HARDWICK LANDFILL HISTORY & DOCUMENT SUMMARY

PREPARED BY GENEVIEVE C. FRASER
ENVIRONMENTAL MONITOR
TOWN OF HARDWICK, MASSACHUSETTS
JUNE 30, 2005

1.1 GENERAL

PURPOSE

Since 1968, Hardwick Landfill, Inc has evolved and expanded from an unlined landfill which accepted 50 tons per day of mostly C&D waste and operated *without* a leachate collection system to a partially lined landfill accepting 90 and then 300 tons per day of trash *with* a leachate collection system in Phase 1 - to a Phase 2 double-lined, 2-cell landfill comprised of a leachate collection system and recently installed gas collection and flare system, due to off-site gas migration. The current system accepts 300 tons per day of construction and demolition material as well as household waste.

Relocation of the waste in the unlined portion of Phase 1 to a lined area, as well as the installation of a gas collection system along Patrill Hollow Road, has yet to be implemented. The Phase 1 portion of the landfill has had documented on and off-site gas migration at and exceeding the 100% LEL (Lower Explosive Level) since 1994.

The Hardwick Landfill is currently operating under the Authorization to Operate a Landfill (BWP SW 10) Hardwick Landfill Phase 2 Expansion, permit date March 4, 2003, permit number W027925.

The purpose of the Landfill History & Document Summary as well as the Environmental Monitor Journal is to present a comprehensive examination of the Hardwick Landfill from its inception to the present so that residents and officials of the Town of Hardwick might make informed decisions concerning the future of the site.

LOCATION

The Hardwick Landfill, Inc. is located at Latitude/Longitude 42 20' 30" N & 72 14' 30" W of the Ware Quadrangle. The original site assignment (Book 2673, Page 103) was for a so-called "30.6-acre "site, located on Patrill Hollow Road in the Town of Hardwick; however, the size of the parcel was based on documents dating back to the 1866. An August 8, 1991 survey of the lot determined that the actual size of the site was 28.747 acres divided into two separate pieces by Patrill Hollow Road. On October 25, 1993, David G. Roach and Norma G. Roach transferred ownership of both parts of the original site to Hardwick Landfill, Inc. The Phase 1 landfills - both the original unlined as well as the lined expansion – are located on a 22.947 portion (Map 83, Lot 2) of the original assigned area. The 5.80 acre remainder, which is located across Patrill Hollow Road and found on Map 83, Lot 1A, was never used as a landfill and as of this date remains in Roach family ownership and is actively mined for sand and gravel. The 22.947 acre, "grandfathered" parcel is owned by Casella, Inc., with 19.1 acres utilized for Phase 1. Phase 2 is mostly located on an adjacent 16.57-acre parcel (Assessor's Map 83 & 85 Lot 1, also formerly owned by the Roach family), though a portion of Cell2A is sited on the original parcel, adjacent to and in part "piggy backed" onto Phase 1.

NOTE:
A September 14, 1977 letter (H-397-00) to the Regional Environmental Engineer signed by the Board of Health Chairman Anthony Bujnevicie describes the book and page number correctly but misidentifies the size of the landfill parcel as 35 acres. No documentation was submitted to back up this claim.

Furthermore, a contract signed by Mr. Bujnevicie, January 18, 1979, on behalf of the Board of Health and David and Norma Roach to "furnish and operate a sanitary landfill for the disposal of refuse and solid waste, as defined herein, for a period of five (5) years, commencing July 1, 1978 and

terminating June 30, 1983," describes the tract of land "to be supplied and furnished by the contraction, consisting of approximately thirty-one (31) acres."

1.2 DOCUMENT SUMMARY

1968 INITIAL SITE ASSIGNMENT

The Hardwick Landfill, Inc.'s initial site assignment, granted in 1968, was for an unlined landfill. The property was purchased by Florence Roach from Jenks and Goss in 1943. Norma and David Roach purchased the property from Florence in 1979. (B6669, P324)

1969 REPORTS ON THE SITE

The Board of Selectman, acting as the Board of Health, had the Roach site and another site studied for suitability to be used as a landfill. The Roach site was chosen. The geologist who conducted the investigation was Carlos Carranza from the University of Massachusetts in Amherst. The report was submitted to the Department of Water Pollution on January 10, 1969.
The report stated that the site was "at least 3-4 feet above existing groundwater levels in November of 1968," which was "Verified by 3 dug trenches to a depth of at least 3 feet from the topographical low of the site."

A February 7, 1969 letter report from Bruce K. Maillet, Junior Sanitary Engineer describes the site:

"The dump, itself, is, at present, an open face dump. It is approximately 50 feet wide with a face 20 feet high. There was no burning at the time of the examination and little evidence that burning had occurred. Some cover material had been placed on the top."0

"Located adjacent to the dump, approximately 50 feet away, is a large gravel bank. Gravel cover material could easily be taken from this bank and used as cover material. An area below the face of the dump could be used for a sanitary landfill with little preparation."

The letter was written in response to "letters of complaint and a petition signed by 10 residents."

The landfill is owned by Mr. David Roach, a resident of Hardwick. The Town of Hardwick pays for the "rental and maintenance" of the landfill. Mr. Roach is described as the "custodian" of the landfill in a 1972 Dump Usage Survey.

1977 PERMIT TO FILL IN OVER EXISTING WATER TABLE

The Hardwick Conservation Commission granted permission to HLI "to fill in a minimum of six (6) feet over existing water table areas." As a result a modified operational plan was developed by their engineers in accordance with state regulations.

1985 MEETING TO DISCUSS TOWN LIABILITY

10/21/85 open meeting held by selectmen with DEQE, state senator and representative, David Roach, Town Council, Boards of Health, Conservation and Finance plus news media. "Discussion of the Department of Environmental Quality Engineering's order to close the Town Dump under Chapter 111, Section 150A and to discuss the liability of the Town pertaining to any toxic leakage."

1986 DEQE PROPOSED CLOSURE

Because HLI did not "comply with standards, required by 310 CMR 19.00 regulations, promulgated in 1971" DEQE suggested the landfill be closed unless upgraded.

1987 OPERATIONAL PLAN

An "Interim Operational Plan for the Hardwick Sanitary Landfill" was prepared by Tighe & Bond in 1987 and approved by DEQE.

1988 MONITORING WELLS

Three groundwater monitoring wells were installed between March 21 and April 1, 1988 (MW -2, MW- 3, MW-4) by Carr-Dee Corp. A fourth well (MW-1) was installed by Guild Drilling Co., Inc. July 8-11, 1988, according to the Tighe & Bond, Quality Assurance and Quality Control plan accompanying the July 14, 1994 DEP approved "Authorization to Operate a Landfill" for the Hardwick Landfill which was seeking "approval for a horizontal expansion to the existing facility."

1991 DECLARATION OF EMERGENCY PROCUREMENT

An Emergency Procurement for solid waste services was issued by the Hardwick Board of Health on June 10, 1991 to contractor/operator David Roach "whereas, compliance with bidding procedures…would seriously endanger the health and safety of the Town of Hardwick."

1990 – 93 PHASE 1 UNLINED CLOSURE

The unlined area was closed and covered in accordance with Massachusetts Solid Waste Regulations 310 CMR 19.000 from 1990 through 1993.

1992 PERMIT TO CONTINUE OPERATION AT 50 TPD

An application for the existing facility "to continue operating the facility at 50 tons/day" was approved by the DEP on 8/28/92.

1993 SEISMIC IMPACT STUDY

A seismic study report conducted for the proposed horizontal expansion area of the Hardwick Landfill was approved by the DEP, November 1993.

1993 PHASE 1 LINED LANDFILL EXPANSION AT 90 TPD

Io November 30, 1993 the 6-acre Phase 1 lined landfill expansion was approved by the Massachusetts Department of Environmental Protection and the tonnage increased to 90 tons per day. The expansion permit included an authorization to construct a 60 (mil) thick "co-extruded flexible membrane liner." 90% of the accepted waste would be Construction and Demolition and 10% Municipal Solid Waste. The method of management would include Landfilling and Recycling and would require Environmental Monitoring of groundwater, leachate and gas produced as well as a leachate collection and storage system for the facility.

"Should this facility wish to expand beyond the existing area which has been site assigned, a new site assignment would have to be obtained and the zoning issues addressed." (p. 4, Summary Response to Comments)

1994 ENVIRONMENTAL NOTIFICATION FORM FILED FOR TONNAGE INCREASE

December 12, 1994 Hardwick Landfill, Inc. filed an Environmental Notification Form (ENF) with the Secretary of Environmental Affairs for a Permit Modification to increase "from 90 tons per day (TPD) to 300 TPD.

"The nearest residence is 1000 feet from the site. It is not anticipated that this receptor will be affected by air contamination due to the proposed changes," the ENF stated. "It is not anticipated that the residence to the South will be adversely affected. There is approximately 500 feet of woodland between the site and the residence to buffer noise. (Source: Site visit)"

1995 DAILY TONNAGE INCREASE TO 300 TONS PER DAY

The MDEP issued a Minor Modification Permit in 1995 to increase daily tonnage from 90tpd to 300tpd.

1998 SPECIAL PERMIT FOR GRAVEL PERMIT

The Planning Board granted a Special Permit to Hardwick Landfill, Inc. on December 14, 1998 "to open a gravel pit to be used in the daily operation of the landfill." The gravel pit was located (Deed Book 17078 page 2; Assessor's Map 85 Lot 1) in a Rural Residential (R6) zoned area - outside of but adjacent to the property granted the initial site assignment in 1968.

1999 ASBESTOS ROOFING

January 11, 1999 HLI letter to DEP requesting a letter stating that "we can accept Asbestos Asphaltic roofing debris for disposal at the landfill. APPENDIX

1999 CSA APPROVAL - PHASE 2

The Massachusetts Department of Environmental Protection (MDEP) issued a Comprehensive Site Assessment Approval for the Hardwick Landfill after reviewing Tighe & Bond's Scope of Work, Phase 2 Hydrological Study dated June 1999. The Phase 2 parcel, owned by HLI, had been operated as a gravel pit since December 1998.

2000 "SPECIAL PERMIT" FOR ZONING CHANGE

On February 14, 2000, the "former gravel bank" which had received a Special Permit to operate for the use of the Hardwick Landfill in 1998 was granted a "Special Permit" for a zoning change from R60 toC40 from Rural Residential to Commercial for an additional cell for landfill use.

July 2000 Draft Environmental Impact Report Certified

The Secretary of the Environment certified on July 14, 2000 that the Draft EIR "adequately and properly complies with the Massachusetts Environmental Policy Act."

2000 FEIR FOR PHASE 2

August 2000, the Final Environmental Impact Report for the Phase 2 Lined Expansion of Hardwick Sanitary Landfill, EOEA file #11886 was prepared for Hardwick Landfill, Inc. by Tighe & Bond.

According to the report, "More than half of the proposed Phase 2 Expansion will be on an abutting parcel that has not been previously site assigned." (1-2)

"There have been no complaints about odor from the landfill." (5-12)

2001 SITE SUITABILITY PHASE 2

On March 12, 2001, the Town of Hardwick Board of Health issued a Site Expansion and Site Suitability final decision determining" that the site at 1123 Patrill Hollow Road is suitable for an expansion of an existing solid waste landfill and grants Site Assignment."

The Hardwick Conservation Commission issued an order of conditions based on the MA Wetlands Protection Act.

2001 PHASE 1 CLOSURE

"Phase 1 lined landfill constructed as a lateral expansion to original landfill in 1994 and operated until July 2001," according to a Tighe & Bond Hardwick Landfill Compliance Summary. The Phase 1 expansion area was subsequently capped and seeded with grasses. In 2002 Tighe and Bond requested a modification to the DEP-approved closure plan, requesting the use of a manufactured topsoil in place of virgin topsoil as the vegetative support layer, proposing instead BioMix, a short paper fiber derivative.

2001 CUMULATIVE RISK ASSESSMENT
FUGITIVE PARTICULATE CONTROL

"The Level 2 quantitative impact evaluation is used to assess potential human health impacts due to inhalation of contaminants from a proposed landfill that meets all the facility and siting requirements … Emissions of

certain non-criteria pollutants or toxins (e.g. benzene, vinyl chloride, perchloroethylene, etc.) are included in the quantitative evaluation of potential risks from proposed solid waste facilities (i.e. new landfills and landfill expansions over 150 tons a day). Total cancer and non-cancer risks associated with emissions of toxics from the proposed facility are estimated under this protocol." (2)

"The project proponents met with MADEP on July 25, 2001 to discuss the facility specific requirements for identifying chemicals of concern for the risk evaluation. At that meeting MADEP confirmed that the statement from the Guidance Document presented above applies to the Hardwick Landfill, and that particulate contaminant is the only contaminant of concern for the purpose of the risk evaluation." (8)

"Because particulate matter has been defined as the only contaminant of concern, a numerical analysis of VOC health risks is not required for this particular landfill." (8)

"Fugitive particulates are those particles generated and dispersed at a facility during day-to-day operations. Particulates may be emitted in conjunction with the loading and unloading of refuse, packing and compacting operations, and other activities, especially in windy, dry conditions. MADEP expects that use of BMP (Best Management Practices) for dust control will address and significantly limit the emission of fugitive dusts from waste processing facilities." (8)

"Volatile organic parameters which exceeded the Method 1 groundwater GW-1 standards in one or more wells include the following:" 2-Butanone at 530 ug/L and Vinyl Chloride at 2.3 ug/L (12)

"Closure of the unlined landfill area was identified as the most appropriate remediation plan to reduce health and environmental risks associated with the groundwater contamination from the existing unlined landfill area." (12)

"Based on the continued improvement in groundwater quality since closure of the unlined landfill, risks to human health and the environment have been effectively controlled." (12)

Tighe & Bond, (H397 Phase 2) Cumulative Risk Assessment,
August 2001

APRIL 2002 AUTHORIZATION TO CONSTRUCT PHASE 2

The MDEP issued a Phase 2 Lined Expansion Final Permit and Authorization to Construct the HLI Phase 2 expansion on April 29, 2002 which consists of two lined cells separated by an internal berm on the liner system and integrated into a leachate collection system and storm water management system.

AUGUST 2002 - AUTHORIZATION TO OPERATE SUSPENDED - HLI FINED $175,000

HLI was fined $175,000 by the Commonwealth and ordered to hire a qualified engineer to inspect and audit the Phase II expansion on the landfill.

See Press Release 12/4/2002– Office of Attorney General
Appendix B

"*Whereas*, in or about June, 2001, HLI applied to the Massachusetts Department of Environmental Protection (DEP) for a permit and authorization to build an expansion of the landfill facility,
Whereas, HLI commenced construction of the landfill expansion before receiving a permit and authorization to build the expansion;
Whereas, in August, 2002, the Massachusetts Attorney General notified HLI that he had been requested by DEP to bring suit against HLI for alleged violations of the Solid Waste Disposal Act, G, L. c. 111, 150A;
Whereas, pending resolution of this enforcement matter, DEP has suspended review of HLI's application for Authorization to Operate…"

Tom Reilly, Attorney General, December 2, 2002
See Appendix E

MARCH 2003 PERMIT TO OPERATE PHASE 2 GRANTED

Casella, Inc. commenced waste disposal operations at the Phase 2 lined waste disposal area at the HLI in June 2003 following receipt of the facility operating permit, dated March 4, 2003. A permit modification allowed change of the waste allocation permit to any combination of construction and demolition, municipal solid waste, and recycling residuals from any town within the Commonwealth. The facility is allowed to accept no more than 82,800 per year of waste. The facility may only accept an average of

300tpd based on a five and one half day operating week and accept no more than 400 tpd maximum.

The Phase 2 area has a double liner and clay barrier and is subdivided into two cells, Cell 2A and Cell 2B. Cell 2A is the current active operating cell.

Approval was also granted (3/04) to install emergency leachate storage capacity by installing one (1) new 300,000-gallon leachate storage tank.

The HLI was also ordered to implement a Department approved Gull Control Plan

The DEP recommended that the Waste Relocation operation involving the unlined area of Phase 1 be conducted "in the fall or winter months to reduce odors and surface water concerns."

"The net effect of the waste relocation and liner construction will be to remediate any subsurface gas migration along Patrill Hollow Road. The installation of a gas migration barrier and venting system along Patrill Hollow Road will prevent subsurface landfill gas migration beyond facility boundaries."

2003 WASTE BAN COMPLIANCE

The MDEP issued a Waste Ban Compliance Plan in 2000 to reduce and eliminate certain cardboards, metals, glass and a variety of other wastes, including toxic substances from the landfill, with a strong emphasis placed on recycling. The HLI 2003 permit included operations protocols for on-site staff pertaining to Waste Ban.

2003 REZONING REQUEST

Hardwick Landfill, Inc. and members of the Roach family submit a request to re-zone the existing landfill area and adjacent land totaling 200+ acres as industrial. The request was later withdrawn.

2004 PHASE 2 MAJOR MODIFICATION FINAL PERMIT & LANDFILL GAS COLLECTION SYSTEM FOR PHASE 1 UNLINED APPROVED

On March 19, 2004, the MDEP issued a Major Modification Final Permit to change from the acceptance 250 tons per day of construction and demolition waste and 50 tons per day of municipal solid waste to a total of 300 tons per day of any combination. At that time the MDEP also approved the excavation and relocation of the waste located in the northwest and northeast portions of the closed unlined landfill area and relocating the waste to the easterly portion of the lined Phase 1 area.

In addition, the Hardwick Landfill was authorized to install a gas migration barrier and venting system along Patrill Hollow Road. If positive gas pressures are present the gas system shall be constructed to provide connection into the future gas extraction and flare system.

As of the date of this report (June 30, 2005), neither task has been accomplished despite consistent reading of above 100% LEL in at least one of the Phase 1 monitoring wells since 1994.

A Response to Comments section follows the Permit (see Appendix B)

2004 WASTE SYSTEM DEVELOPMENT IMPACT ASSESSMENT

A June 2004 Weston and Sampson Development Impact Assessment report was prepared for Casella, Inc. to assess the impact of an expansion to the HLI and the rezoning of lands adjacent to the landfill to industrial use. Increased capacity proposed is 750tpd at the landfill.

The report states that the proposed expansion might cause odor problems due to the C&D residual materials which contain gypsum waste material as a component which typically results in the generation of hydrogen sulfide gas during biodegradation. The report states “due to the remote nature of the Expansion area, there are very few operational issues posed by the Expansion that would disrupt the daily lives of the residents of Hardwick.”

Landfill gas is to be managed, according to the DIA, by a series of passive landfill gas vents to allow the landfill gas that is produced as the waste decomposes to dissipate into the atmosphere. In addition an active gas management system would collect landfill gas and “destroy it through a gas flaring system.”

2005 LANDFILL GAS ODOR PERMEATES NEIGHBORHOODS

Landfill gas odor migrated off site in January and February into the western section of Hardwick and was detected at times in other sections of town and in the Town of Ware. Board of Health meetings during this time attracted dozens of residents who voiced health concerns regarding the gasses.

2005 COAL ASH AS DAILY COVER

February 16, 2005 - The Board of Health approved the use of coal ash as daily cover at the Hardwick Landfill. The HLI would mix C&D fines, presently used as cover, at a 50/50 ratio with coal ash. The use of the coal ash would cease once the proposed flare system is in place and fully operational.

2005 PHASE 2 LANDFILL GAS COLLECTION SYSTEM

February 28, 2005, the MDEP approved individual temporary solar flare installation at the Hardwick landfill to address "odor" problems at the landfill that had permeated Hardwick neighborhoods and migrated to the nearby town of Ware. The temporary flares were installed on the recently installed vertical gas wells within the lined Phase 1 section of the landfill. Additional work would involve the construction of a permanent Landfill Gas Collection System for Phase 2 and the lined portion of Phase 1

The HLI was granted a Major Modification permit on March 15, 2005 pertaining to the creation of a Landfill Gas Collection System.
See Appendix E for complete details.

JUN 30, 2005 HARDWICK LANDFILL LOSES ZONING APPEAL

The Hardwick Landfill is ruled an improper use for land
Casella loses zoning appeal
By James F. Russell Correspondent
HARDWICK— Landfill owner Casella Waste Systems Inc. enjoys no grandfathered rights to operate on land zoned residential, the Zoning Board of Appeals has ruled.

The ruling on Tuesday upheld the town zoning officer's determination March 10 that 65 percent of the Hardwick Landfill operates on residential-zoned land, Town Clerk Paula Roberts said yesterday.

Hardwick zoning enforcement officer Ralph Brouillette informed Casella in March that 65 percent of the landfill is on residential-zoned land, which cannot be used for landfills. Town bylaws require refuse operations to operate in an industrial zone with a special permit to accept trash. On April 8, Casella appealed Brouillette's decision to the Zoning Board of Appeals.

During the hearing, which began May 17, the company said it was grandfathered and had rights to continue operations on the residential-zoned land, saying the waste site constitutes a "pre-existing nonconforming use."

Worcester Telegram and Gazette, June 30, 2005

2.1 PHASE 1 (1970 – 2000) ISSUES OF CONCERN

According to the Final Environmental Impact Report for the Phase 2 Lined Expansion of Hardwick Sanitary Landfill, EOEA file #11886, dated August 2000, and prepared for Hardwick Landfill, Inc. by Tighe & Bond:

"6.2.1 History

Hardwick Landfill, Inc. has had no violations, has always complied with regulations and has maintained a very proactive approach." (p. 6-1)

The above statement did not take into account the following, located in DEP files in Worcester as well as on file in the Town of Hardwick.

