (1958)

	Contribution to Total Variance (%)
Ingestion rate	47%
Exposure time to surface water	33%
Exposure frequency to surface water	16%
Body weight	2.4%
Water concentration	1.0%
Fraction of water ingested that was contaminated	0.3%
Relative bioavailability factor	0.1%
Sum	100%

Scarboro Community
Child Skin Contact with EFPC Water (1958)

	Contribution to Total Variance (%)
Exposure time to surface water	37%
Surface area of exposed skin	30%
Permeability constant	22%
Exposure frequency to surface water	11%
Water concentration	0.4%
Fraction of water contacted that was contaminated	0.2%
Body weight	0.0%
Sum	100%

Robertsville School Student

Robertsville School Student
Incidental Ingestion of EFPC Water (1958)

	Contribution to Total Variance (%)
Ingestion rate	38%
Exposure time to surface water	34%
Exposure frequency to surface water	23%
Body weight	4.5%
Water concentration	0.8%
Fraction of surface water ingested that was contaminated	0.2%
Relative bioavailability factor	0.1%
Sum	100%

Robertsville School Student
Skin Contact with EFPC Water (1958)

	Contribution to Total Variance (%)
Exposure time to surface water	36%
Permability Constant	32%
Exposure frequency to surface water	25%
Body weight	4.9%
Surface area of exposed skin	1.4%
Fraction of surface water contacted that was contaminated	0.4%
Water concentration	0.3%
Sum	100%

Robertsville School Student
Soil Ingestion (1958)

	Contribution to Total Variance (%)
Soil concentration	60%
Relative bioavailability factor	28%
Ingestion rate	7.8%
Body weight	1.6%
Soil concentration adjustment factor	1.5%
Fraction of soil ingested that was contaminated	1.3%
Sum	100%

Robertsville School Student
Skin Contact with Soil (1958)

	Contribution to Total Variance (%)
Soil concentration	60%
Soil loading on skin	28%
Relative bioavailability factor	7.0%
Body weight	1.8%
Soil concentration adjustment factor	1.5%
Fraction of soil contacted that was contaminated	1.3%
Surface area of exposed skin	0.3%
Sum	40%

Fish Consumers

Watts Bar Commercial Angler, Adult (1958)

	Contribution to Total Variance (%)
Fish concentration	9%
Fish consumption rate	90.0%
Body weight	1.3%
Sum	100%

Watts Bar Category 1 Fish Consumer, Adult (1958)

	Contribution to Total Variance (%)
Fish concentration	63%
Fish consumption rate	28.8%
Body weight	7.8%
Sum	100%

Watts Bar Category 2 Fish Consumer, Adult (1958)

	Contribution to Total Variance (%)
Fish concentration	57%
Fish consumption rate	36.5%
Body weight	6.6%
Sum	100%

Watts Bar Category 3 Fish Consumer, Adult (1958)

	Contribution to Total Variance (%)
Fish concentration	35%
Fish consumption rate	60.6%
Body weight	4.3%
Sum	100%

KEY TECHNICAL REPORTS OF THE OAK RIDGE DOSE RECONSTRUCTION PROJECT

• Volume 1 •
Iodine-131 Releases from Radioactive Lanthanum Processing at the X-10 Site in Oak Ridge, Tennessee (1944-1956)– an Assessment of Quantities Released, Off-Site Radiation Doses, and Potential Excess Risks of Thyroid Cancer
The report of project Task 1

• Volume 1A •
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