VIOLATIONS, ENVIRONMENTAL EXCEEDANCES & DEP, TOWN AND HLI FILE DOCUMENTS

Summary

1969 – Department of Environmental Health
A letter was written by the Director of the Division of Environmental Health on November 18, 1969, "In response to additional complaints from Hardwick residents concerning the operation of the municipal refuse disposal area."

1972 -Annual Report Town of Hardwick
Board of Health Report
"The Sanitary Landfill Operation on Patrill Hollow Road was the prime concern of the Board of Health this year. Several Citations have been issued by the State Board of Health, against the Town, because of improper use of the Sanitary Landfill Operation on Patrill Hollow Road, this stems from complaints by two residents, also the towns misuse of wetlands and mismanagement of the facility."

1974 -Annual Report Town of Hardwick
Board of Health Report
"The Board of Health has been kept busy during the year with the Sanitary Landfill Operation on Patrill Hollow Road, the main concern. Again, your cooperation at the Landfill is appreciated as the Central Health District in Rutland makes frequent inspections at the sight (sic) and as of this writing a citation has been issued against the town."

1975 -Annual Report Town of Hardwick
Board of Health Report
"The Hardwick Board of Health was busy during the first part of 1975, as the town received it's (sic) second violation notice from the Department of Public Health, Central Health District, Rutland, Mass., concerning the Sanitary landfill operations off Patrill Hollow Road, 17 violations were reported against the town on January 31, 1975 and the board of health met with officials in Boston, on this matter."

3/25/77 DEP FILES
Memo re: disposal of chemical cleaning solvent being disposed at landfill:

Subject – Gilbertville Mill Inc
To - Water Pollution Control

From - Michael Quink

"While performing a routine inspection of the above mentioned facility, I was made aware of the fact that a good portion of a chemical cleaning solvent – Varsol #1 used at the facility in a silk screening operation for thinning of inks and cleaning purposes, is being transported and deposited in the Hardwick Landfill."
Appendix A

1970s Undated DEP FILES
Note from WPC to DSHW – "Two pickups on South Main Street hauling "solvent" from silk screening process to Hardwick Town dump."
Appendix

4/23/81
Certified Letter from DEQE to Hardwick BOH re: Sections 310 CMR 19.03 (1) (2) (3) (4) (5) (6) and 19.28 (2)

"An engineering plan and design data have never been submitted to this department for its review and approval… etc."

"Furthermore, the Department, in correspondence with the landfill operator since 1977, has been informed that the engineering plans for the facility were forthcoming."

Re: Section 310 CMR 19.15 (1)
"The wood waste and demolition material has been piled in a wide area some 20 feet in height. This area has not been covered for a considerable length of time. In the event this wood waste is set afire, deliberately or accidentally, an underground fire which would be difficult and costly to extinguish would result. The storage of wood wastes so as to enable them to be incinerated is also a violation of air pollution standards."

1980s
Samples of paints and solvents and print shop by products that had been dumped at the Patrill Hollow Site sent to Environmental Police Officer Connor by landfill "neighbor" and caretaker, Randy Noble.

Mr. Noble-

I could not locate any reference here to samples taken by EPO Conner. Do you have any more specific information regarding the approximate date of the sample? Please feel free to call me at the number below.

Lt. Gail D. Larson
Mass. Environmental Police
Office of the Attorney General
One Ashburton Place, Room 1811
Boston, MA 02108
617-727-2200, ext. 2814
617-727-5755 (fax)

Conservation <conservation@townofhardwick.com>

03/24/2005 02:01 PM

To: Gail.Larson@ago.state.ma.us
cc:
Subject: HARDWICK LANDFILL INC.

March 24 2005

Lieutenant
Gail Larson
Environmental
Strike Force

Regards Hardwick Landfill Inc.
Lieutenant

Back in the 1980`s I as Caretaker and Neighbor of H.L.I I Gave E.P.O Officer Conner a Sample of Paint`s and Solvents and what was Print Shop By Products That Had Been Dumped At the Patrill Hollow Site. I Would like any analytical data that was Derived from that sample and any info from the stake out report .

Thank You
Randall L.Noble Hardwick conservation commission chairmen
Box 575
Gilbertville Ma. 01031

1980s DEP FILES

"Some kind of solvent analyzed." (Division of Enforcement)

Appendix

7/11/1983
DEP Files – Report and hand drawn maps of site
"Much leachate observed in wetlands and stream"
"Drainage into swamp"

3/6/84
Note from Ed Benoit re: complaints from Senator Wetmore's office.

5/6/85
Letter from DEP to Hardwick BOH re: April 25, 1985 inspection of the landfill by engineers from the DEQE

Ten violations of the Department's Regulations for the Disposal of Solid Wastes by Sanitary Landfill (310 CMR 19.00) were observed at the time regarding the following.

1) 19.02 (Selection of Site)
2) 19.03 (Plan Approval)
3) 19.09 (Fire Protection
4) 19.10 (Access Facilities)
5) 19.14 (Spreading and Compacting of Materials)
6) 19.15 (Depths of Cover)
7) 19.17 (Disposal of Bulky Wastes)
8) 19.20 (Vector Control)
9) 19.21 (Drainage of Surface Water)
10) 19.23 (Supervision of Operations)

"It was noted that the working face was not adequately covered and that bulky wastes (brush and stumps) were left uncovered. **The current disposal area is in close proximity to a wetlands resulting in leachate contamination of the wetlands. The landfill is also operating without engineering supervision and is open for disposal at times when an attendant is not on duty. In addition the town of Hardwick is operating the landfill without approved engineering and operational plans."**

6/9/85
Letter from Ryan and White re schedule for site investigation and remediation plan

9/26/85
Notice of violations/Show Cause Conference

11/8/85
Letter from Board of Health asking for "grandfathered" site assignment and extension

11/9/85
Notice of 11/25/85 meeting re: Closing

1985 -Annual Report Town of Hardwick
Board of Health Report
"This year we were notified by the D.E.Q.E. we must begin the process of closing our sanitary landfill. We have met with our Senator's office, Representative Engineer, and other concerned parties to initiate the long process we will be obliged to promote in the coming year…. We have also begun to investigate what options will be available to the town concerning the future disposal of our garbage and refuge."

2/20/87
Inspection Report

3/11/87
Notice of Non-compliance

5/22/87
Order and Notice of Non-compliance

6/87
Interim Plan from Tighe & Bond, addresses non-compliance issues, establishes operational protocols.

6/17/87
Office of General Council DEQE
Notice of Claim for Adjudicatory Hearing
Re:
a) Possible closure of the landfill "due to concern of contamination of the aquifer utilized by the Ware Water Department"

b) DEQE Notice of Non-compliance demanding "design plans in accordance with modern environmental practices (CMR 19.02 and 19.03)
c) Proposed scope of work for the hydrological investigation/assessment of the landfill and its environs…"
Mr. Thomas Couture of Tighe & Bond represented Hardwick Landfill, Inc.

4/28/93 Monitoring for PCBs
On April 28, 1993 a water sample taken from MW-3 was analyzed for PCBs. A reading of 0.50 for PBB-1254 was found by Gas Chromatography. The wells were checked for PCBs as part of the site expansion protocol.

July and October 1994
"**Data for July and October, 1994 show that landfill gas was detected at levels above 100% of the LEL at MW-1S and MW-3S during the CSA monitoring.** Levels of explosive gasses remained nondetectable at MW-7S throughout the monitoring program. Detection of landfill gas at this location is not expected under most conditions since the unsaturated interval of this well is at a lower elevation than the base of the refuse."
Tighe & Bond "Comprehensive Site Assessment, Hardwick Landfill" dated January 1996, p. 5-12.

January and July 1995
"Analysis for dissolved metals revealed **lead concentrations** exceeding the Massachusetts drinking water standard in samples from MW-2S, MW-7S, MW-4S and MW-6S. Reported concentrations for **chromium** (MW-6S and MW 6D) **and nickel** (MW-4S) exceeded drinking water standards for the first time."

"**Combustible gas readings of 428%LEL at MW-1S and 742% at MW-3S were reported during the July 1995 monitoring**. In addition, elevated methane and carbon dioxide levels were reported during the July 1995 monitoring, and both gases had much higher readings at MW-1S and MW-3S than at MW-7S."
Thomas C. Couture, P.E., Tighe & Bond, H-0397-4-50, Sept. 6, 1995

3/26/96
In the HLI Comprehensive Site Assessment Technical Review – Conditional Approval Transmittal #62447 it states, "The Department has some concerns about various volatile organic compounds (VOC) detected in groundwater

sampling…. These exceedances suggest that a plume of chlorinated solvents could enter Muddy Brook and Hardwick Pond, and potentially contaminate the High Yield Potentially Productive Aquifer (Bureau of Waste Site Cleanup Priority Resource Map) in the area."

7/18/96
Gas reading in MW-1S reached 35.5% Methane and 724 %LEL explosive levels. MW-3S was at **320.00%LEL.**

October 1996
"There were a total of 14 exceedances of drinking water standards for six (6) different compounds in samples collected in October 1996, whereas there were seven (7) exceedances for only two (2) compounds, vinyl chloride and 1,1-dichloroethane (1,1-DCE), in samples collected in July 1996."

"A combustible gas reading above 100% of the LEL was recorded at MW-1S."
Thomas C. Couture, P.E., Tighe & Bond, H-0397-4-50, Feb. 3, 1996

January 1997
"Exceedances of drinking water standards (MMCLs) were reported for four (4) compounds (vinyl chloride, 1,1-DCE, toluene and 2-butanone)."

"The data in Table 4 show that detectable levels of methane and explosive gasses were detected only at shallow well MW-1S."
On 1/16/97 MW-1S methane was at 32.6% and explosives at 654%LEL.
Thomas C. Couture, P.E., Tighe & Bond, H-0397-4-50, May 19, 1997

April 1997
"There were a total of six (6) exceedances of drinking water standards for three (3) compounds (vinyl chloride, toluene and 2-butanone)in samples collected in April 1997, whereas there were nine (9) exceedances for only four (4) compounds (vinyl chloride and 1,1-dichloroethane (1,1-DCE), toluene and 2-butanone in samples collected in the January 1997 sampling round."
Thomas C. Couture, P.E., Tighe & Bond, H-0397-4-50, July 15, 1997

7/10/97
Methane readings in MW-1S were at 7.10 and the LEL was at 150%.

July and October 1997
"During the month of July 1997, there were a total of eight (8) exceedances of drinking water standards for five (5) compounds (vinyl chloride, toluene and 2-butanone, 1,1-dichloroethane (1,1-DCE) and methyl-tert-butyl ether). Whereas, during the month of October 1997, there were a total of two (2) exceedances for only two (2) compounds (vinyl chloride and toluene)."
Thomas C. Couture, P.E., Tighe & Bond, H-0397-4-50, May 15, 1998

1/22/98
Methane reached 13.9% and LEL was at **274.00% in MW-1S**

7/9/98
MW-1S sustained Methane readings of 28.10% and 586.00%LEL
MW-2R was at **126.00%LEL.**

7/22/98
MEMORANDUM TO FILE
FROM Mohamed Haji-Ahmed
SUBJ. Environmental Monitoring Data of Hardwick Landfill

"I was reviewing the Environmental monitoring data of Hardwick landfill (January 1998) and have some concerns about various volatile organic compounds (VOC) detected in the groundwater sampling. Several wells showed an exceedance (sic) of the Massachusetts drinking water standards (MMCL) i.e. MW-5s and MW-5D both have Vinyl Chloride above MMCI."

"I was also concerned about the relatively high specific conductivity values of most of the wells, suggesting a high concentration of ions in the samples. However, individual ions are not reported at high concentrations to account for these conductivities. This suggests that some of the elements in the water sample may not have been detected in the sampling."

"MY COMMENT ABOUT THE DATA
It will (be) helpful to be certain that contaminants generated on the site are remaining at or close to the landfill."

October 1998

"April 1998: There were three exceedances (sic) of drinking water standards for vinyl chloride in monitoring wells MW-5S, MW-5D and MW-6D. Additionally, Ethanol, C2H6O isomer, chlorofluoromethane, ***tetrahydrofuran*** and 1,3,3,t-Bicyclo[2,2]hepton-2-one were tentatively identified in MW-5S, 1,2-diethylbenzene was tentatively identified in MW-5D and 1-chloro-1-fluoromethane and 1,2-dichloro-1-fluro-ethane were tentatively identified in MW-6D."
Thomas C. Couture, P.E., Tighe & Bond, H-0397-4-50, March 3, 1999

7/15/99
Email on file with the Massachusetts Department of Environmental Protection "For Use in Intra-Agency Policy Deliberations," following a review of the "Hardwick Scope of Work for the landfill assessment of their new expansion.

1.7 Concerns were raised that the "Gas monitoring during the CSA has shown LEL's above 100%."

1.8 Response, "My recollection is that the draft CSA was grossly inadequate and I raised many issues (including lf gas) that were to be addressed." (See 1. 8 Landfill Gas (LFG), DEP Policy Deliberations)

10/25/99
MW-1S readings were at 23.40% Methane and 468.00%LEL

2.2 FIRE HISTORY

According to former Hardwick Fire Chief Ray Walker, he can recall at least three fires in the late 1980s and in the 1990s at the Hardwick Landfill.

1) The landfill compactor's hydraulic line broke causing a fire in the engine compartment where oil and other combustibles burst into flames. Nearby construction and demolition debris caught fire.
2) Another fire ignited within the cell and consumed solid waste near the surface.
3) The largest fire consumed about ¼ acre and was at least 20 feet deep within the depth into the cell. The former Fire Chief claims that water from the fire spilled into the leachate container; therefore the fire must have taken place after the installation of the liner and leachate collection system was in place. He claims the fire resulted in double the amount of leachate for the day. The state permit to operate the Phase 1

> lined expansion was given in September 1994, which means the fire would have occurred some time after that date. The following year the tonnage was increased from 90 tons per day to 300 tons. Depending on the date of the fire and the height of the lift areas in the cell, the heat from a fire of that magnitude may have compromised the Phase 1 liner.

Current Hardwick Fire Chief Robert Goodfield stated that he recalls brush and wood deposited at the landfill catching fire in the late 1960s or early 1970s. In addition around 1981 a fire started at the base of one of the brush piles from a carelessly tossed cigarette. Also in the 1980s ashes from a hot load created a small fire in the unlined portion of the Phase 1 landfill. Chief Goodfield has served on the force since 1953.

2.3 HIGH – MEDIUM – LOW YIELD AQUIFER QUESTION

Tighe & Bond's "Final Environmental Impact Report (FEIR)" dated August 2000 states "groundwater underlying the Phase 2 area has been impacted by the release of VOC contaminants at the unlined landfill. The Phase 2 area does not overlie a "medium yield" or "high yield" aquifer as defined by MDEP."

According to an EDR (Environmental Data Resources, Inc.) Radius Map with GeoCheck®, "The Site is located within a zone identified as a potentially productive aquifer (PPA). PPA's are identified as medium or high yield aquifers by USGS. The PPA designation is used by MDEP when evaluating sites for a higher level of groundwater protection (drinking water) under the Massachusetts Contingency Plan (MCP)." The EDR Report is based on a database search of state and federal government agency files and lists using the standard ASTM search radii, according to SHA (Sanborn, Head & Associates) in the "Phase 1 Environmental Site Assessment, Hardwick Landfill, Hardwick, MA, File 2188, August 2002, pages 2, 6 & 7.

This statement is confirmed by two DEP CERO emails dated Friday, March 1, 1996. The first is to Cheryl Poirier from Stephen Hallem regarding "Hardwick LF" states, "Just a quick note to let you know that Andrew Bagley (SSWM-Boston) came by to look at the Ware BWSC map. The map shows the landfill is partially in the high yield, and moderate yield aquifer which is running N-S along the axis of the brook. About ½ of the landfill is not in the designated area."

A second email from that date from Abdul Turkay SWM DEP – Boston and forwarded to Cheryl and others states in part, "We plan to disagree with the conclusion of the Baseline Risk Assessment (in the CSA) that a Quantitative Risk Assessment is not needed. Because of the location of the high yield PPA, Muddy Brook, Hardwick Pond, and public water supplies, we plan to ask for a SOW for a Qualitative Risk Assessment which we will have ORS review. But for now it will help us if you ask them to send a plan that shows the limit of waste in relation to monitoring wells and potential receptors."

2.3 1987 OPERATIONAL PLAN

On July 1, 1987, an "Interim Operational Plan for the Hardwick Sanitary Landfill" prepared by Tighe & Bond was submitted to the DEQE which contained the information quoted below.

The operational plan addressed non-compliance issues and established protocols for operations based on best practices of the time.

Certain approved commercial and industrial wastes were allowed as well as municipal sludge from treatment plants. In addition, there was no leachate control system on site and the landfill remained unlined.

Report Excerpts

1.1
"During the 1960s, the Town of Hardwick needed a sanitary landfill and, after some detailed geological investigation, obtained permission to utilize the above site as a landfill." (Book 2673, Page 103 WCRD approximately 25 acres along Patrill Hollow Road)

"The town initially operated the landfill with Town forces and equipment, however, since then the Roach family has provided all land, equipment, manpower, and cover material as necessary to properly operate the landfill."

"From the opening of the landfill in 1968 through 1986, solely refuse and other solid waste generated within the Town of Hardwick were disposed of

at the landfill. During 1986, some demolition debris was disposed of by Associated Wrecking; also, per request of John Desmond of the Department of Environmental Quality Engineering (DEQE), acting as a Town of Ware Board of Health member, some paper remnants from Ludlow Paper of Ware, Massachusetts were disposed of weekly. Otherwise, since its opening, the landfill has been used exclusively for the Town of Hardwick."

1.2
"Once groundwater monitoring wells are installed, a detailed stratigraphy evaluation and a reasonably illustrative groundwater contour map will be prepared."

2.2 Sequence of Operations

"Solid Waste will be placed in each row to the proposed interim contours prior to the placement in the next lift… etc."

(A hand drawn map of the site contours and outlining a "Metals" disposal area up gradient along Patrill Hollow Road was also developed. See Appendix __)

2.3 Solid Waste Placement

"Solid waste shall be placed in a series of cells, which in turn will form rows in the disposal area… etc."

"In order to form the first row, an earthen beam may be required to contain the solid waste, thence the solid waste shall be dumped in the cell area, moved into place by the landfill equipment, compacted by repeated passes of the equipment, and covered at the end of the day with 6 inches of cover material. Each day's compacted solid waste, completely covered by a continuous layer of compacted soil, constitutes a cell."

"Solid Waste shall be placed in such a manner that surface runoff will not be ponded on the surface of the refuse or uphill of the solid waste."

"The recommended depth of the cell is 5-7 feet. The deeper the cell, the less cover material is required. Therefore, wide shallow cells should be discouraged."

"It is important that the solid waste be compacted to obtain the maximum density possible. Thorough compaction extends the life of the landfill area and reduces the extent of settlement after completion of portions of the landfill."

2.5 Cover Material

"Material for the daily cover can be obtained from various sources on site. Daily cover material shall be granular in nature and free of substances that would attract flies and rodents and shall be free of large objects that would hinder spreading and compaction. The material shall be easily graded and handled under freezing conditions…etc."

2.6 Types of Solid Waste

"The landfill shall accept for disposal only conventional municipal solid waste and certain commercial and industrial wastes approved by the Massachusetts Department of Environmental Quality Engineering for disposal in a conventional sanitary landfill."

"The landfill shall also accept dewatered municipal sewage sludge from the town's wastewater treatment plant. The material shall be placed on the operating face of the landfill and thoroughly mixed and deposited with incoming solid waste."

"Chemical wastes, liquid wastes with a solids concentration of less than 18%, and wastes delivered in sealed containers should not be accepted for disposal at the landfill."

2.8 Runoff and Erosion Control

"The drainage ditches along the perimeter of the landfill shall be maintained at all times and vegetation shall be maintained on the surfaces of the drainage ditches and the side slopes along the road."

"All interim slopes within the landfill, shall be no steeper than a 5:1 grade, and shall be uniformly graded to shed surface water."

2.9 Closure

"The final, impervious cap on the landfill must be covered/treated so as to support vegetation. The vegetation will prevent erosion and enhance site aesthetic."

2.10 Site Supervision

"A professional engineer will visit the site on a monthly basis."

2.10 Gas Control

"Gases generated by the decomposition of refuse material vent naturally through the existing ground surface. The physical character of the landfill site (open slopes on 3 sides) and the porous gravel discourages lateral gas migration through the soil to areas beyond the landfill boundaries."

2.11 Leachate Control

"There are no leachate collection facilities at the sanitary landfill. Therefore the only way to control leachate is to minimize the amount of water that percolates through the solid waste."

Recommended methods include:
"…installation of drainage ditches to quickly transport runoff from the site. Drainage culverts and riprap channels should be used as necessary to transport runoff away from the solid waste."

"In the event that leachate outbreaks do occur…

- Excavate a pit directly down-gradient of the leachate breakout.
- Fill the pit with crushed stone to create a sump for the leachate and allow it to percolate back into the ground.
- The affected area should then be treated with lime to inhibit odors (if required) and the area recovered."

2.12 Fire Protection

"In order to prevent fires, trucks that are identified as carry hot loads should be directed to dump their contents in an isolated area, where the contents can be safely handled. If a hot load is dumped on the working face of the active

disposal area, the hot material should be pushed away from the open face, if possible and extinguished."

Extinguishing fires on the surface of the landfill should be accomplished by smothering the fire with daily cover material.

In the event that a fire is started at the landfill, the Fire Department should be notified immediately so that the operator will have assistance in the event that the fire spreads."

2.16 Dust Control

"In the event that dust becomes a problem along the unpaved portions of the access ways in the landfill, the roadways should be treated with calcium chloride to minimize the dust problem."

2.10 Closure

The final, impervious cap on the landfill must be covered/treated so as to support vegetation.

2.18 Bulky Waste

"Salvageable metal and white good, such as appliances, are removed from the landfill site periodically by a private hauler."

"Bulky items that must be disposed of in the landfill shall be buried in the active disposal area along with the solid waste."

"Building demolition wastes, when accepted at the landfill, should be disposed of separately and broken up and thoroughly compacted with proper equipment."

3.1 INITIAL SITE ASSESSMENT (ISA) 1993

The Initial Site Assessment (ISA) was completed in May 1993 to address the regulatory requirements of the closure of the active older portions of the

landfill and for the new horizontal expansion. The Hardwick Landfill processes primarily C&D waste which is characterized as one of the "Difficult to Manage Wastes" in the Massachusetts Solid Waste Master Plan.

"The solid waste problem in the Town of Hardwick came into focus early in 1966 when a lease for a disposal site on the Lower Road in Gilbertville was terminated by a decision of the landowner. An extensive survey of likely sites for the acquisition and operation of a sanitary landfill for solid waste disposal was initiated by the Board of Health, and was later assumed by the Board of Selectmen."

"After negotiations to which several safeguards were agreed upon, the Selectmen concurred with Angelo Iantosca, DEP (then DEQE) Regional Environmental Engineer, granting the present site located on Patrill Hollow Road as the designated disposal site for the Town."

"The anticipated closure date for the present active area is December 1994, with capping to be completed by July 1994. The proposed expansion area will have an estimated useful life of 5 years. This estimate is based on anticipated disposal rate of 66 tons per day for 312 operating days per year."

"The facility has been operated by David G. Roach since the date of site approval."

"From the start of operations in December of 1968 until 1986, commercial generators, and residents of the Town of Hardwick were the sole users of the landfill. In 1986, Mr. Roach started allowing Associated Building Wreckers to dispose of building debris at the site. From that point on, other commercial haulers have been permitted to dispose of demolition of debris at the landfill.

"There are currently nine (9) commercial haulers using the site. The names of those haulers and the descriptions of the types of clients they serve are listed below:

> Browning Ferris Industries – Haul construction debris to the landfill from the Springfield and Worcester area.
>
> Waste Management, Inc. – Haul construction debris from the Worcester area.

Commercial Disposal, Inc. – Haul debris to the landfill from the Springfield area.

Associated Building Wreckers, Inc. - Haul in demolition debris.

Stamford Wreckers, Inc. – Haul in demolition debris.

Matter-Flynn – The material which is brought in by Mr. Flynn is composed of equal amounts of residential rubbish and construction debris from the Worcester area.

Al's Rubbish Removal – Hauls residential rubbish and construction debris from the Brookfield area.

Fred Fijal – Hauls in 80% of the rubbish that is generated by the Town of Hardwick. Fred Fijal also serves the neighboring Town of Ware with trash removal and provides roll-off containers for construction debris.

Paul Young – Has a few residential accounts in Hardwick, but the bulk of the rubbish that he brings to the landfill is from the Town of Ware."

Initial Site Assessment (ISA)
Hardwick Sanitary Landfill
May 1993
Tighe & Bond

3.2 INITIAL HYDROLOGICAL INVESTIGATION 1988

Four (4) shallow groundwater monitoring wells (MW- 1, MW- 2, MW- 3S, and MW-4S) were installed along the perimeter of the unlined landfill area as part of a 1988 Hydrogeologic Investigation.

3.3 PHASE 1 UNLINED CLOSURE

The unlined area was closed and covered in accordance with Massachusetts Solid Waste Regulations 310 CMR 19.000 from 1990 through 1993.

As part of a Comprehensive Site Assessment (CSA) in 1993 and 1996, six additional groundwater monitoring wells were installed, including three down gradient shallow wells (MW -5S, MW- 6S and MW- 7S), two down gradient bedrock wells (MW- 5D and MW- 6D) and one up gradient bedrock well (MW- 1D).

Monitoring wells MW-3S and MW-4S were decommissioned in place. Monitoring well MW-2 was destroyed and replaced with well MW-2R.

According to an undated map, a "Clay Cap" **Area** was created on the North – North/West slope of the landfill by the "Truck Weigh Scale" as indicated on the map not far from SG- 3 and MW- 7S. Along the Western edge of the unlined Phase 1 area, a small "Primary Paper Sludge Cap Area" was created by MW – 1D and MW 1S. A larger "Paper Sludge Cap Area" is indicated nearby SG – 1. The remainder of the cap over the unlined portion of the landfill is undesignated and wraps around the lined area from West to East adjacent to SG -2 and MW 2S and extends into MW -3S terminating most Easterly by the 8" Leachate Pipe and Leachate Collection Manholes not far from the Leachate Collection tanks and Retention Basin as well as MW- 5S and MW - 5D as indicated on the map. (Scale is not indicated) The bulk of the map is an area referred to as the Active Landfill Area.

4.1 PHASE 1 LINED LANDFILL EXPANSION

In 1993 the 6-acre Phase 1 lined landfill expansion was approved by the Massachusetts Department of Environmental Protection.

In a letter to Mr. David Roach from the Town of Palmer, dated October 20, 1993 in regard to the future acceptance of leachate generated at the Hardwick Landfill for the disposal at the Palmer Water Pollution Control Facility, the Chief Operator, John Gladkowski stated that leachate would be

accepted provided that analytical data is provided prior to the disposal that would include pH, BOD5, TSS, metals and PCBs. The expected range of leachate at the time was between 2,000 gallons to 20,000 gallons per week, but was not to exceed 60,000 gallons per week.

In May 1994 HLI was issued an Industrial Wastewater Holding Tank permit to create a leachate collection and storage system for the facility. September 1994 the MDEP issued an Authorization to Operate for the Phase 1 landfill expansion. In April 1995 a Minor Modification Permit was obtained to increase daily tonnage from 90 tons per day to 300 tons per day.

The 1999 Solid Waste Facility Report filed by Hardwick Landfill Inc. to the MDEP indicated that the facility had been open for operation for 300 days, had deposited 6,756.52 tons of MSW and 41,170.94 tons of C&D for a total of 47,927.46 tons of Solid Waste for the year, had utilized 3,350 tons of soil and sand (no contaminated soil, DPW waste, C&D fines, Paper Sludge Wood Chips or other materials had been used), 1,345,667 gallons of leachate had been collected and trucked off site to the Town of Hardwick – Water Pollution Control Facility. The tons per year under future capacity was listed as 93,600, with 7 tons per year available for MSW. The expected date to Cease Landfilling was 12/31/1999. However, Tighe and Bond reports that operations actually ended in July 2001 when the Phase 1 lined site has reached capacity

NOTE: The Active Landfill Area outlined on the map became the area for the lined Phase 1 expansion, where the liner was placed over the top of the unlined area and was to act as a form of a cap for this portion. The up gradient Western unlined portion of the Phase 1 landfill is susceptible to penetration by rain and melting snow and ice. The leachate from the unlined area then travels subsurface into the unlined area beneath the Phase 1 lined area. The results are indicated in the monitoring wells which show a variety of VOC contaminants. In addition, monitoring wells at the western edge of the landfill, along the edge of Patrill Hollow Road have indicated the presence of a variety of gases as well as combustible gas registering at 100% LEL. The gases which travel along Patrill Hollow Road are beyond the boundary of the landfill and have traveled off-site.

4.2 LANDFILL GAS (LFG)

Landfill gas (LFG) is caused by the microbial decomposition of material in wastes and is a by-product of any landfill operation. Carbon dioxide (CO2) and methane (CH4) constitute approximately 90% of the gases produced. According EPA Operating Criteria for landfills, these gases in the presence of oxygen may become highly explosive. Other lesser amounts of gases include hydrogen, volatile organic compounds, and hydrogen sulfide).

Methane gas, the principal component of natural gas, is generally the primary concern in evaluating landfill gas generation because it is odorless and highly combustible. Typically, hydrogen gas is present at much lower concentrations. Hydrogen forms as decomposition progresses from the acid production phase to the methanogenic phase.

While hydrogen is explosive and is occasionally detected in landfill gas, it readily reacts to form methane or hydrogen sulfide. Hydrogen sulfide is toxic and is readily identified by its "rotten egg" smell at a threshold concentration near 5 ppb.

4.3 LANDFILL GAS REGULATIONS

STATE REGULATIONS 310 CMR 19:117

19.117: Air Quality Protection Systems

(1) General Performance Standard. Landfills shall control the concentration levels of explosive and malodorous gases and other air pollutants as necessary in order to maintain air quality and to prevent the occurrence of nuisance conditions or public health or safety problems.

(2) General Design Standard. Air quality protection systems shall be designed to control the concentration of explosive gases to no greater than 25% of the Lower Explosive Limit (LEL) or 10% of the LEL in any building, structure, or underground utility conduit at the property boundary at any time, excluding gas control or recovery system components or any leachate collection components.

(5) Landfills shall demonstrate that they are in compliance with the State and Federal air quality regulations, including but not limited to,

New Source Performance Standards (NSPS) and Maximum Achievable Control Technology (MACT) requirements. In general a facility must document:

(a) which federal air quality regulations are applicable to the facility, either initially or at full build-out; and,

(b) how the facility will comply with all applicable state and federal air quality regulations.

FEDERAL REGULATIONS 3.5
EXPLOSIVE GASES CONTROL 40 CFR SECTION 258.23

3.5.1 Statement of Regulation

(a) Owners or operators of all MSWLF units must ensure that:

(1) The concentration of methane gas generated by the facility does not exceed 25 percent of the lower explosive limit for methane in facility structures (excluding gas control or recovery system components); and

(2) The concentration of methane gas does not exceed the LEL for methane at the facility property boundary.

(b) Owners or operators of all MSWLF units must implement a routine methane monitoring program to ensure that the standards of paragraph (a) of this section are met.

(1) The type and frequency of monitoring must be determined based on the following factors:

(i) Soil conditions;

(ii) The hydrogeologic conditions surrounding

the facility;

(iii) The hydraulic conditions surrounding the facility; and

(iv) The location of facility structures and property boundaries.

(2) The minimum frequency of monitoring shall be quarterly.

(c) If methane gas levels exceeding the limits specified in paragraph (a) of this section are detected, the owner or operator must:

(1) Immediately take all necessary steps to ensure protection of human health and notify the State Director;

(2) Within seven days of detection, place in the operating record the methane gas levels detected and a description of the steps taken to protect human health; and

(3) Within 60 days of detection, implement a remediation plan for the methane gas releases, place a copy of the plan in the operating record, and notify the State Director that the plan has been implemented. The plan shall describe the nature and extent of the problem and the proposed remedy.

(4) The Director of an approved State may establish alternative schedules for demonstrating compliance with paragraphs (2) and (3).

(d) For purposes of this section, lower explosive limit (LEL) means the lowest percent by volume of a mixture of explosive gases in air that will propagate a flame at 25 degrees C and atmospheric pressure.

Source material:
SWANA, (1992). "A Compilation of Landfill Gas Field Practices and Procedures"; Landfill Gas Division of the Solid Waste Association of North America (SWANA); March 1992.

5.1 DEP – PHASE 2 PROPOSED

1999 COMPREHENSIVE SITE ASSESSMENT (CSA)

DEP POLICY DELIBERATIONS

In an email on file with the Massachusetts Department of Environmental Protection, dated 7/15/99, addressed to Cheryl Poirier at the BRP/DEP which was "For Use in Intra-Agency Policy Deliberations," William A. DiLibero, Municipal Assistance Program writes:

"Cheryl:
I have reviewed the Hardwick Scope of Work for the landfill assessment of their new expansion. The document raised two concerns.

1) They are proposing to conduct fracture trace analysis to determine 'If there is evidence of any uniform bedrock fracture features under the proposed expansion. I question whether this is appropriate to conduct at this location.
2) **Gas monitoring during the CSA has shown LEL's above 100%.** Do we want to recommend additional gas wells in the northwest section of the property near. (sic) One factor is the grade of the hollow, another is the location of the weigh station.

Any feedback would be helpful."

Abdul Turay, a DEP Hydrogeologist responded:

"Bill,
My recollection is that the draft CSA was grossly inadequate and I raised many issues (including lf gas) that were to be addressed. In

addition, I do not believe that they have sufficient info to determine appropriate location for fracture trace profiles. It would be interesting to find out their justification for the analysis."

CERTIFIED LETTER FROM DEP DATED JULY 1999

A certified letter, dated July 26, 1999, was issued to the Hardwick Landfill, Inc. from Purnachander B. Rao, Solid Waste Program, the Massachusetts Department of Environmental Protection (MDEP) regarding the Hardwick Landfill's Comprehensive Site Assessment Approval after reviewing Tighe & Bond's Scope of Work, Phase 2 Hydrological Study dated June 1999. The letter was copied to Abdul Turay and others.

"The SCA Scope indicates that two landfill gas monitoring wells are proposed for the western and southwestern portions of the proposed expansion areas. The Department recommends that landfill gas monitoring probes or monitoring points be installed in proximity to that building. Prior to the installation of the gas wells and probes, the following protocol is recommended:

2. "Initial perimeter screening for landfill gas be conducted, and based on the initial perimeter screening, monitoring locations for landfill gas characteristics would be determined…. "
3. "If methane is detected at concentrations greater than Lower Explosive Limits (LEL), the concentrations shall be quantified as percent methane.
4. Landfill gas characterization samples shall be submitted for laboratory analysis for:

- Fixed gases including methane, carbon dioxide, oxygen, nitrogen and hydrogen sulfide
- Individual non-methane organic compounds (NMOCs) by EPA Method TO-14, or equivalent (an effort shall be made to characterize unknown peaks in addition to standard analytes)
- Total NMOC by EPA 25A, or equivalent"

5.2 1999 PHASE 2 HYDROLOGICAL INTERIM REPORT

GAS

According to the Tighe & Bond December 1999 Phase 2 Hydrological Interim Report for The Hardwick Sanitary Landfill (p. 2-3), "Landfill gas monitoring has also been conducted as part of the long-term monitoring program at three (3) monitoring well locations (MW-1S, MW-2R, and MW-7S) and soil gas monitoring points SG-1, SG-2 and SG-3. *Elevated levels of combustible landfill gases have been detected at monitoring well MW-1S located adjacent to Patrill Hollow Road."*

Page 3-28 of the same report informs us that "As part of the monitoring program for the proposed Phase 2 expansion area, the two (2) newly installed gas wells GW-1 and GW-2 were monitored for percent methane, percent LEL, percent carbon dioxide and percent oxygen. Methane and percent LEL were not detected in the two (2) gas wells. Carbon dioxide was measured at low levels of 1.2% in GW-1 and 0.3% in GW-2."

"Table 3-11 summarizes the initial monitoring of landfill gases in the proposed Phase 2 expansion area and includes for comparison gas monitoring data from the unlined and Phase 1 lined landfill areas performed as part of the current environmental monitoring program."

Table 3-11 (dated 12/3/99) only includes the initial monitoring and not the analytical data available for the report from 10/25/99 as well as any mention of MW-1S which indicated Combustibility levels significantly above the % LEL standard.

TABLE 3-11 – SEE APPENDIX D

Based on reports supplied by Severn Trent Laboratories in 1999, the following can be reported from the same time period:

PHASE 1 UNLINED LANDFILL
NEAR OR ALONG PATRILL HOLLOW ROAD

%LEL = PERCENTAGE OF LOWER EXPLOSIVE LIMIT

Location	Date	Methane (%CH4)	**Combustibility (% LEL)**	Carbon Dioxide (%CO2)	Oxygen (%O2)	Hydrogen Sulfide (H2S) ppm	

SG-1 south/west	7/26/99 10/25/99	0% 0%	0% 0%	0.7% 2.10%	20.5% 18.3%	0% 0%	
SG-3 north/west	7/26/99 10/25/99	0% 0%	0% 0%	1.9% 4.10%	19.7% 17.4%	0% 0%	
GW-1 barn/south	7/26/99 10/25/99	0% 0%	0% 0%	1.2% 1.4%	20.0% 19.5%	0% 0%	
MW-1S Mid-west	**7/26/99 10/25/99**	**Barred 23.4%**	**Barred 468**	**Barred 13.4%**	**Barred 13.2%**	**Barred 0%**	
MW-7S Northeast	7/26/99 10/25/99	0% 0%	0% 0%	5.1% 0.10%	15.4% 20.2%	0% 0%	

SOUTH OF UNLINED LANDFILL – WITHIN CURRENT PHASE 2

Location	Date	Methane (%CH4)	**Combustibility (% LEL)**	Carbon Dioxide (%CO2)	Oxygen (%O2)	Hydrogen Sulfide (H2S) ppm	
GW-2 west	7/26/99 10/25/99	0% 0%	0% 0%	0.3% 0.40%	20.5% 20.4%	0% 0%	
MW-2R Midway	7/26/99 10/25/99	0% 0%	0% 0%	6.5% 0.20%	13.7% 19.6%	0% 0%	

- MW-1S is upgradient along Patrill Hollow Road and midway between the north and south ends of the Phase 1 unlined portion of the landfill. The %LEL at this location was not only above exceedance levels but migrating off-site which is a violation of Massachusetts & Federal Regulations. However, Hydrogen Sulfide was not detected at any of the locations so the gases would have remained undetected.

- Original laboratory analytical data on gas monitoring is frequently found at the back of reports and included along with Chain of Custody data.

5.3 PHASE 2 HYDROGEOLOGIC STUDY ADDENDUM NOV. 2000 - GAS

INACCURACIES

Tighe & Bond "Phase 2 Hydrogeologic Study Addendum" November 2000 page 2-7 states the following, which as the laboratory analysis demonstrates is not accurate.

"As indicated in Table 2-5, methane and percent LEL combustible gas have not been detected in any of the monitoring points during quarterly monitoring."

1) Table 2-5-Summary Landfill Gas Monitoring, which included the July 26, 1999 October 25, 1999 as well as the January 3, 2000 and April 25, 2000 analysis failed to include the MW-1S data from October 1999 and January 2000.

2) The Severn Trent Laboratories handwritten analysis for October 1999 and January 3, 2000 is located toward the back of the report along with chain of custody documentation and once again methane and percent LEL were detected in MW-1S.

Below is a comparison of the October 1999 and January 2000 laboratory analysis of MW-1S which demonstrates that combustibility had exceeded acceptable limits at least at one location. As stated in the 1999 DEP protocol, "If methane is detected at concentrations greater than Lower Explosive Limits (LEL), the concentrations shall be quantified as percent methane." This indicates that both in 1999 and 2000 the Combustibility %LEL levels were at 100%.

MS-1S is located not far from the Scale Station and HLI office, along Patrill Hollow Road on the western edge of the Phase 1 unlined portion of the landfill about a few hundred yards before the bend in the road. It is the midway point between the north-south edges of the unlined landfill, by the "Primary Paper Sludge Cap Area."

Location	Date	Methane (%CH4)	**Combustibility (% LEL)**	Carbon Dioxide (%CO2)	Oxygen (%O2)	Hydrogen Sulfide (H2S) ppm
MW-1S	**10/25/99** **1/03/00**	***23.4%*** ***23.4%***	***468*** ***486***	13.4% 7.9%	13.2% 12.3%	0% 0%

6.1 AMBIENT AIR QUALITY

According to the Final Environmental Impact Report (Phase 2 August 2000, p 5-11), "Air Quality has never been a problem in the area. The landfill accepts a small amount of MWC, which is promptly covered. There have not been any complaints about landfill odors in the past." On page 5-12 under Odor, the document further states, "The Hardwick Landfill is a small operation in an isolated area with no sensitive receptors and wastes are predominantly composed of C&D."

LEL found to be greater than 100% in 1994
Reported in 2002 ESA

"Landfill gas was detected at greater than 100 percent of the lower explosive limit (LEL) for methane at two monitoring points near the landfill property during July and October 1994."
Phase 1 Environmental Site Assignment prepared for New England Waste Services by Sandborn, Head & Associates (**August 2002**) page 8.

The quote is cited from the Tighe & Bond "Comprehensive Site Assessment, Hardwick Landfill" dated January 1996. However, the Sandborn, Head and Associates statement continues:
"Subsequent sampling events have yielded non-detectable levels of methane at monitoring locations and the files we reviewed did not appear to include MDEP correspondence related to landfill gas migration concerns at the Site."

However according to records from 1999 and 2000 sampling:

By October 1999 monitoring well MW-1S located west along Patrill Hollow Road, midway between the northern and southern ends of the Phase 1 unlined site, indicated 23.4% Methane and was registering well over the 100% Combustibility Lower Explosive Level at 468. By January 2000, the methane level remained the same but the Combustibility factor had risen further to 486. (Documents pertaining to gas monitoring at the Hardwick Landfill in 1999 and 2000 can be found in the handwritten lab reports at the back of Phase 2 Hydrogeologic Study Addendum (November 2000 Tighe &

Bond. The results indicating rising methane and combustibility levels were not transcribed into graphs at that time.)

Though CO2 (carbon dioxide) and %O2 (oxygen) gases were rising for the most part in the monitoring wells around Phase 1, the H2S (hydrogen sulfide) levels which produces the rotten egg smell remained at o% - undetectable, as a result the rise in gases went largely unnoticed by the public.

Because the Sandborn, Head & Associates, August 2002 report mentioned explosive levels as recorded at monitoring wells as early as 1994, I conducted an extensive file review at the DEP headquarters in Worcester and was able to retrieve the following documentation reported below:

6.2 PHASE 1
LANDFILL GAS MONITORING 1994 - 1999

%LEL = PERCENTAGE OF LOWER EXPLOSIVE LIMIT
NOTE EXPLOSIVE LEVELS AT MONITORING WELL MW-1S AS WELL AS PHASED OUT MW-3S

Location	Date	Methane (%CH4)	**Combustible (% LEL)**	Carbon Dioxide (%CO2)	Oxygen (%O2)	Hydrogen Sulfide (H2S) ppm	CO ppm
MW-1S Mid-west	10/28/93	NM	0.02%	NM	21.7%		
	4/14/94	NM	0.00	NM	NM		
	7/21/94	NM	**>100**	NM	NM		
(along Patrill	10/26/94	NM	1.50	NM	N.M.		
Hollow	1/17/95	NM	0.00	NM	NM		
Road)	7/13/95	**21.4**	**428.00**	19.60	0.80		
DEPTH	1/18/96	0.00	0.00	0.00	20.0		
25 feet	7/18/96	**35.8**	**724.00**	18.60	7.10		
	10/24/96	NM	**>100**	NM	13.20		

	1/16/97	**32.60**	**654.00**	11.50	9.50	0.00	
	4/18/97	**54.60**	30% by vol.	21.90	1.00	3.90	
	7/10/97	**7.10**	**150.00**	4.90	14.80	6.00	
	10/23/97	0.60	12.00	1.40	20.70	0.00	
	1/22/98	**13.90**	**274.00**	5.50	19.10		
	4/16/98	NM	NM	NM	NM		
	7/09/98	**28.10**	**586.00**	17.10	3.90		
	10/22/98	**1.80**	36.00	5.10	13.90	0.00	
	7/26/99	Barred	Barred	Barred	Barred	Barred	
	10/25/99	**23.40**	**468.00**	13.4	13.20	0.00	
MW-2S	10/24/96	NM	2.00%	NM	21.70%		
	1/16/97	0.00	0.00	2.80	13.00	0.00	
south of	4/18/97	0.00	0.00	6.50	4.50	0.00	
Phase 1	7/10/97	**4.50**	**90.00**	17.00	0.60	0.00	
	10/23/97	NM	NM	NM	NM		
MW-2R	1/22/98	0.00%	0.00%	0.40%	19.80%	0.0%	
South of	4/16/98	NM	NM	NM	NM		
Phase 1 in	7/09/98	**6.70**	**126.00**	4.50	18.20	-	
lined	10/22/98	0.10	2.00	0.30	20.40	0.00	
Midway	7/26/99	0.00	0.00	6.50	13.70	0.00	
DEPTH	10/25/99	0.00	0.00	0.20	19.60	0.00	
19 feet							
MW-3S	10/28/93	NM	0.03%	NM	21.20%		
southeast							
tip of	4/14/94	NM	0.00	NM	NM		
Phase 1	7/21/94	NM	**>100**	NM	NM		
unlined	10/26/94	NM	24.00	NM	NM		
Well	1/17/95	NM	0.00	NM	NM		

abandoned after 7/10/97	7/13/95 1/18/96 7/18/96	**37.50** 0.00 **16.00**	**742.00** 0.00 **320.00**	37.00 0.00 24.20	0.40 19.80 0.90		
MW-7S Northeast DEPTH 15 feet	10/28/93 4/14/94 7/21/94 10/26/94 1/17/95 7/13/95 1/18/96 7/18/96 10/24/96 1/16/97 4/18/97 7/10/97 10/23/97 1/22/98 4/16/98 7/09/98 10/22/98 7/26/99 10/25/99	NM NM NM NM NM 0.00 0.00 0.10 0.00 0.00 0.00 0.00 0.00 0.00 NM 0.10 0.00 0.00 0.00	0.06% 0.00 0.00 0.00 0.00 0.00 0.00 2.00 0.00 0.00 0.00 0.00 0.00 0.00 NM 2.00 0.00 0.00 0.00	NM NM NM NM NM 6.30 0.00 4.60 6.10 0.20 2.10 5.40 0.20 0.00 NM 7.20 0.00 5.10 0.10	22.70% NM NM NM N.M. 13.70 20.00 15.40 1.94 20.20 17.90 13.70 21.40 20.50 NM 12.70 20.40 15.40 20.2	 0.00 0.00 0.00 0.00 - - 0.00 0.00 0.00	

SOIL GAS (SG) MONITORING POINTS

Location	Date	Methane (%CH4)	**Combustible (% LEL)**	Carbon Dioxide (%CO2)	Oxygen (%O2)	Hydrogen Sulfide (H2S) ppm	CO ppm

SG-1 South/west of Phase 1 Along Patrill Hollow Road Between Cell2A and Cell 2B	10/24/96 1/16/97 4/18/97 7/10/97 10/23/97 1/22/98 4/16/98 7/09/98 10/22/98 7/26/99 10/25/99	N.M. 0.00 0.50 0.00 0.00 0.20 NM 0.00 0.00 0.00 0.00	3.00% 0.00 10.00 0.00 0.00 4.00 NM 0.00 0.00 0.00 0.00	N.M. 1.00 1.70 1.30 0.90 1.30 NM 1.10 1.10 0.70 2.10	21.00% 18.60 18.00 19.60 20.10 18.10 NM 19.90 19.40 20.50 18.30	 0.00 0.00 0.00 0.00 - - 0.00 0.00 0.00	
SG-2 South of Phase 1 unlined – currently in Phase 2	10/24/96 1/16/97 4/18/97 7/10/97 10/23/97 1/22/98 4/16/98 7/09/98 10/22/98	NM 0.00 0.00 0.00 0.00 0.00 NM 0.00 **3.00**	0.00% 0.00 0.00 0.00 0.00 0.00 NM 0.00 6.00	NW 1.10 0.90 1.40 1.00 1.40 NM 1.70 1.60	19.70% 19.70 19.40 19.50 19.20 19.00 NM 19.50 19.40	0.00 0.00 0.00 0.00 - - 0.00	
SG-3 North/west Of unlined Phase 1	10/24/96 1/16/97 4/18/97 7/10/97 10/23/97	NM 0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00 0.00	NM 1.50 1.50 2.50 1.30	18.60% 19.50 19.50 18.30 19.50	 0.00 0.00 0.00 0.00	

Between the fork where Patrill Hollow Road splits with the road leading to the scales & office	1/22/98 4/16/98 7/09/98 10/22/98 7/26/99 10/25/99	0.00 NM 0.00 0.00 0.00 0.00 0.00 0.00	0.00 NM 0.00 0.00 0.00 0.00 0.00 0.00	1.30 NM 3.50 2.90 1.90 4.10 1.20 0.00	19.00 NM 17.60 18.10 19.70 17.40 19.20 20.20	- - 0.0 0.00 0.00 0.00 0.00	

GAS MONITORING WELLS (GW)

Location	Date	Methane (%CH4)	**Combustible (% LEL)**	Carbon Dioxide (%CO2)	Oxygen (%O2)	Hydrogen Sulfide (H2S) ppm	CO ppm
GW-1 Near barn South West Along Patrill Hollow Road	7/26/99 10/25/99	0.00% 0.00	0.00% 0.00	1.20% 1.40	20.00% 19.50	0.00% 0.00	
GW-2 west South West tip of Cell 2B Phase 2 DEPTH 11 feet	7/26/99 10/25/99	0.00% 0.00	0.00% 0.00	0.30% 0.40	20.50% 20.40	0.00% 0.00	

6.3 (HAP) HAZARDOUS AIR POLLUTANTS IN LANDFILL GAS (LFG)

According to the EPA document, Frequent Questions Landfill Gas and How It Affects Public Health, Safety and the Environment, "Landfills are the largest single human source of methane emissions in the U.S. accounting for 33% of all methane sources. Uncontrolled MSW landfills also emit nonmethane compounds (NMOC), which include volatile organic compounds (VOC) that contribute to ozone formation and hazardous air pollutants (HAP) that can affect human health when exposed."

"Nonmethane organic compounds are contained in discarded items such as household cleaning products, materials coated with or containing paints and household cleaning products, and adhesives, and other items."

"During the waste decomposition process, NMOC can be stripped from the waste by methane, carbon dioxide, and other gases and carried in LFG."

"Three different mechanisms are responsible for the production of NMOC and their movement into LFG: (1) vaporization (the change of state from liquid or solid to vapor) or organic compounds until the equilibrium vapor concentration is reached, (2) chemical reaction of materials present in the landfill, and (3) biological decomposition of heavier organic compounds into lighter, more volatile constituents."

Subsurface migration

"Subsurface migration is the underground movement of LFG from landfills to other areas within the landfill property or outside of the landfill property. (Note: Most subsurface migration occurs at older unlined landfills because there is minimal barrier for lateral migration. The Resource Conservation and Recovery Act began requiring all new or expanded landfills to be lined as of October 3, 1993. This requirement decreases the likelihood of subsurface migration.) Since LFG contains approximately 50% methane (a

potentially explosive gas) it is possible for LFG to travel underground, accumulate in enclosed structures, and ignite. There have been incidences of subsurface migration causing fires and explosions on both landfill property and private property."

Surface emissions

"Possibly the biggest health and environmental concerns are related to the uncontrolled surface emissions of LFG into the air. As previously mentioned, LFG contains carbon dioxide, methane, VOC, HAP, and odorous compounds that can adversely affect public health and the environment."

"Exposure to HAP can cause a variety of health problems including cancerous illnesses, respiratory irritation, and central nervous system damage."

Flaring

"Thermal treatment of NMOC (including HAP and VOC) and methane through flaring or combustion in an engine, turbine, or other devise greatly reduces the emission of these compounds."

Dioxins/Furans

"Dioxins and furans are a group of toxic chemical compounds, known as persistent organic pollutants that share certain chemical structures and biological characteristics."

"Some of the conditions that are conducive to dioxin/furan formation are the combustion of organic matter in the presence of chlorine and particulate matter under certain thermodynamic conditions such as low combustion temperatures and brief combustion times."

"EPA review of the available data indicates that dioxins/furans can be released in small amounts when LFG is combusted by flare or for recovering energy."

Mercury

"Sources of mercury in MSW landfills can include batteries, fluorescent light bulbs, electrical switches, thermometers, and paints. Once mercury enters the waste stream, it will ultimately be released from the landfill and is contained in uncontrolled LFG. However, combustion of LFG reduces the toxicity of LFG emissions by converting the organic mercury compounds, including methylated mercury, to less toxic, less hazardous,, inorganic mercury compounds."

See Appendix H

7.1 PHASE 2
LANDFILL GAS MONITORING 2000 - 2005

%LEL = PERCENTAGE OF LOWER EXPLOSIVE LIMIT
NOTE EXPLOSIVE LEVELS AT MONITORING WELL MW-1S AS WELL AS PHASED OUT MW-3S

Location	Date	Methane (%CH4)	**Combustible (% LEL)**	Carbon Dioxide (%CO2)	Oxygen (%O2)	Hydrogen Sulfide (H2S) ppm	CO ppm
MW-1S	**1/3/00**	**23.40**	**486.00**	7.90	12.30	0.00	
west	**7/26/00**	**40.30**	**848.00**	14.5	4.70	0.00	
	1/18/01	**23.10**	**>100**	5.40	12.30	0.00	NS
(along	4/05/01	0.00	0.00	1.00	19.90	0.00	NS
Patrill	**7/24/01**	**39.80**	**>100**	17.80	5.60	0.00	NS
Hollow	**10/29/01**	**68.2**	**>100**	28.70	0.60	0.00	0.00
Road)	**1/10/02**	**1.90**	**28.00**	1.40	19.80	0.00	0.00
DEPTH	**4/17/02**	**27.8**	**>100 (478)**	13.40	11.50	0.00	24.00
25 feet	**7/11/02**	**60.10**	**>100**	31.70	0.70	7.00	60.00
	8/22/02	**60.00**	**>100**	30.60	0.30	3.60	NS
	11/21/02	**60.00**	**>100**	30.10	0.50	4.20	60.00
	3/24/03	**34.50**	**>100 (554)**				
	6/26/03	**33.40**	**>100 (670)**	0.00	17.40	0.00	NS

				17.50	6.50	22.00	9.00
	9/28/04	**50.20**	**832**				
	12/16/04	**63.70**	**>100**	25.90	5.90	24.00	193
				35.30	1.20	3.00	59.0
	3/22/05	NS	NS				
				NS	NS	NS	NS
MW-2S	NM						
	1/3/00	0.00	0.00	0.00	20.10	0.00	
	7/26/00	0.00	0.00	0.00	20.40	0.00	
MW-2R							
South of	1/18/01	0.00	0.00	0.10	20.70	0.00	NS
Phase 1	4/05/01	0.00	0.00	0.00	20.20	0.00	NS
in lined	7/24/01	0.00	0.00	0.90	19.60	0.00	NS
Midway	10/29/01	xxx	xxx	xxx	xxx	xxx	xxx
DEPTH	11/21/02						60.00
19 feet							
MW-3S	Abandoned	7/10/97					
MW-4S	Abandoned	'95					
MW-7S	1/3/00	0.00	0.00	0.00	20.4	0.00	
Northeast	7/26/00	0.00	0.00	0.00	20.9	0.00	
DEPTH	1/18/01	0.00	0.00	0.00	20.80	0.00	NS
15 feet	4/05/01	0.00	0.00	0.10	19.70	0.00	NS
	7/24/01	0.00	0.00	1.10	20.90	0.00	NS
	10/29/01	0.00	0.00	0.10	20.60	0.00	0.00
	1/10/02	0.00	0.00	0.00	20.60	0.00	0.00
	4/17/02	0.00	0.00	2.10	15.80	0.00	0.00
	7/11/02	0.00	0.00	0.30	20.60	0.00	0.00
	8/22/02	0.00	0.00	2.10	18.70	0.00	NS
	11/21/02	0.00	0.00	0.00	20.60	0.00	0.00
	3/24/03	0.00	0.00	1.10	19.20	0.00	NS
	6/26/03	0.00	0.00	1.3	19.50	0.00	0.00
	9/28/04	0.00	0.00	0.00	20.70	0.00	0.00
	12/16/04	0.00	0.00	0.00	19.50	0.00	0.00

	3/22/05	0.00	0.00	0.00	20.6	0.00	0.00

SOIL GAS (SG) MONITORING POINTS

Location	Date	Methane (%CH4)	**Combustible (% LEL)**	Carbon Dioxide (%CO2)	Oxygen (%O2)	Hydrogen Sulfide (H2S) ppm	CO ppm
SG-1 South/west of Phase 1	1/3/00	0.00	0.00	1.20	18.60	0.00	
	7/26/00	0.00	0.00	0.00	20.80	0.00	
	1/18/01	0.00	0.00	0.00	20.80	0.00	Xxx
Along Patrill Hollow Road	4/05/01	0.00	0.00	0.40	19.40	0.00	NS
	7/24/01	0.00	0.00	0.00	19.80	0.00	NS
	10/29/01	0.00	0.00	0.00	21.00	0.00	0.00
	1/10/02	0.00	0.00	0.20	20.30	0.00	0.00
Between Cell2A and Cell 2B	4/17/02	0.00	0.00	0.00	21.00	0.00	0.00
	7/11/02	0.00	0.00	0.10	20.70	0.00	0.00
	8/22/02	0.00	0.00	0.10	21.10	0.20	NS
	11/21/02	0.00	0.00	0.70	19.90	0.20	0.00
	3/24/03	0.00	0.00	0.00	20.20	0.00	NS
	6/26/03	0.00	0.00	0.00	20.60	0.00	0.00
	9/28/04	0.00	0.00	0.30	20.10	0.00	0.00
	12/16/04	**2.70**	**54.00**	1.70	18.40	0.00	0.00
	3/22/05	0.00	0.00	0.00	20.90	0.00	0.00
SG-2 within Phase 2	1/3/00	NM	NM	NM	NM	0.00	

SG-3	1/3/00	0.00	0.00	1.20	19.20	0.00	
	7/26/00	0.00	0.00	0.00	20.20	0.00	
North/west							
Of unlined	1/18/01	0.00	0.00	0.00	20.70	0.00	NS
Phase 1	4/05/01	0.00	0.00	0.10	20.20	0.00	NS
	7/24/01	0.00	0.00	0.10	20.50	0.00	NS
Between the	10/29/01	0.00	0.00	0.00	20.90	0.00	0.00
fork where							
Patrill	1/10/02	0.00	0.00	0.00	20.70	0.00	0.00
Hollow	4/17/02	0.00	0.00	0.00	21.00	0.00	0.00
Road splits	7/11/02	0.00	0.00	0.20	20.70	0.00	0.00
with the	8/22/02	0.00	0.00	0.20	21.10	0.00	NS
road leading	11/21/02	0.00	0.00	0.40	20.30	0.00	0.00
to the scales							
& office	3/24/03	0.00	0.00	0.00	20.10	0.00	NS
	6/26/03	0.00	0.00	0.00	20.80	0.00	0.00
	9/28/04	0.00	0.00	0.40	20.30	0.00	0.00
	12/16/04	0.00	0.00	0.10	19.40	0.00	0.00
	3/22/05	0.00	0.00	0.10	20.80	0.00	0.00

GAS MONITORING WELLS (GW)
NOTE EXPLOSIVE LEVELS AT GAS WELLS GW-3

Location	Date	Methane (%CH4)	**Combustible (% LEL)**	Carbon Dioxide (%CO2)	Oxygen (%O2)	Hydrogen Sulfide (H2S) ppm	CO ppm
GW-1	1/3/00	0.00	0.00	0.00	20.4	0.00	
	7/26/00	0.00	0.00	2.10	17.60	0.00	
Near barn							
South West	1/18/01	0.00	0.00	0.00	21.00	0.00	NS
Along	4/05/01	0.00	0.00	1.20	19.10	0.00	NS

Patrill Hollow Road	7/24/01	0.00	0.00	0.10	20.50	0.00	NS
	10/29/01	0.00	0.00	2.70	18.80	0.00	0.00
	1/10/02	0.00	0.00	0.30	20.60	0.00	0.00
	4/17/02	0.00	0.00	0.30	20.90	0.00	0.00
	7/11/02	0.00	0.00	4.60	15.70	0.00	0.00
	8/22/02	0.00	0.00	0.20	20.70	0.00	NS
	11/21/02	0.00	0.00	0.40	19.90	0.00	0.00
	3/24/03	0.00	0.00	3.10	16.20	0.00	NS
	6/26/03	0.00	0.00	1.00	19.50	0.00	0.00
	9/28/04	0.00	0.00	2.00	20.70	0.00	0.00
	12/16/04	0.00	0.00	5.60	14.30	0.00	0.00
	3/22/05	0.00	0.00	2.00	19.10	0.00	0.00
GW-2 west	1/3/00	0.00	0.00	0.00	20.20	0.00	
	7/26/00	0.00	0.00	0.00	20.60	0.00	
South West tip of Cell 2B Phase 2	1/18/01	0.00	0.00	0.00	21.30	0.00	NS
	4/05/01	0.00	0.00	0.20	20.10	0.00	NS
	7/24/01	0.00	0.00	1.10	20.20	0.00	NS
	10/29/01	0.00	0.00	0.30	20.70	0.00	0.00
DEPTH 11 feet	1/10/02	0.00	0.00	0.20	20.40	0.00	0.00
	4/17/02	0.00	0.00	0.20	20.50	0.00	0.00
	7/11/02	0.00	0.00	1.20	19.50	0.00	0.00
	8/22/02	0.00	0.00	0.40	20.80	0.00	NS
	11/21/02	0.00	0.00	1.20	19.20	0.00	0.00
	3/24/03	0.00	0.00	0.40	19.10	0.00	NS
	6/26/03	0.00	0.00	0.10	20.10	0.00	0.00
	9/28/04	0.00	0.00	2.30	18.10	0.00	0.00
	12/16/04	0.00	0.00	3.20	14.20	0.00	0.00
	3/22/05	0.00	0.00	1.30	18.70	0.00	0.00
GW-3	1/18/01	xxx	xxx	xxx	xxx	xxx	xxx

	4/05/01	**51.90**	**>100**	38.20	4.00	0.00	MA
Phase 2	7/24/01	NS	NS	NS	NS	NS	X
	10/29/01	**61.30**	**>100**	33.00	0.00	0.00	NS
Upgradient							
West by	**1/10/02**	**59.50**	**59.30**	31.60	0.00	0.00	0.00
Patrill	**4/17/02**	**55.00**	**>100**	43.40	0.00	0.00	18.0
Hollow	**7/11/02**	**54.10**	**>100**	37.00	0.60	0.00	16.0
Road	**8/22/02**	**56.90**	**>100**	37.80	0.00	0.20	NS
	11/21/02	**62.10**	**>100**	36.20	0.00	0.00	14.0
Between							
Cell2A	**3/24/03**	**58.00**	**>100**	31.80	0.00	0.00	NS
& Cell2B	**6/26/03**	**59.00**	**>100**	32.90	0.00	0.00	5.00
	9/28/04	**61.70**	**>100**	33.1	1.10	0.00	16.0
	12/16/04	**62.00**	**>100**	37.4	0.60	0.00	17.0
	3/22/05	**51.60**	**>100**	28.30	2.10	0.00	6.00
GW-4	1/18/01	xxx	xxx	xxx	xxx	xxx	xxx
	4/05/01	**57.40**	**>100**	29.9	0.40	0.00	72.0
Upgradient	7/24/01	NS	NS	NS	NS	NS	NS
	10/29/01	**57.70**	**>100**	28.40	0.00	0.00	0.00
Near MW-	**1/10/02**	**0.00**	0.00	0.00	0.00	0.00	0.00
1S &1D	**4/17/02**	**62.40**	**>100**	27.30	0.00	0.00	26.0
	7/11/02	**58.80**	**>100**	65.40	0.30	0.00	27.0
West	**8/22/02**	**57.40**	**>100**	35.30	0.00	0.10	NS
Midway	**11/21/02**	**61.70**	**>100**	35.10	0.00	0.00	21.0
Next to							
Unlined	**3/24/03**	**63.40**	**>100**	28.50	0.00	0.00	NS
Phase 1	**6/26/03**	**62.30**	**>100**	31.10	0.00	0.00	8.00
	9/28/04	**62.90**	**>100**	34.20	0.00	4.00	25.0
	12/16/04	**59.30**	**>100**	37.10	0.50	0.00	20.0
	3/22/05	**59.60**	**>100**	27.50	8.00	0.00	4.00
GW-5	1/18/01	xxx	xxx	xxx	xxx	xxx	xxx
	4/05/01	0.00	0.00	3.00	17.70	0.00	7.00

North of	7/24/01	NS	NS	NS	NS	NS	NS
Unlined	10/29/01	0.00	0.00	1.50	20.10	0.00	0.00
Phase 1							
Left of	1/10/02	0.00	8.00	0.00	20.10	0.00	0.00
Office bld.	4/17/02	0.00	6.00	0.00	20.10	0.00	0.00
	7/11/02	0.00	0.00	0.00	20.80	0.00	0.00
	8/22/02	0.00	0.00	2.30	18.20	0.00	NS
	11/21/02	0.00	0.00	0.70	20.00	0.00	0.00
	3/24/03	0.00	0.00	0.00	20.10	0.00	NS
	6/26/03	0.00	0.00	0.00	20.80	0.00	1.00
	9/28/04	0.00	0.00	0.70	20.10	0.00	0.00
	12/16/04	0.00	0.00	2.30	17.20	0.00	0.00
	3/22/05	0.00	0.00	0.10	20.50	0.00	0.00
GW-6	1/18/01	xxx	xxx	xxx	xxx	xxx	xxx
	4/05/01	0.00	0.00	1.80	17.80	0.00	7.00
North East	7/24/01	NS	NS	NS	NS	NS	NS
Near MW-	10/29/01	0.00	0.00	2.00	19.20	0.00	0.00
7S and tip							
Of lined	1/10/02	0.00	0.00	0.00	20.50	0.00	0.00
Phase 1	4/17/02	0.00	0.00	0.00	20.10	0.00	0.00
	7/11/02	0.00	0.00	0.00	20.90	0.00	0.00
	8/22/02	0.00	0.00	0.00	21.10	0.00	NS
	11/21/02	0.00	0.00	1.80	18.80	0.00	0.00
	3/24/03	0.00	0.00	0.90	19.20	0.00	NS
	6/26/03	0.00	0.00	0.10	20.80	0.00	10.0
	9/28/04	0.00	0.00	3.70	17.00	0.00	0.00
	12/16/04	0.00	0.00	1.10	18.00	0.00	0.00
	3/22/05	0.00	0.00	0.00	20.80	0.00	0.00

NOTE: In their 2001, 2002, 2003, 2004 and 2005 reports, Tighe & Bond misidentified the locations of the Phase 1 Monitoring Wells, claiming the eastern wells were western and visa versa. The ramification of the error is that a reader is led to believe that the 100% Lower Explosive Limits detected

are within the landfill property bounds; however, they were upgradient in the western Monitoring Wells adjacent to the Phase 1 unlined portion of the landfill, along Patrill Hollow Road – off-site of the landfill.

See Appendix H

8.1 MONITORING FOR VOC & METALS 1993-99

SAMPLING LOCATIONS JUNE 1999

June 17, 1999 Tighe & Bond

Table 2 – Current Sampling Locations	Hardwick Landfill
LOCATION	DESCRIPTION
MW- 1S MW-1D	Up gradient shallow well - west of current landfill up gradient bedrock well - west of current landfill
MW-2R	Cross to down gradient shallow well - south of current landfill
MW-5S MW-5D	Down gradient shallow well - southeast of current landfill Down gradient bedrock well - southeast of current landfill
MW-6S MW-6D	Down gradient shallow well - east of current landfill Down gradient bedrock well - east of current landfill
MW-7S	Down gradient shallow well – northeast of current landfill
SW-1	Up gradient surface water – Muddy Brook
SW-3	Down gradient surface water – Muddy Brook

"Eight (8) existing monitoring wells and two (2) surface water locations are sampled as part of the current environmental monitoring program."

"Monitoring wells MW-3S and MW-4s are not sampled as part of the current environmental program because these wells were abandoned in-place during the Phase 1 lined expansion of the landfill. Shallow monitoring well MW-2R was installed in August 1997 to replace MW-2S, which had been inadvertently screened mostly above the water table. MW-2S was abandoned in place following replacement." Tighe & Bond

H-397-4-50, page 2-13, June 17, 1999

4.3 GROUNDWATER VOC & METALS FROM 1993-99

Source: Tighe & Bond reports 1993 - 1999

Sampling Locations Hardwick Landfill	Metals (mg/L) 1993-1999 (mg/L) **Boldface** – exceeds standards of guidance	VOC -Volatile Organic Compounds 1993 – 1999 (ug/L) **Boldface** – exceeds standards of guidance
LOCATION		
MW- 1S (west of Phase 1) MW-1D	**'93, '95 Iron** **'93, '95 Manganese** ***'96 Lead***	'93 1,1,1 Trichloroethane '93 Trichlorofluoromethane **'93, 94-Methylene Chloride** '93 Xylenes '96 Ethylbenzene '96, '99 Chloroethane **'96,** '97**-Vinyl Chloride** '97, '98 Acetone '96, '99 Methyl-tert-butl ether
MW-2R (south of Phase 1) MW -2S	**'93-'99 Iron** **'94-'99 Manganese** ***'94-'99 Lead*** **'95 Cadmium** '98,'99 '94-'99 Copper **'97-'99 Chromium** '94-'99 Zink	'93 Chloromethane **'93-Methylene Chloride** '94 1,1-Dichloroethane '94 Trichlorofluoroethane **'95 Trichlorofluoromethane** '95, '96, 97 Acetone '96, '97 Xylene '99 Benzene '99 Chloroethane '99 cis-1,2-Dichloroethene
MW -3S Located on the southeastern tip of Phase I unlined Well abandoned	**'93, '95 Iron** **'93, '95 Manganese** **'94-'97 Barium** **'96 Cadmium** **'94-'97 Chromium** ***'94-'97 Lead***	**'93-Methylene Chloride** '95, 96, '97 1,1-Dichloroethane **'96, '97-Vinyl Chloride** '96 Trichloroethane '96 Trichlorofluoromethane '96, '97 Acetone

after 7/10/97	***'96, '97 Mercury*** '94, '95 Nickel **'94, '95 Titanium** **'96, '97 Selenium** **'94-'97 Zink**	'96, '97 Methyl-tert-butl ether
MW-4S Located midway within the northeastern edge of Phase 1 unlined. Covered over by the lined expansion. Abandoned after 1/17/95	**'93, '95 Iron** **'93, '95 Manganese** **'95 Nickel** ***'94, '95 Lead*** **'94, '95 Barium** **'94 Cadmium** **'94, '95 Chromium** **'94 Copper** **'94, '95 Nickel** **'94 Titanium** **'94, '95 Zink**	'93, '94 Trichlorofluoromethane '93 Dichlorofluoromethane **'93 Vinyl Chloride** '94 1,1-Dichloroethane **'94 Methylene Chloride** **'94, '95 2-Butanone** '94, '95 Acetone '94, '95 Toluene '94 4-Methyl-2-Pentanone
MW-5S (southeast) MW-5D	**'93, '95 Iron** **'93, '95 Manganese** ***'95 Lead***	**'93, '94, '96,** '99 **Methylene Chloride** '93 through'99 1,1-Dichloroeth*ane* '95**, '96, '97, '98 1,1-Dichloroeth*ene*** '96, '97, 98 cis-1,2-Dichloroethene '96, '95, '97, '98, '99 Chloroethane '96, '97, '98, '99 Benzene '96, '97, '98, '99 Chlorobenzene '95 Chloromethane '95, '98 Chlorofluoroethane '95 Chlorofluoromethane '94, '95, **'96**, '97 **Acetone** '94, '95, **'96, '97 2-Butanone** '95, '96, '98 Trichlorofluoromethane **'96, '97,** '99 **Chloride** '96**, '97,** '98 **Toluene** **'96, '97,** '98, **'99 methyl-tert-butl ether** **'96, '97, '98, '99 Vinyl Chloride** '97 4-Methyl-2- Pentanone

		’98 Ethylbenzene ’98 Isopropylbenzene ’98 p-Isopropyltoluene ’98 Benzene ’98, ‘99 Xylene ’95, ‘98 Carbon disulfide (DET) ’98 Carbon Tetrachloride ’98 Hexanone ’98 Tert-Butylbenzene ’98 1,2,5-Trimethylbenzene (BQL)* ’98 Trichloroethane (BQL)* ‘98 Ethanol* ’98 C2H6O isomer* ‘98 *Tetrahydrofuran** ’98 1,3,3,t-Bicyclo[2,2]hepton-2-1* ’98 1,2-diethylbenzene* ’98, ’99 1,4 Dichlorobenzene ’99 cis-1,2-Dichloroethene ‘99 1,2,4-Trimethylbenzene * Special note in T&B report 4/98 as tentatively identified. Tom Couture
MW-6S (east) MW-6D	**’93-‘99 Iron** **’93-’99 Manganese** **’95-‘97 Chromium** ’95-’99 Copper ***’95-’99 Lead*** ’95-’99 Silver ’95-’99 Zink	’93, ’97, ‘**99 1,1-Dichloroethane** **’94,** ’96, ‘97 **1,1-Dichloroeth*ene*** **’94, ’96 Methylene Chloride** ’94 Trichlorofluoromethane ’95,’96, ’97, ‘99 Acetone **’94, ’95,** ’96, ’97, ‘98 **2-Butanone** ’95, ’96, ’97, ‘98 Toluene ’95 Carbon Disulfide ’95 Dichlorofluoromethane ’96, ’97, ‘99 Chloroethane **’96, ’97, ‘99 Vinyl Chloride** ’96, ’97, ‘99 methyl-tert-butl ether ’95 Carbon disulfide (DET) ’98 4-Methyl-2-Pentanone ’98 1-chloro-1-fluoromethane*

		’98 1,2-dichloro-1-fluro-ethane* ’99 Benzene ’99 cis-1,2-Dichloroethene ’99 Isopropylbenzene * Special note in T&B report 4/98 as tentatively identified. Tom Couture
MW-7S (northeast)	**’93, ’95 Iron** **’93, ’95 Manganese** **’96-’99 Barium** ’96-‘99 Cadmium ’96-’99 Chromium **’97-’99 Copper** ***’94-’99 Lead*** ’96-’99 Zink	**’94 Vinyl Chloride** **’94 Methylene Chloride** **’94, ’96, ’97**, ‘98 **1,1-Dichloroeth*ene*** ’95, ‘98 Xylenes ’95 Trichlorofluoromethane ’96 Toluene ‘97 1,1-Dichloroeth*ane* ’96, ’97 1,1,1- Trichloroethane **’96 Trichloroethene** ’96, ‘97 Trichlorofluoromethane ’97 Acetone ’97 2-Butanone ’98 1,2,4-Triethylbenzene
SW-1 Upgradient Muddy Brook	**’93-‘99 Iron** **’93-‘99 Manganese** ***’94, ’95, ’98 Lead*** ***’94 Mercury***	**’94 Methylene Chloride**
SW-3 Down gradient Muddy Brook	**’93, ’95 Iron** **’93, ’95 Manganese**	**’93-Methylene Chloride** ’96 Tetrachloroethene ’98 C12H20O2 isomer* ’98 Acetone

Sampling conducted by Jeffery J. Thelen, P.G., Senior Hydrogeologist on behalf Tighe & Bond for Hardwick Landfill, Inc.

LEAD & MERCURY CONTAMINATION

Lead Pb (mg/L) exceeded fresh water Chronic Criteria and in some cases, Acute Criteria and MA Drinking Water Standards at various times from 1994 through 1999 in MW-6S and 6D along the eastern edge of the Phase 1 lined expansion, in MW 7s northeast of Phase 1, at SW-1 within the up gradient surface water of Muddy Brook, MW-2S and 2R south of the unlined area within phase 2, at MW-3S at the south east corner of the unlined portion and underneath the Phase 1 lined expansion along the north east edge of the unlined landfill and in PZ-11S, 14S and 16S, along the northeast edge of the current phase 2, southwest near the Roach barn, and south east near the present garage, respectively.

Mercury (Hg) was found at two locations at MW -3S, located on the southeastern tip of the Phase I unlined portion of the landfill in 1996 and again in 1997 (the monitoring site was abandoned in 1997) and at the upgradient surface water sample location SW-1 in Muddy Brook in 1994.

8.2 PHASE 2 GEOTECHNICAL INVESTIGATIONS

The December 1999 Phase 2 Hydrological Interim Report outlined Phase 2 Geotechnical Investigations involving the drilling of nineteen shallow piezometer wells to determine hydraulic conductivity values, to characterize soils, conduct bedrock fracture trace analysis and to determine the depth of water tables. Groundwater sampling was conducted to determine pH, temperature, dissolved oxygen as well as for VOCs (volatile organic compounds), total metals, and a variety of other variables including nitrates and chloride. As in prior practice, surface water sample (SW-1) was also collected from the downstream location on the intermittent stream located to the south of the Phase 2 expansion area, near the confluence of Muddy Brook, and analyzed for the same parameters as the groundwater.

PHASE 2 HYDROLOGICAL STUDY – HARDWICK LANDFILL – GROUNDWATER SAMPLING JULY 26, 1999 - PIEZOMETERS

Sampling Locations Hardwick Landfill S - Shallow D - Deep B - Bedrock	Metals (mg/L) **Boldface** – exceeds standards of guidance	VOC -Volatile Organic Compounds **Boldface** – exceeds standards of guidance TID – tentatively identified
LOCATION		
PZ-8S PZ-8D PZ-8B South/East of Phase 2 Lined Expansion	**S, D, B – Barium** **S - Chromium** **S, D, B – Copper** **S, D, B – Iron** **S, D, B – Manganese** **D - Zink**	**ND**
PZ-11S PZ-11D PZ-11B (Midway - East of Phase 2 Lined Expansion	**S, D, B – Barium** **S, D, B – Copper** **S, D, B – Iron** **S, D, B – Manganese** ***S - Lead*** **S, D - Zink**	D - **Methylene Chloride** D – Chlorofluoroethane (TID) **B – Benzene** **B - Chloroethane** **B - 1,1-Dichloroethane** **B - methyl-tert-butl ether** B - Dichlorofluoromethane (TID) B – Ether (TID) B – 1-Chloro-1 –floroethane (TID)
PZ-14S PZ-14D South/West of Phase 2 Lined Expansion - along Patrill Hollow Road	**S – Arsenic** **S, D – Barium** **S - Chromium** **S, D – Copper** **S, D – Iron** **S, D – Manganese** ***S - Lead*** **S - Zink**	ND
PZ-16S PZ-16D PZ-16B	**S – Arsenic** **S, D, B – Barium** **S - Chromium** **S, D, B – Copper**	B - **Chloroethane** **B - 1,1-Dichloroethane** **B – 2-Hexanone** D - **Chloroethane**

East of Phase 2 Lined Expansion – near equipment garage	**S, D, B – Iron** **S, D, B – Manganese** ***S - Lead*** **S, D - Zink**	**DB - 1,1-Dichloroethane** **D – 2-Hexanone** **DB - Isopropylbenzene** **D - methyl-tert-butl ether** **D - Vinyl Chloride** D – Chlorofluoroethane (TID) B – Chlorofluoroethane (TID) DB- Dichlorofluoromethane (TID) D – Ether DB - 1-Chloro-1 –floroethane (TID)
Inorganic Analysis – all wells	**Nitrate**	
SW-4	-	-
SW-5 down stream of Muddy Brook	**Barium** **Iron** **Manganese**	**ND**

Monitoring wells MW-2R and Piezometers PZ-12 and PZ- 20 through PZ – 26 which were located within the proposed Phase 2 expansion area were decommissioned prior to beginning operations within the Phase 2 expansion area.

9.1 PHASE 2 LANDFILL EXPANSION

AN ENVIRONMENTAL NOTIFICATION FORM (ENF) WAS FILED WITH THE EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS 2/18/99. THE SECRETERY OF EOEA DETERMINED ON 4/8/99 THAT AN ENVIRONMENTAL IMPACT REPORT MUST BE FILED.

FINAL ENVIRONMENTAL IMPACT REPORT
PHASE 2 LINED EXPANSION - AUGUST 2000 - TIGHE & BOND

In 2000, a 16.57 parcel adjacent to Phase 1 located in a permitted gravel mining pit was proposed for a Phase 2 landfill expansion, with approximately 35% (10.6 acres) within the boundaries of the existing 30.6

acre site assigned area. Approximately 2.3 acres of the Phase 2 lined expansion area overlays the southern side-slope of the capped and closed un-lined area. The proposal called for a continuation of the 300 tpd capacity which would serve as a regional waste disposal facility with its capacity allocated as 90 percent construction and demolition (C&D) material or difficult-to-manage DTM waste, and 10 percent municipal solid waste MSW. At that time the volume of Phase 2 was projected to be about 800,000 cubic yards and have a life span of approximately 4 years. It was to be constructed with a composite liner and leachate collection system, with leachate collected in existing storage tanks for off-site transport and treatment, as was the practice for the Phase 1 lined area.

According to the FEIP report, though Phase 2 would result in changes in existing site grades that would redirect surface water drainage, surrounding impact to the surrounding natural areas would be mitigated by a storm water management system including drainage swales and detention/sedimentation basins constructed for the project.

Environmental Monitoring Requirements

According to the Final Environmental Impact Report (Phase 2 August 2000, p 2-9 – 2-10), "Groundwater, surface water and soil gas are sampled, analyzed and reported on a semi-annual basis. The same frequency is planned for the future for both Phase 1 and Phase 2 proposed Phase 2 landfills. ***There are no monitoring requirements for air quality, noise or traffic conditions.*** There is a separate Long Term Monitoring Program in place for the old unlined landfill."

The Phase 2 Hydrogeological, Expansion, and Environmental Impact reports include metals and inorganic analysis from 1993 onward for the Phase 1 monitoring of MW-1S and MW-1D; MW-2R; MW-5S and MW-5D; MW-6S and MW-6D; and MW-7S. ***However, the report does not include VOC analysis from 1996 – 1999 for these same monitoring sites, which include many VOC exceedances..***

The date in these same Tighe & Bond reports do include Phase 2 monitoring data for piezometer wells PZ 8-16 include metals, inorganic analysis and VOCs from 1999 to the present.

Groundwater

The Tighe & Bond August 2000 report states on page 1-6, "Groundwater in the area flows toward the south and east with limited impact from the old unlined landfill." They also state that "due to natural conditions, groundwater in the area upgradient of the landfill has high levels of iron and manganese that is unsuitable for use as drinking water."

It is unclear how the VOC evident in down gradient monitoring wells are interpreted to have a "limited impact from the unlined landfill." PZ wells 11 and 16 indicate that there had been significant migration of VOCs as well as metals.

On July 26, 1999, analysis of groundwater in PZ-11S, PZ-11D, and PZ-11B which is midway - East of the Phase 2 Lined Expansion indicated the presence of D - **Methylene Chloride;** D – Chlorofluoroethane (TID); **B – Benzene; B – Chloroethane; B - 1,1-Dichloroethane; B - methyl-tert-butl ether;** B - Dichlorofluoromethane (TID); B – Ether (TID); B – 1-Chloro-1 – floroethane (TID) as well as metals such as in wells **S, D, B – Barium; S, D, B – Copper; S, D, B – Iron; S, D, B – Manganese; *S* – *Lead; and* S, D – Zink** all exceeding acceptable groundwater limits.

Analysis of groundwater PZ-16S, PZ-16D, and PZ-16B which is East of Phase 2 Lined Expansion – near the equipment garage indicated the presence of in well B – **Chloroethane; B - 1,1-Dichloroethane; B – 2-Hexanone;**
D – **Chloroethane; DB - 1,1-Dichloroethane; D – 2-Hexanone;**
DB – Isopropylbenzene; D - methyl-tert-butl ethe; D - Vinyl Chloride
D – Chlorofluoroethane (TID); B – Chlorofluoroethane (TID)
DB- Dichlorofluoromethane (TID); D – Ether; and
DB - 1-Chloro-1 –floroethane (TID) as well as metals **S – Arsenic**
S, D, B – Barium; S – Chromium; S, D, B – Copper; S, D, B – Iron
S, D, B – Manganese; *S* – *Lead; and* S, D – Zink all exceeding acceptable groundwater limits.

Metals were also found in PZ-8S, PZ-8D and PZ-8B which are South/East of the Phase 2 lined expansion including **S, D, B – Barium; S – Chromium; S, D, B – Copper; S, D, B – Iron; S, D, B – Manganese;** and **D – Zink**.

Along Patrill Hollow Road south west of Phase 1

In PZ-14S, and PZ-14D South/West of the Phase 2 lined expansion, along Patrill Hollow Road, the following metals were found in Piezometer Wells **S – Arsenic; S, D – Barium; S – Chromium; S, D – Copper; S, D – Iron S, D – Manganese; *S – Lead; and* S – Zink. All exceeded acceptable groundwater limits based on data obtained from the July 1999 analytical reports.**

A map of Phase 1 shows that discarded "metals" were deposited above the unlined portion of Phase 1 along Patrill Hollow Road

In addition, though the concentration of iron and manganese in the groundwater found in the monitoring wells is extremely high, the so-called "natural occurrence" of these levels may in part be precipitated by the extremely corrosive nature of the solvents and other toxic wastes permeating through the aquifer through legal and confirmed illegal dumping in the unlined portion of Phase 1. According to soil scientists, iron is present in most soils, mainly in the form of its oxides, which are largely responsible for the red and brown colors in soils. Manganese and iron's solubility increases with an increase in acid levels.

10.1 GROUNDWATER

VOC & METALS FROM 2000-2005

Source: Tighe & Bond reports 2000-2005
Iron and Manganese are consistently above approved state and federal standards

Sampling Locations Hardwick Landfill	Metals (mg/L) 2000-2005 (mg/L) **Boldface** – exceeds standards of guidance	VOC -Volatile Organic Compounds 2000-2005 (ug/L) **Boldface** – exceeds standards of guidance
LOCATION		

MW- 1S (west of Phase 1) MW-1D	**'00-'04 Iron** **'00-'04 Manganese** '01,'03 Lead '01-'04 Barium	'04 1,4 Dichlorobenzene '00 Xylenes **'00 Ethylbenzene** '01,'02,'03,'04,'05 Chloroethane **'03 Vinyl Chloride** '03,'04 Acetone '02,'04 Benzene '02,'03 Isopropylbenzene '01,'02,'03,'04 Chlorobenzene '03 1,3,5-Trimethylbenzene '01,'02,'03,'04 sec-Butylbenzene '01,'02,'03,'04 Methyl-tert-butl ether
MW-2R (south of Phase 1) NS after 1/18/01	**'00,'01 Iron** **'00,'01**	'00 1,4 Dichlorobenzene '00,'01 Benzene '00,'01 Chlorobenzene '00 Chloroethane '00 cis-1,2-Dichloroethene '01 Methyl-tert-butl ether
MW-3S Abandoned '97		
MW-4S Abandoned 1/17/95		
MW-5S (southeast) MW-5D	**Iron** **Manganese** ***Lead***	'00 Methylene Chloride '00,'04 1,1-Dichloroeth*ane* '01,'02,03 1,1-Dichloroethene '00, '01,'02,'04 Chloroethane '00, '01,'02,'03,'04 Benzene '02 2-Chlorotoluene '02 4-Chlorotoluene '01,'03 Toluene '01,'02 Acetone **'01 2-Butanone** '00,'01,'02,'03,'04 Chlorobenzene '01,'02 **'03 Vinyl Chloride**

		’01,’02 Ethylbenzene ’02 Isopropylbenzene ’01,’02 Benzene ’01 m&p Xylene ’01,’02 o-Xylene ’01,’02 Toluene ’02 1,2,3 Trichlorobenzene ’02 1,2,4-Trimethylbenzene ’02 1,2,3 Trichloropropane ’01,’02,’03,’04 1,4 Dichlorobenzene ‘00’01,’02,’03,’04,’05 methyl-tert-butl ether ’00,’01,’02,’3 cis-1,2-Dichloroethene TID 4/25/01 Chlorofluoromethane 1-chloro-1-fluoroethane Dichlorofluoromethane 1,2-dichloro-1-fluroethane
MW-6S (east) MW-6D	**’00-‘04 Iron** **’00-’04 Manganese** ***‘00 Lead*** ’04 Selenium ’00-’04 Barium	’00,’01,’04 cis-1,2-Dichloroethene ’02,’03,’04 Chlorobenzene ’03 1,2,4-Trimethylbenzene ’03 1,2,5-Trimethylbenzene ’01,’02 p-Isopropyltoluene ’01, ’03 m&p Xylene ’01,’02, ‘03 Ethylbenzene ’02,’03 ,’04 1,4 Dichlorobenzene ’01, ’03 0-Xylene ’01,’03,’04 1,1-Dichloroethene ’03,’04 sec-Butylbenzene ’01,’02’03 Acetone ’00, ’04 Benzene ‘00 Methylene Chloride

		’00,’01,’02,’03,’04 1,1-Dichloroethane **’00,’01,02,’03,’04 Vinyl Chloride** ’00,’01,’02,’03,’04 methyl-tert-butl ether ’01,’02,’03 Benzene ’01,02,03cis-1,2-Dichloroethene ’00,’01,’02,’03,’04 ’01 Isopropylbenzene TID 4/25/01 SD -Chlorofluoromethane S- 1-chloro-1-fluoroethane S- 2-methyl-1-protene S- 2-methyl-2-protene S- 2-Pentene S- Dichlorofluoromethane S- 1,2-dichloro-1-fluro-ethane D- substituted cyclohexane S- 4-heptanone S- substituted heptan-2-one SD- ether *S- Tetrahydofuran*
MW-7S (northeast)	**’00-‘04 Iron** **’00-’04 Manganese** ’00-‘04 Barium ‘04 Chromium ‘03,’04 Lead	’01 methyl-tert-butl ether
SW-1 Upgradient Muddy	**’00-’04 Iron** **’00-‘04**	

Brook	**Manganese** '01 Lead ***'02 Mercury***	
SW-3 Down gradient Muddy Brook	Iron Manganese **'01 Copper**	

PHASE 2 SAMPLING 2000-2005 - PIEZOMETERS

Sampling Locations Hardwick Landfill S - Shallow D - Deep B - Bedrock	Metals (mg/L) **Boldface** – exceeds standards of guidance	VOC -Volatile Organic Compounds **Boldface** – exceeds standards of guidance TID – tentatively identified
LOCATION		
PZ-8S PZ-8D PZ-8B South/East of Phase 2 Lined Expansion	**S, D, B – Barium** **S - Chromium** **S, D, B – Copper** **S, D, B – Iron** **S, D, B – Manganese** **D - Zink**	B- '03 Vinyl Chloride **B- '02 Benzene** '00,'02,'04,'05 S,D,B- methyl-tert-butl ether B - VOA TIC Methane, Chlorofluoro- Ethane, 1-Chloro-1-fluoro-
PZ-11S PZ-11D PZ-11B Midway - East of Phase 2 Lined Expansion	S, B '00-'04 Barium B '04 Selenium **S, D, B – Copper** **S, B '00-'04 Iron** **S, B '00-'04 Manganese** ***S - Lead*** **S, D - Zink**	BD-'00,'02 1,4 Dichlorobenzene **B-'03 Vinyl Chloride** B –'00,'03,'04 Benzene DB- '02,'04 Chlorobenzene SB –'00,'02 '03,'04 Chloroethane B – '00,'02,'04,'05 1,1-Dichloroethane DSB –'00,'01,'02,'03,'04,'05 methyl-tert-butl ether

		B - VOA TIC ’04 Methane, Chlorofluoro- Ethane, 1-Chloro-1-fluoro- S - VOA TIC ’04 1,2-dichloro-1-fluro-ethane
PZ-14B PZ-14S PZ-14D South/West of Phase 2 Lined Expansion - along Patrill Hollow Road	S,‘04 – Barium S ‘04– Copper **S ‘04 – Iron** S ‘04 – Manganese	SB-’00 methyl-tert-butl ether
PZ-16S – out ‘02 PZ-16D PZ-16B East of Phase 2 Lined Expansion – near equipment garage	**’00,’02 SBD– Iron** **’00,’02 SBD– Manganese**	DBS-’02 methyl-tert-butl ether D- ’00,’02 Benzene D-‘02 Chlorobenzene DB-’00,’02 Chloroethane DB- ’00 cis-1,2-Dichloroethene DB- ’00,’02 Isopropylbenzene D- ’02 Vinyl Chloride DB- ’00,’02 1,1-Dichloroethane
Inorganic Analysis – all wells	**Nitrate** **Chloride**	
SW-1	Barium, Manganese Iron	ND
SW-2	Barium, Manganese Iron	ND
SW-4	-	-
SW-5	Barium	**ND**

down stream of Muddy Brook	Iron Manganese	

10.2 HARDWICK POND ANALYTICAL DATA – VOCs & METALS

Date	Hardwick Pond HP-1 - Inlet	Hardwick Pond HP-2 - Outlet
2000		
2001		
2002		
2003	Manganese Iron	Methyl-tert-butyl-ether Toluene
2004	Methyl-tert-butyl-ether **Lead** Manganese Iron	Methyl-tert-butyl-ether
2005	Manganese Iron	

10.3 LEACHATE & UNDERDRAIN (BETWEEN LINERS) VOCS & METALS

Date	***Leachate – Hardwick Landfill Phase 1 & 2***	***Leachate Gilbertville Treatment Plant***
	Metals	***VOCs***
2001	Arsenic Barium Cadmium Chromium Copper Lead Mercury	Ethylbenzene Methyl-tert-butyl-ether o-Xylene Toluene 1,2,4-Triethylbenzene

	Nickel Selenium Silver Zinc	
2002		
2003		Methyl-tert-butyl-ether Toluene
2004	Arsenic Aluminum Iron Barium Cadmium Chromium Copper Manganese Zinc Lead	Acetone Chloroethane Toluene 1,1-Dichloroethane 1,4 Dichlorobenzene cis-1,2-Dichloroethene **Methyl-tert-butyl-ether** **2-Butanone** (MEK) Trichlorofluoromethane – Freon 11 Methylene Chloride p-Isopropyltoluene o-Xylene m&p-Xylene Tetrachlorethane 1,1,1 Tetrachlorethane Trichloroethene (TCE) 1,1,1 Trichloroethene VOA YIC 1,1-dichloro-1-fluroethane Ethane, 1-Chloro-1-fluoro Methane, dichlorofluoro- Silanol, trimethyl-
2005		
	Phase 2 Liner	***Underdrain***
2003		Methyl-tert-butyl-ether Tentatively Identified 3/24/03 Methane

		Chlorofluoro-Ethane 1-chlorofluoro-Ethyl Ether
'04- '05	NS NS	Station dry Station dry

10.4 CONTAMINATED SOILS AS COVER AT HLI

DEP APPROVED AS BENEFICIAL USE

SITE ORIGINATION	DATE & AMOUNT	CONTAMINANTS
#1 N. Londonderry Exxon, Londonderry NH	8/7/03 600 Tons 3 stockpiles sampled	Arsenic - nd – 7.52 ug/Kg Cadmium – nd -1.6 Chromium – 11.3 -13.0 Lead – 153 – 233 Mercury – nd – 0.781 Total Petroleum Hydrocarbons (TPH) 78.5 – 201 PCBs – nd – 1.501 SVOCs 2.246 – 23.951 VOCs – nd – 0.166 TCLP Lead – 0.695 – 1.96
#2 Atlas Die, LLC Bondsville (Palmer) MA	11/24/03 300 Tons 3 stockpiles sampled	Chromium – 9.88 mg/Kg Total Petroleum Hydrocarbons (TPH) - 49.7

#3 First Street Pump Station #5 Palmer, MA	2/2/2004 100 cubic yards Composite samples	Arsenic – 1.3 ppm Cadmium – <0.44 Chromium – 12 Lead – 6.5 Mercury – <0.08 Total Petroleum Hydrocarbons (TPH) 350 PCBs – 0 SVOCs - 0 VOCs – 0
#4 Rte. 146 Relocation Project Millbury/Worcester, MA	5/27/2004 7,000 cubic yards Multipoint composite samples	Arsenic – 9.76 -20.6 Barium – 21.7 – 122 Cadmium – nd – 5.42 Chromium – 13.1 – 27.4 Lead – 11.2 - **741** Mercury – nd – 0.73 Total Petroleum Hydrocarbons (TPH) 93 - 980 PCBs – 0 SVOCs – 0 – 2.97 VOCs – 0 – 22.7
#5 Mass Bay Transportation Authority Malden Center Commuter Rail Service Malden, MA	6/15/2004 750 cubic yards 3 multipoint composite samples	Arsenic – 4.5 – 6.53 ppm Barium – 35.8 – 46.1 Cadmium – < 0.5 Chromium – 18.3 – 24.5 Lead – 44.9 – 107 Mercury – <0.10 – 0.59 Total Petroleum Hydrocarbons (TPH) <50 - 200 PCBs – 0.4 SVOCs 5.98 – 18.16 VOCs – <0.19 - <32.- 3.8
#6 Corner of Main & Appleton Streets Holyoke, MA	1/03/2005 40 tons	Arsenic – 2.7 mg/Kg Cadmium – 0.67 Chromium – 16

	Composite soil sample	Lead – **440** Mercury – 0.1 Total Petroleum Hydrocarbons (TPH) <50 - 200 PCBs – <0.11 SVOCs 1.19 VOCs – nd
# 7 NLWS Water Treatment Facility 120 Malden Street Boston, MA	4/18/2005 1,000 cubic yards 2 samples 1/500 cy	Arsenic – 7.9 & 8.06 ppm Cadmium – nd Chromium – 27.8 & 24.2 Lead – 8.9 **& 7.2** Mercury – nd Total Petroleum Hydrocarbons (TPH) 160 & 210 PCBs – nd SVOCs .53 & .94 VOCs – nd

Note: All materials suitable for use in accordance with requirements of DEP Policy #COMM-97-011 for disposal at a lined landfill.

10.5 CONSTRUCTION & DEMOLITION (C&D) FINES USED AS COVER AT HLI

DEP APPROVED AS BENEFICIAL USE

SITE ORIGINATION	**DATE & AMOUNT**	**CONTAMINANTS**
Southbridge Recycling and Disposal Park Southbridge, MA	2/25/2005 3 composite piles sampled	Arsenic – 4.0 – 4.5 mg/Kg Cadmium – U(0.35 – 0.36) Chromium – 10 - 16 **Lead – 230 - 550**

		Mercury – 0.46 – 0.53 Total Petroleum Hydrocarbons (TPH) 500 - 600 SVOCs 7.2 - 24

Note: All materials suitable for use in accordance with requirements of DEP Policy #COMM-97-011 for disposal at a lined landfill.

10.6 CONSTRUCTION & DEMOLITION (C&D)

The Third Party Asbestos Inspection Report, dated 3/3/2005 did not detect the presence of asbestos in the Construction and Demolition waste at the Southbridge Recycling and Disposal Park, Southbridge, MA.

10.7 ANNUAL SOLID WASTE FACILITY REPORT

The Hardwick Landfill operated during all of 2004 and was open 255 days in 2004. HLI received 60,505 tons of MSW from Massachusetts, 21,120 tons of C&D Waste from Massachusetts and 1,169 tons from the state of New Hampshire in the course of the year, for a total of 82,797 tons of waste in 2004. The Town of Hardwick contributed 773 tons to the waste stream. There were 17,911 tons of C&D Fines used as cover material; 6,355 tons of Contaminated Soil; 420 tons of Paper Sludge and 5 tons of Ash used as cover in 2004. There are 24.8 acres of that remain uncapped. Zero acres were capped in 2004. Leachate is trucked off-site. Approximately 4,978,432 gallons of leachate was collected from Phase 1 and Phase 2 in the course of the year. The leachate was trucked off-site to the Ware and Gilbertville Wastewater Treatment Facilities.

Prior to the startup of Phase 2, in the year 1999, Phase 1 received 6,756.52 tons of MSW and 41,170.94 tons of C&D Waste, which totaled 47,927.46 for the year. In 2000, there was 5389.46 tons of MSW received at the facility and 32,468.89 tons of C&D Waste, for a total of 37,858.35 tons for the year 2000. In 2001, the landfill operated until July collecting 2,342.01 tons of MSW and 19,581.52 tons of C&D Waste, for a total of 21,923.53 tons of solid waste for the year. At that point, the landfill had reached total capacity for Phase 1.

10.8 LANDFILL GAS COLLECTION SYSTEM

HLI received a Major Modification Permit on March 15, 2005 to operate a Landfill Gas Collection and Treatment System. The purpose of the system is to extract landfill gas from the landfill, and to transport the gas to a landfill gas flare station. Most documentation regarding federal regulation states that the flare combustion temperature shall be maintained at a minimum of 760 degrees Celsius or 1400°F or greater, averaged over a three hour period. However, the flare has been operating at a low of 808 °F on 4/29/05 to a high of 1156 °F on 3/24/2005.

The permit issued by MDEP does not specify a temperature for the flare. I would strongly recommend that the BOH contact the MDEP and an independent consultant to discuss this and other issues associated with the system. For example, according to the EPA, "Some of the conditions that are conducive to dioxin/furan formation are the combustion of organic matter in the presence of chlorine and particulate matter under certain thermodynamic conditions such as low combustion temperatures and brief combustion times."

11.1 CHEMICALS OF CONCERN

TCE or vinyl chloride

"TCE or vinyl chloride can pass through intact flexible membrane landfill liners as well as compacted clay liners, and be transported to the groundwater." Though the most recently installed double Flexible Membrane Liner (FML)/Geomembrane Liner and Geosynthetic Clay Liner (GCL) may be less vulnerable to penetration, the Phase 1 liner was of an earlier construction and may be more susceptible to leakage due to a variety of factors.

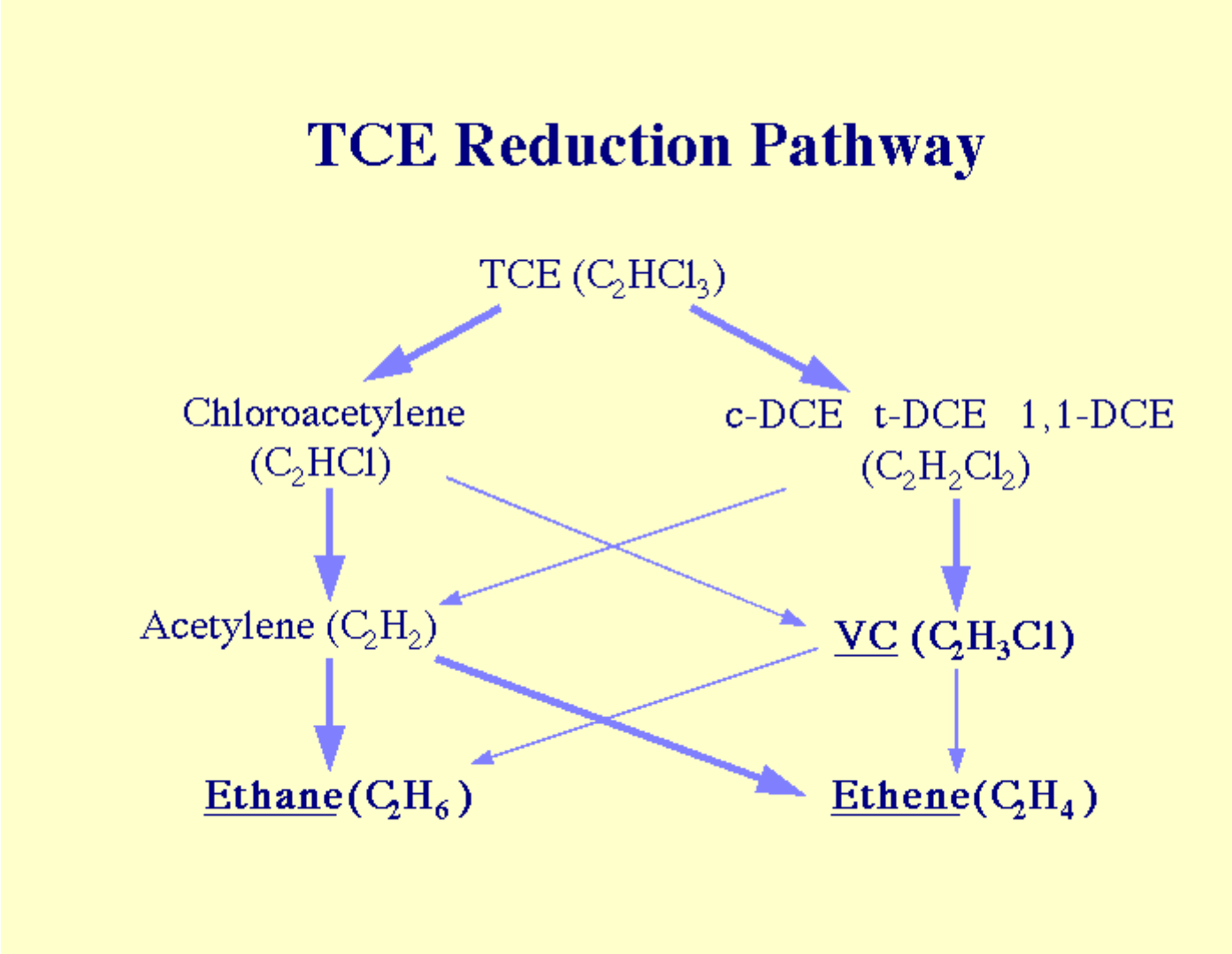
Vinyl chloride was detected in groundwater in the unlined portion of the landfill (MW-4S) later covered by a liner in the Phase 1 expansion. It was also found to exceed groundwater standards in the first piezometer readings in 1999 (PZ-16D) traveling as far as the equipment garage and is still

detected at various locations. Trichloroethene (TCE) was found early on in MW-1S in 1993 has been found in 2004 leachate results.

Trichloroethene (TCE) is not degraded in the landfill to innocuous products; rather there is a high probability that it will be converted to vinyl chloride in the landfill environment.

“If present in sufficient amounts, conventional contaminants can cause severe degradation of groundwater quality and preclude its use for domestic water supply purposes. For example, organics measured as BOD, COD, or TOC can cause taste and odor problems and oxygen depletion in the groundwater. The chemicals that comprise those parameters may also adversely affect public health. Some of those organics can serve as co-substrates for microorganisms that can facilitate the conversion of hazardous chemicals to even more hazardous forms.

An example of the latter is the conversion of TCE, a suspected human carcinogen, to vinyl chloride, a highly potent, known human carcinogen. The contamination of groundwaters by municipal landfill leachate contributes to the anoxic (oxygen-free) conditions that promote the conversion of TCE to vinyl chloride. Under anoxic conditions, bacteria in groundwater systems convert TCE to vinyl chloride.” ***“Jones-Lee, A. and Lee, G. F., 'Groundwater Pollution by Municipal Landfills: Leachate Composition, Detection and Water Quality Significance,' Proc. Sardinia '93 IV International Landfill Symposium, Sardinia, Italy, pp. 1093-1103, October (1993). [47k]”***)



TCE Chart: Prof. Pei Chiu, Department of Civil & Environmental Engineering, **University of Delaware**

Methylene chloride/Dichloromethane

Methylene chloride, also called dichloromethane, is a volatile, colorless liquid with a chloroform-like odor which was found both upgradient and down gradient of the Phase 1 unlined landfill.

According to OSHA, methylene chloride is used in various industrial processes in many different industries including paint stripping, pharmaceutical manufacturing, paint remover manufacturing, metal cleaning and degreasing, and so forth. The most common means of exposure to

methylene chloride is inhalation and skin exposure and through drinking contaminated water. Methylene chloride is mainly released to the environment in air. About half of the methylene chloride in air disappears in 53 to 127 days. Exposure to methylene chloride carries health risks.

12.1 ISSUES OF CONCERN

2000 – 2005

GAS EXCEEDANCES

Location	Date	Methane (%CH4)	**Combustible (% LEL)**
MW-1S west (along Patrill Hollow Road) DEPTH 25 feet	**1/3/00** **7/26/00** **1/18/01** **7/24/01** **10/29/01** **1/10/02** **4/17/02** **7/11/02** **8/22/02** **11/21/02** **3/24/03** **6/26/03** **9/28/04** **12/16/04**	**23.40%** **40.30** **23.10** **39.80** **68.2** **1.90** **27.8** **60.10** **60.00** **60.00** **34.50** **33.40** **50.20** **63.70**	**486.00%** **848.00** **>100** **>100** **>100** **28.00** **>100 (478)** **>100** **>100** **>100** **>100 (554)** **>100 (670)** **832** **>100**

SG-1	**12/16/04**	2.70%	54.00%
GW-3			
	4/05/01	**51.90%**	**>100%**
Phase 2	**10/29/01**	**61.30**	**>100**
Upgradient	**1/10/02**	**59.50**	**59.30**
West by	**4/17/02**	**55.00**	**>100**
Patrill Hollow	**7/11/02**	**54.10**	**>100**
Road	**8/22/02**	**56.90**	**>100**
	11/21/02	**62.10**	**>100**
Between			
Cell2A	**3/24/03**	**58.00**	**>100**
& Cell2B	**6/26/03**	**59.00**	**>100**
	9/28/04	**61.70**	**>100**
	12/16/04	**62.00**	**>100**
	3/22/05	**51.60**	**>100**

12.2 MONITORING FOR CHEMICALS & METALS

Though the DEP has approved the landfill as a predominantly C&D landfill, leachate would indicate that many contaminants are being disposed of along with the refuse. According to a Tighe and Bond inspection report dated December 5, 2003, "Alternative daily cover materials are used including C&D (fines), petroleum contaminated soils in accordance with MDEP Policy #COMM-97-001, and earthen material from local construction projects."

The VOC-Metals Chart 2000-2005 outlines the chemicals of concern associated with contamination from Phase 1 operation of the Hardwick Landfill. Phase 2 areas of concern are outlined in the list of chemicals found in the leachate. Though these chemicals may not be leaching into the groundwater, they may become airborne (including pulverized lead particulates) and impact the ambient air quality on and off-site.

12. 3 VIOLATIONS, NON-COMPLIANCE, AND OTHER AREAS OF CONCERN

6/25/2002
DEP email regarding unauthorized construction.

8/12/2002
DEP interoffice email regarding possible need for risk assessment and concern about past groundwater contamination.

August 2002
Attorney General - Authorization to Operate Suspended. HLI Fined $175,000 by the Commonwealth for constructing prior to the granting of all necessary permits and ordered to hire a qualified engineer to inspect and audit the Phase II expansion on the landfill.

9/25/2002
Letter from HLI/Roach family to Office of the Attorney General offering a defense for their actions regarding premature construction of the Phase 2 portion of the landfill.

1/17/03
DEP observed 10 cubic yards of municipal solid waste illegally disposed on the closed portion of the Hardwick Landfill.

9/30/04
"Deficiences observed. Significant landfill gas that owner associates with paper fiber sludge they're mixing with dirt for cover. Today is the last day they will be taking in any of the paper fiber. Other sources of odor like C&D fines are suspected…" Steve Bergstom/Molly Hack – DEP Inspection Summary

10/3/04
The HLI received a notice of Enforcement Conference letter from John Regan, Section Chief, Solid Waste Management Program of the DEP in regard to an inspection conducted by Department personnel at the landfill on 9/30/04 pertaining to issues of non-compliance.

1) During the inspection, two air conditioners, a television set and tires were observed to be buried in the compacted trash.

Accepting the restricted trash for disposal is a violation of 310 CMR 19.017 (3).

2) During the inspection, significant damage and erosion to the sand drainage layer on the western and southern slopes of the operating cell of the landfill was observed. The failure of the owner/operator of the landfill to adequately control ponding adjacent to the landfill and control storm water flow and minimize run-on of stormwater into the operating cell of the landfill is a violation of 310 CMR 19.130 (19) (a).
3) During the inspection excessive odors were detected on the operating face of the landfill and off the landfill site. The failure of the owner/operator of the landfill to control the odors is a violation of 310 CMR 7.01.
4) Review of records subsequent to the inspection revealed that the owner/operator does not possess a NPDES stormwater discharge permit. The failure of the owner/operator to obtain a NPDES discharge permit constitutes a violation of the Massachusetts Clean Waters Act, M.G.L. c. 21, 26-35 and the Departments surface water regulations 314 CMR 3.14 CMR 3.04(2)(a), and the Federal Clean Waters Act, 33 U.S.C. 1251 et seq, and the National Pollutant Discharge Elimination System Permit Regulations at 40 CFR Part 122.
5) The failure of the owner/operator to obtain a NPDES multi-sector general stormwater permit for the discharge of stormwater from the landfill is the violation of a permit condition specified in Section III General Permit Conditions 3. (Compliance with other Approvals) in Permit #W027925 Authorization to operate approval issued to the landfill on March 4, 2003; and specified in Section III General Permit Conditions 2. (Compliance with Other Approvals) in Permit# W041069 Major Modification issued on March 19, 2004. This failure is considered a violation of 310 CMR 19.043 (5)(a)1.
6) The failure of the owner/operator to submit an Active Landfill Gas Extraction and Flare System Plan to the Department as specified in Section IV Specific Permit Condition 3. (Gas Migration Prevention Measures) of Permit #W041069 Major Modification approval is also considered a violation of 310 CMR 19.043(5)(a)1.

12/9/04
Hardwick Landfill, Inc. letter to Board of Health regarding request from Hardwick residents Larry and Katie Crockett for additional information about leachate treatment. The response letter summarizes the steps taken to treat leachate in the Town of Hardwick.

3/7/05
DEP Email Update to Hardwick BOH

From: "Regan, John J. \(DEP\)" <John.J.Regan@state.ma.us>
Date: Mon, 7 Mar 2005 09:02:01 -0500
To: <Larry4@comcast.net>
Cc: "Bergstrom, Stephen \(DEP\)" <Stephen.Bergstrom@state.ma.us>, "ORourke,
Thomas \(DEP\)" <Thomas.Orourke@state.ma.us>
Subject: Hardwick Landfill

Larry, As we discussed this AM, the Department has implemented the following measures in regards to the Hardwick Landfill Inc.(HLI)/ Casella Waste Systems:

1. On 3/1/05 the Department executed an Administrative Consent Order with Penalty with HLI. The terms of this order require:
A. Revision of existing Waste Ban Compliance Plans.
B. Development of a Storm Water Management Plan.
C. Development of an Odor Mitigation Plan - this plan is to incorporate the construction of an active gas collection system.
D. Payment of an $18,000 penalty.

2. On 3/2/05 Department representatives met with Casella senior management to discuss several Casella facilities including HLI. Casella Management was informed by our Regional Director that odors from the Hardwick facility are unacceptable and HLI is enjoined to implement any and all measures to mitigate odors at the facility.

3. Approximately two weeks ago, HLI commenced use of coal ash at the facility subsequent to receipt of necessary approvals from the Department and Town.

4. In the past month, the Department has approved the use of temporary flares at the facility. The installation of these candlestick flares does not suffice to meet the requirement noted in 1C above but are to serve as a best management practice to ameliorate LF odors in the interim. The Department anticipates receipt of an Air Quality application this week, detailing the plans for the active gas collection system.

5. It should be noted that Casella has continues to proactively cooperate with the Department in regards to Hardwick Landfill issues. They are in near daily contact with our Air Quality and Solid Waste staff.

3/15/05
Hardwick Landfill Gas Collection System (BWP SW 11) Major Modifications Permit granted. (Appendix E)

12.4 EXCERPTS FROM "LANDFILL MONITOR'S JOURNAL"

10/25/04
9:00 AM Overcast. Inspected the landfill cell with binoculars. Predominantly white cardboard I suspect but there is also a strong odor – possibly sulfur and/or chemical smell along with the rubbish odor. I walked up the liner edge of cell 1 to the leachate area. Once again there is an oily sheen to the puddle areas plus a strong odor of gas.

10/27/04
Board of Health meeting
Reported discovering a leachate breakout along the southern edge of Phase 1 capped area spilling onto the exposed liner. Additional leachate breakouts were noted along the eastern slope between Phase I and 2 along the liner and springing out from within the exposed soil area. Casella responded by bringing in engineers and plugging the areas with an impervious soil mixture.

In a Landfill Inspection Report filled by Tighe & Bond on June 1, 2003, it was noted, "minor iron staining was observed on the external slopes of the Phase 1 area. The staining appears to be the result of iron oxides from the intermediate cover materials applied on Phase 1." However, on closer

inspection, an oily substance was floating on the surface of puddled waters with the tell tale gas odor indicating it was indeed leachate.

Photos and a color-coded map were supplied to the BOH.

11/22/04

9:00 AM Strong odor of gas as you approach the landfill on Patrill Hollow Road. It is almost overwhelming at site near barn overlooking the landfill as well as the entire length of the road along the top of the ridge.

12/3/04
12:15 Conducted site inspection of the retention area below site 1. No leachate is visible in the muddy water and no leachate outbreaks are visible along the east side of the slope. But there is a slight odor of methane gas.

12/12/04

1:00 PM Drove to the area close to the n/w leachate outbreak and investigated. Walked up to the freshly capped area where gas odor is and some leachate visible.

1/11/05
10:30 am – As I drive along Patrill Hollow Road past the weigh-in station, a strong odor of gas permeates the valley.

1/21/04
10:30 Near transfer bins. A strong smell of gas permeates the air.

1/22/05 (Saturday)

8:00 AM. Below zero. Overcast sky, few birds in sight.

.9 miles from the landfill along Patrill Hollow Road, a faint odor of gas is present.

11:00 Seagulls have begun to amass by the landfill open cell and both bins are full to overflowing. The metals bin and overflow area are also badly in need of being carted off.

Because so many seagulls are now overhead, I traveled up to the newly created access road off of Cell 2 A to check if any new household trash has been illegally dumped in either Cell 2 a or B. Both appear to be clean of fresh trash though perhaps not as well compacted as in the past. Meanwhile I am forced to relocate because the gas is so strong I am beginning to feel dizzy

1/25/05

9:30 There has been a steady stream of traffic. The road is extremely treacherous and the gas odor is evident about .5 miles from the south-western edge of cell B.

10:30 An SUV dumps at the dumpster as I move up to the overlook spot – nearly overcome with methane gas fumes.

3:00 Bucket loader compacting down transfer bins, tapping down MSW and other items. The area is with saturated with a gas odor.

2/2/05

Corresponded with the BOH and Mark White about the meeting and other issues such as the gas odor that is traveling along Greenwich Road.

2/3/05

It is crucial that the BOH do all in its power to require that Casella alleviate conditions at the landfill that are creating gasses that are spreading to homes along Patrill Hollow Road, Greenwich Road and beyond. The DEP must be notified too. Fumes are inhaled by workers and residents alike as well as trash haulers and residents dropping off their trash. Though short term inhalation may not be a serious problem, there may be long-term health impacts for residents. I am particularly concerned about children and pregnant women who might be subjected to these gases on a frequent basis.

2/4/05

Letter from John Farese of HLI to the BOH regarding the use of coal ash and monitoring the ambient air quality along Patrill Hollow Road on a weekly basis until the active landfill gas system is operating. “As you are

aware we are continuing to work with the town to obtain approval to relocate Patrill Hollow Road enabling us to relocate the waste in that area and install a collection trench to eliminate potential gas migration."

2/5/05 (Saturday)

7:00 AM

Strong gas odor. Clear, 20s, a few gulls, crows and small birds present. Trucks enter and dump in the dumpster as the excavator continues to work on the metals pile.

2/8/05
11 AM – High 30s to low 40s. Overcast with a strong gas odor. The weather forecast calls for a storm starting tomorrow night and into Thursday. 8 – 12" predicted. The landfill is quiet.

6:30 BOH Meeting

T&B and residents discuss odor migration. I presented map and gas stats of 100% combustibles with T&B reversal of info where east is labeled as west. The 100% combustibles were reading along Patrill Hollow Road not at the eastern section of the site from 01 – 03. Though presently the eastern section gases are also present and pose a hazard as sign indicate.

Casella rep discusses the odor and possible solutions including a flare and gas collection system as well as the use of coal ash to absorb the odor (carbon in coal)

I mentioned possible residuals within the ash including heavy metals which could become airborne.

2/9/05
11:15 Scott walks to the gas outlet S/E outside of cell 2B checks for odors. There is a strong smell by the dumpsters. Though trucks and cars have been dumping into the bins today only one bin has a small amount of trash visible. However debris litters the ground outside the bin including the pizza boxes from last week.

Saturday, February 12, 2005

8 AM – Grey, overcast, low 30s. The landfill was well covered with soils following the snow storm. Tom and Jim mark air conditioners as a pick-up and SUV exit the bin area. Strong gas smell by the office.

2/14/05
1:50 PM Driving from the upper edge of the landfill along Patrill Hollow Road I noticed gas starting at the new access road entrance – the odor was evident all the way to the office area but seemed to let up as I approached the dumpsters.

2/18/04
12:45 pm The bulldozer pats down the access road. Odor of gas is up gradient of the site.

2/24/04

BOH meeting.

7:00 Rick from Casella explained issues pertaining to toxicity of the ash which will be mixed with cover material and used to absorb landfill gas odors.

30-50 people present – many complaining about the gas odor at and in their homes and how it makes them feel sick and their eyes water from the gas. They are concerned about the public health impact of the gas.

Casella's spokesperson explains that "bugs" digest the debris and this helps create the gas and that other gases (VOC) can travel with the methane and hydrogen sulfide.

One resident complains that the gas travels in the early morning up to Main Street.

It was explained that cover soils are no longer fresh loam. Nothing is virgin anymore, Rick explained. Approved contaminated soils are used as daily cover. A Licensed professional tests these soils and evaluates them for suitability.

The state approves the list of VOCs and heavy metals that are allowed into the landfill. Then Casella reviews the soils data for further approval.

One of the neighbors to the landfill claimed that his house is invaded by the gases.

When asked about the monitoring system that only monitors for one gas, it was explained that to monitor for more than one gas would be too expensive. Some residents felt that monitoring stations should be set up around the town so that people can be alerted if things reach a level dangerous to health and safety.

Bill Zinni claimed that 5 ppb were sampled last Friday.

Others claimed that the gases are floating along Muddy Brook and hitting the pond.

Kevin said that there were excessive odors September 30th and they were cited for failing to submit an active plan.

February 23, Casella began testing for H2S hydrogen sulfide gas along Greenwich Road, Patrill Hollow Road, Muddy Brook Road and along the perimeters of the landfill.

FOR THE COMPLETE REPORT SEE:

ENVIRONMENTAL MONITOR'S JOURNAL

OCTOBER 12, 2004 – JUNE 21, 2005

BY GENEVIEVE CORA FRASER

3/11/2005

Hardwick landfill is fined $18,000

By James F. Russell Correspondent

"HARDWICK— The state has fined Hardwick Landfill owner Casella Waste Systems Inc. $18,000 and told the company daily fines up to $1,000 could ensue should Casella fail to correct problems at the Patrill Hollow Road waste site.

The company was ordered to pay the fine within 30 days of a consent order, which was issued March 1 by the state Department of Environmental Protection.

The order found that the company failed to control odors on the operating face of the landfill and off the landfill site and failed to submit an active landfill gas extraction and flare system plan to control odors.. A rotten egg-like stench caused by hydrogen sulfite gas has permeated west Hardwick and Ware along Greenwich Road. The smell has some residents saying the landfill must cease operations.

Casella is expected to gain permits and begin constructing the flare system late this month, DEP said.

A Casella engineer told the Hardwick Board of Health last month, "We should have the system up and running mid-March at the latest."

The state declined to venture a guess when the gas extraction system might become operational. Board of Health Chairman Lawrence Ostiguy said the full board would review the DEP order.

The consent order says Casella received restricted material at the waste site, failed to control stormwater flow and failed to adequately control ponding adjacent to the landfill.

Enforcement action begun in October by the state resulted in Casella hiring an additional waste inspector to prevent banned items from entering the landfill, training current staff to recognize banned waste materials and engineering action to stem water runoff problems, DEP said.

The order requires that Casella pay administrative penalties of up to $1,000 per day if it violates the consent order or fails to correct problems at the Hardwick landfill. The landfill has DEP permits to accept 82,800 tons of trash per year.

Casella operates the Southbridge landfill and hopes to open a landfill in Templeton some day."

12.5 RESIDENTS VOICE CONCERNS

The Board of Health has received a number of letters during Winter/Spring 2005 complaining of the odors and concerns over the long-term impact on the health of residents. A letter from Erin Roy expresses concern for the health of one of her sons who has been diagnosed with a rare disease that is typically the result of exposure to certain chemicals in the environment. She states that she has smelled odors emanating from the landfill for about 3-4 years.

Appendix F

13.1 HARDWICK RECYCLING PROGRAM

The Hardwick Recycling Program has been instrumental in reducing locally generated waste bans from entering the waste stream at the Hardwick Landfill.

A BRIEF HISTORY OF RECYCLING IN HARDWICK
By Linda Paquet

(This report has been put together from past Town Reports and my personal recollection of events that occurred. I did not go through 15 years worth of files but they do exist should anyone challenge the material herein.)

- 1988 – 1990 The initial activity was very much a grass roots effort, not really Town associated. Eventually the Recycling Commission was appointed with the task of establishing a recycling program for the Town. Three major goals were to do the environmentally correct thing, reduce the amount of solid waste disposal, and work toward compliance of the MA State mandate on recycling (310CMR, 18.00-21.00). Material was collected in town trucks on Saturday mornings behind the Town Barn and then taken to Wheelwright and stored in a building owned by the Hardwick Farmer's Coop. At some point a roll-off was purchased for #2 plastics and eventually all the stored material was loaded onto trucks by volunteers and shipped to a paper mill. During this time, the thrust was to find a permanent site. The town appropriated $940 for recycling containers and trucking costs!

- 1991-1993 Town meeting established an Enterprise Fund for the Recycling Program and approved the transfer of annual tipping fees from

the landfill to the fund. These funds were to be used for operating expenses and future development. In December, the program was moved to Wheelwright to a building owned by the Farmers Co-op…rent-free, but the town paid insurance and maintenance. Behind the scenes work included a new roof, floor and painting the exterior of the building. We acquired a used truck and 2 plastics grinders and began collecting plastics from other towns. We also purchased a glass grinder and a baler. All the material was collected and processed by volunteer staff and Quabbin seniors fulfilling community service projects. The center was opened to New Braintree residents; a few very dedicated volunteers came from New Braintree. A bag and tag program was established with the landfill for municipal solid waste. The Commission became members of the South Central Recycling Association of Massachusetts (SRAM). As often happens, a small nucleus of people carried the organization and it was becoming difficult to recruit new volunteers. It was becoming obvious that we would have to hire part-time staff. There was pressure from the DEP to achieve progressively higher recycling rates to support the state Master Plan for Waste Management.

- 1994 We received our first DEP grant of a 40-yard roll-off, a recycling chart sent to all residents, a technical assistance grant to aid in finding a new site, and recycling bins for each classroom in the elementary school, municipal building and post offices. We began picking up recyclables at all of these sites. We also sponsored the town's first Hazardous Waste Collection, a huge success. We hired our first supervisor. We stopped collecting plastics from other towns, but continued to grind our own material.

- 1995 More grants from the DEP. We sponsored a recycling program for all Hardwick and New Braintree children in grades K through 4 and arranged for a HHW exhibit at the Hardwick Fair. We started taking #1-#3 plastics and no longer required residents to separate newspapers. We also started accepting tires, batteries and oil filters.

- 1996 We began the chore of trying to establish a regional recycling center. We spoke with Petersham, Oakham and New Braintree select boards. Although everyone said they supported what we did and would like to become partners, these towns would not appropriate any funds to the operation. It became obvious that a regional program would not work and we began to look for a site just for Hardwick residents. We

increased hours of operation and started collecting appliances. We sent a newsletter home with all elementary school children. We arranged and paid to have approximately 24 tons of scrap metal and debris removed (and recycled) from the gravel area in Wheelwright, a site we had considered for the new center. We continued to search for and ultimately eliminate several sites for a new station. A used book program is established at the center by a high school student as part of a girl scout project.

- 1997 Our recycling rate as reported by the DEP was 24%. DEP's goal was 46% by 2000. We attempted unsuccessfully to establish "Buy Recycled" programs in the schools and town offices. We began negotiation with Hardwick Kilns to purchase the former "Scoops" garage and adjoining 26 acres. We received HHW and waste oil collection equipment through a state grant and trained our staff in the handling of paint and hazardous materials. We worked with the schools to collect textiles in conjunction with Massachusetts Recycled Day. Proceeds of the program went toward the Nature's Classroom fund-raising project. I think this was the year that town meeting vote took away the tipping fees that had previously been awarded to our enterprise fund. We did however establish a construction fund of $150,000 from funds already in the Enterprise Fund.

- 1998 A newsletter is mailed to every household. The selectmen take over the negotiation and purchase of the Scoop's property. Plans are drawn and approved by Conservation Commission. The book program is taken over by a permanent volunteer.

- 1999 saw a lot of frustration as we just couldn't seem to progress much toward moving into the new center. Delays in remediation of the contaminated soil behind the building and the excavation of the site extended the move-in date. However other improvements went forward. We received a grant to construct a pole barn to house our "Swap Shed" and storage area of excess construction material. We began searching for used compactors and a fork lift truck.

- 2000 Remediation of contaminated soil from behind Scoop's garage was completed (or so we thought). The site and access road was cleared, excavated and graded. A concrete pad and retaining wall was constructed. Equipment was purchased and delivered. Electrical service,

including new poles, was installed. All this came about through the persistence of a lot of volunteers and the donated time and equipment from some great people! Thanks to John Samek for hauling away stumps; to Robinson Lumber for purchasing, delivering and placing the recycled concrete blocks that make up the retaining wall; to Mike Howe and the Highway Department for implementing a drainage system and grading the access road; to Tom Couture of Tighe & Bond for constant consulting and problem-solving; and to Norma Roach. Hardwick Landfill contributed all manpower and equipment used in the excavation of the new site and the remediation of the contaminated soil behind Scoops. Without these folks, this project would have cost the town additional tens of thousands of dollars. Tom Couture was my constant "ear" for several years, always available to me at no charge to help in decision and encourage me through the process. Aside from our regular services, we conducted another HHW collection this year and hired another staff member.

- (I'm not exactly sure, but sometime in this timeframe, the DEP changed their target goals sadly, realizing that recycling efforts would not eliminate the need for increased landfills.)

- 2001 Construction continued. The site was graded, a concrete pad poured, electricity installed, and the dock constructed. We planted shrubs – one for each person who donated time or equipment to the project. We moved in December and had a wonderful opening ceremony attended by Senator Brewer and Rep. Ann Gobi, as well as Peggy Harlow from the DEP. We sponsored our 4th HHW collection. We began to charge a $75 annual fee to non-residents (from Ware, New Braintree and Oakham) and average between 50 and 60 sticker sales annually.

- 2002 It didn't take long for the center to become the place to go on Saturday mornings. Our "Swap Shed" is a huge success, as is the Book Exchange. Bring an item… take an item… you never know what treasure you'll find in our barn! Aside from regular recyclable material, we take waste oil, household batteries, clothing, eyeglasses and fluorescent bulbs at no charge. And for reasonable fees, you can bring us your appliances, tires, electronics, automotive batteries and oil filters on a weekly basis. You will need a sticker to enter, but they are free to all residents… just drop by the office during open hours: Saturdays 8 – 1 pm and Wednesdays 9 – 11. With a sticker, you can also attend several

annual regional Hazardous Waste collections in North Brookfield." To summarize, we recycled over 162 tons of paper, plastic, glass and tin, collected vast amounts of hazardous materials that your haulers won't take, provided part-time jobs for three great and very helpful employees and did it all for less than $25,000 annually.

- 2003 Several new and innovative programs were started. We collected mercury thermometers and gave back free digital thermometers, one for one. The cost was covered in full by a Department of Environmental Protection grant. Hands Across the Water is a literacy program that collects books from individuals, schools and libraries, and sends them to developing nations for use by children and adults. The center had to purchase a sea container in which to store the books and did so with set-up funds for the center. All kinds of books are acceptable, including children's, textbooks, fiction, etc. The only requirement is that the books be packed in boxes with closed tops so that they are easily stacked. When the container is full, the contents will be added to books collected at other sites and shipped overseas. As Household Hazardous Waste collections have become extraordinarily expensive for small towns to sponsor, and as we have had several collections over the past few years, we decided to join a regional collection program in North Brookfield. Two collections are held at the North Brookfield Recycling Center each fall and spring. Hardwick residents can and did take advantage of this service for a fee of $20 for up to 5 gallons of normal HHW and $40 for up to 10 gallons. The Swap Shed continues to be a most popular program and the place to meet and catch up with your neighbors on Saturday mornings. Good articles barely make it into the barn before being "scooped" up! Again for less than $25,000 per year!

- 2004 A few minor services were added. We now accept cell phones and printer cartridges, and had a very successful one-day scrap metal collection last fall. We also participated in two regional hazardous waste collections in North Brookfield. The major thrust for recycling this year was to represent our interests on the Landfill Advisory Committee. Linda Paquet was a member of the LAC and has consulted with the Host Community Agreement Negotiating Team on recycling issues. We were persistent in making sure that the program stays at the site in Wheelwright because we felt that we could and would provide much more user-friendly services than could ever be provided at the landfill. Both Casella and the landfill operators are very supportive of what we

do. Our program will be enhanced with the signing of the Host Community Agreement. Our ultimate goal is to increase participation.

Conclusion: It was the Commission's hope, and certainly the Town's assumption that the program would break even or better yet, be profitable, but with constantly changing and saturated markets and insufficient effort on the part of government to subsidize, recycling programs will always be an expense to run – not unlike other mandates by the state with inadequate funds to support.

Recycling is changing and evolving. We are much farther ahead than we were 10 years ago, and Massachusetts is farther ahead of many other states. We need to stay current in the needs of our "Disposable Society". Education and a user-friendly program is the key to good participation. It is no longer feasible to expect such a program to be run by volunteers. It is time to hire an administrator for the program.

14.1 Gull Policy

GULL CONTROL PLAN
Submitted as part of Landfill Permit Modification Application
7/23/03

HARDWICK LANDFILL INC.
Hardwick, Massachusetts

GULL CONTROL PROGRAM AND PLAN
HARDWICK LANDFILL

1.0 INTRODUCTION

The Hardwick Landfill will comply with MDEP policy # BWP-98-003 on gull control at landfills. These standards require that gulls be prohibited from feeding and that opportunities for gulls to rest and roost should not be provided.

The Gull Control Program must prevent impacts to nearby water supplies from the Hardwick Landfill and must prevent gull populations from impacting airports. There is a surface water supply reservoir within gull commuting distance of the landfill. There are no major airports within 10 miles that are registered with the Federal Aeronautics Administration. There are two small landing strips within 10 miles that are registered with the Massachusetts Aeronautics Commission.

This gull control program addresses the particular needs and situation of this landfill. Landfills vary in characteristics that make them suitable or attractive to gulls, such as location, size and operational methods. Consequently, some sites may only need to implement minimal control methods to successfully control gulls, whereas other sites may need more aggressive measures to achieve effective gull control.

This Gull Control Plan is implemented as part of the Operations & Maintenance Plan and includes recommendations for standard site operations such as prompt use of daily cover, limited mowing to prevent vegetation on unused landfill areas that may provide shelter, procedures for gull harassment and the use of pyrotechnic devices.

2.0 SITE LOCATION

The Hardwick Landfill is located in a remote area of western central Massachusetts. The Regional Map (Figure 1) shows the topography, surface water supply reservoir, and a landing strip within the 5-mile radius. There are no major airports within 10 miles. There are two small landing strips within 10 miles; the Barre-Hiller strip in Wheelwright and a private strip on the Ware River in Ware, MA, that are registered with the Massachusetts Aeronautics Commission. The Quabbin Reservoir is approximately 3 miles to the west of the landfill. The Locational Map (Figure 2) shows a 50-mile radius around the landfill.

3.0 HISTORY AND EXTENT OF GULL ACTIVITY

The Hardwick Landfill has historically been a C&D landfill and has not had a problem with gulls as long as it has been operating. The lack of gulls has been attributed to the operational methods for MSW being disposed and the lack of hospitable habitat area adjacent to the landfill. The small area of the landfill with trees close to the sides does not provide the wide-open views that gulls prefer to avoid predators. The new gull control program includes these continued Operational and Habitat Controls and is designed to prevent conditions attractive to gulls from occurring.

4.0 GOALS AND OBJECTIVES OF PROGRAM

The objective of the Gull Control Program at the Hardwick Landfill is to prevent birds from foraging at the landfill and to deny them places to rest or roost. If the gulls are prevented from foraging, roosting and resting, operation of the facility will not result in adverse impacts on water supplies or aircraft.

Thresholds of gull activity are discussed in Section 9.0.

5.0 NOTIFICATION OF THE DEPARTMENT

On the occasion that gull activities at the facility have resulted in complaints by any abutter or public official on any three (3) consecutive days or any five (5) days within one month period, the landfill operator will notify the MDEP within 48 hours.

6.0 ALTERNATIVES ANALYSIS

Landfill Operational Controls. Methods of unloading, spreading, compacting and covering refuse need to be critically examined and evaluated. Possible methods to reduce the likelihood of gulls feeding include minimizing the size of the daily active area (active face), maintaining human presence at all times and cover material placement (type, depth and frequency).

Habitat Controls. These focus on altering the landfill environment to keep it unattractive to gull resting, loafing or roosting activity. Such control methods include maintaining short grass areas.

Harassment Methods. These include the use of pyrotechnics, propane cannons, recorded distress calls and trained dogs with the objective of actively trying to scare gulls away.

Lethal Methods. This primarily means the use of shooting to kill gulls. Reliance on killing gulls can never be the primary means for gull control. Shooting or any lethal method can only be used to reinforce other control methods. The implementation of lethal methods will require a permit issued by the United States Fish and Wildlife Service (USFWS), which generally limits the taking of gulls to between 50 and 200 a year at any given facility.

7.0 DESCRIPTION OF GULL CONTROL STRATEGY

Vector attraction will be minimized through the continuous placement and compaction of wastes in the active cell, a constant human presence at the disposal area, the daily placement and compaction of cover material across the waste disposal cell at the end of the day.

Active, direct methods include harassment and killing of birds. Passive, indirect methods include habitat control. A short intense period of gull harassment can be very effective, requiring only reinforcement thereafter. Daily records of gull activities and responses, and a mix of active and passive control methods are included.

The operation of the daily waste disposal cell shall be conducted to minimize the gathering of birds by providing for the continuous placement and compaction of incoming waste materials. Once wastes are delivered to the facility, waste materials shall be unloaded adjacent to the daily operating cell, placed and compacted in the cell. All exposed waste

materials at the end of the operating day shall be covered with daily cover material to segregate the refuse from the surface environment. Continuous compaction and placement of refuse, combined with the proper covering of wastes at the end of the operating day serve to minimize the potential food source that incoming waste materials represent to birds. If birds are attracted to the landfill and constitute a nuisance condition, the operator will employ appropriate control measures at the landfill to curb the gathering of large numbers of birds. Control measures may involve habitat control, the use of non-lethal pyrotechnic devices designed to scare birds off the landfill and managed destruction following appropriate depredation permits that are required from the U.S. Fish & Wildlife Service and the Massachusetts Division of Fish & Wildlife.

Habitat Management is the primary effort/strategy in gull control. This involves depriving the gulls of access to the things they want: places to feed and roost. The following items will be incorporated as a part of the proposed project's landfill management plan for gull habitat management:

- Minimize the surface area of the active cell, decreasing the site's attractiveness to gulls and facilitating gull control on the remaining active area.

- Cover the waste daily with approved daily cover that will discourage or prevent feeding before closing the landfill operations. Staff should inspect this activity daily. Alternate daily cover technologies have also been shown to be gull detractors and may be used.

- Manage the inactive portions of the landfill so that exposed soil or mowed areas are minimized as much as possible. Exposed soil should be seeded with fast growing vegetation. Vegetation should be allowed to grow higher than ten (10) inches where possible. One mowing per year is recommended.

- Eliminate on-site surface waters such as ponds, borrow pits, and puddles. Surface waters that must remain (nearby wetlands or stormwater control ponds) should be included in the dispersal/hazing patrols when appropriate.

- Physical barriers could be erected if necessary. Wire grids can be erected over areas of the landfill where birds may congregate. These can be either monofilament plastic line or stainless steel.

Harassment

Even if the site has been made as unattractive as possible to gulls, they may still come to feed if they can, and thus must be actively discouraged. Habitat management and harassment must go hand in hand. The following human activities will be incorporated as part of the project formal gull management plan:

- Human Patrols are the cornerstone of the dispersal methods of the plan. The patrols depend on the staff for success. Patrols will include reconnaissance (counting any gulls on site and recording their behavior, checking the

condition of equipment and habitat management) and harassment. Patrols will be on foot or from a vehicle and will be of sufficient coverage and intensity to ensure that all gulls on the property are identified, counted, and put to flight. The operator gull control personnel will patrol the landfill on an as-needed basis to meet the DEP performance standard of keeping gulls from feeding. It is particularly important to patrol during the times that have been noted to be peak feeding periods, as well as all other times. Patrol protocols will be developed which emphasize flexibility and the element of surprise, in order that gulls do not learn how to avoid patrol times in order to feed. Gull Patrol records will be maintained on the MDEP Form.

- Pyrotechnics - noisemaking devices shot from blank pistols, shotguns or even canons may be used. The screamers and bangers may be easily fired from a .22 caliber starter or blank pistol and have been found to be effective on gulls. A firearm license may be required. The staff will patrol the landfill as much as necessary, using these noise-makers as necessary to scare the gulls from feeding. An intense effort will be required as the project begins. The projectiles should be fired at birds whenever they are observed on the ground or attempting to land. The same type of projectile should not be fired for more than five consecutive days. The following equipment should be maintained for this purpose: single-barreled breech-loading 12 gauge shotgun with open choke; shotgun cleaning kit; .22 caliber starter pistol with 15 and 17 mm. adapters; stores of at least three types of projectiles. When not in use, all firearms shall be stored in secure locked cabinets.

- Gull distress calls can be played in conjunction with pyrotechnics to enhance their effectiveness.

- Visual frightening devices such as balloons painted to look like eyes can be used also.

- Trained dogs- the harassment potential of dogs, along with the methods above can be very useful.

The designated bird control staff should arrive at the landfill each day as early as possible. Reconnaissance and record taking should be the first activity, followed by harassing any gulls that attempt to land. Gulls will go to water bodies to roost for the night, but will fly long distances to search for food. The staff should meet them each day to scare them off. After the initial period, this should become somewhat routine.

Depredation

Reinforcement of harassing techniques may be necessary. This requires a permit from the U.S. Fish and Wildlife and Massachusetts Division of Fish and Wildlife federal and state agencies. Permit application would be made if needed. These permits commonly allow the killing of up to two birds per day. Occasional exercise of this technique is necessary to prevent habituation of the gulls to other methods and to eliminate problem gulls. Use of this method will be at the discretion of the staff under advisement of the Consultant. Safety is paramount. Shooting should only be done when reinforcement is

required, and must be done with great care. Permits are usually issued for 50-200 kills/ year.

8.0 REFERENCES

9.0 Massachusetts Department of Environmental Protection Bureau of Waste Prevention Policy # BWP-98-003.
10.0 A Manual for Gull Control at Massachusetts Landfills

11.0 CONTINGENCY MEASURES

In general, the following criteria shall be used to determine if a facility has a gull control problem:

1. gulls observed or otherwise known to be feeding at the site;
2. the number of gulls frequenting the site;
3. availability of a food source for the gulls;
4. compliance with good operational practices such as use of daily cover material;
5. location relative to:
   a. surface water supplies;
   b. airports;
   c. abutters or other nearby receptors;
   d. recreational waters;
   e. endangered species habitat;
   f. parks or other recreational facilities;
6. the frequency of use by gulls;
7. suitability of the site for resting, loafing or roosting; and

Complaints/problems resulting from the gull control program will be recorded through use of a daily phone log. The log will include entries to indicate how complaints were resolved.

12.0 STAFF AND RESOURCES

Implementation, monitoring and evaluation of the plan/program will involve a variety of personnel in a team effort. These will include the Landfill Site Manager and landfill operations staff.

> Landfill Superintendent - responsible for entire landfill project, oversees gull control, files periodic reports with Town and MDEP, other agencies as required.on-site supervisor of landfill including on-site gull control
>
> Designated Bird Control Officer - staff member for whom gull control is a primary duty.
>
> Other members of the landfill staff-assistance as necessary.

Landfill operations staff will be familiar with the goals and objectives of this plan and with the importance of their being accomplished. Staff will be made aware that nothing

but maximum effort and effectiveness is acceptable in bird control measures. A wildlife biologist will be retained on a consulting basis should aspects of the plan require change. The superintendent is responsible on a daily basis to make sure that gull control activities are being carried out with maximum effectiveness and will have ultimate oversight of the entire project, and will be responsible for making sure that all aspects of the project run smoothly, including gull control. The operator will meet with staff regarding gull control on a regular basis to review activities, report progress and problems, and change actions as needed. The operator will consult with the wildlife biologist when necessary.

The Bird Control Officer will be an on-site staff whose first duty is gull control. The BCO or designated, trained alternate will be on site at all times when the facility is open, and will be reachable by radio at all times. Duties will include undertaking daily gull reconnaissance and reporting patrols, assuring that all equipment is in working order and supplies are adequate. Implementing or directing habitat control and dispersal methods, keeping detailed accurate records on methods used and responses. Communicating with staff and management on a regular basis, alerting management if expert consultation is required.

13.0 DAILY INSPECTION

Each day the landfill staff will fill out the MDEP policy Field Data Form that documents gulls' presence, activities, and control methods. Observations of gull behavior will be made at least once each working day. Monitoring will document any gulls on or near the site, as well as those on adjacent properties. Should other data be required, the Consultant will prepare appropriate report forms. Staff will provide monthly reports to the Operator, and when required, to MDEP. Yearly reports will be prepared, summarizing the more detailed monthly reports.

14.0 NOTIFICATION OF MODIFICATION

Notice will be given for any change in the Gull Control strategies implemented to abutters and those likely to be affected by the noise or displacement of gulls.

15.0 CONTACT

Hardwick Landfill, Inc. may be contacted at (413) 967-5985.

16.0 SCHEDULE FOR IMPLEMENTATION

Implementation of the Gull Control Plan will occur immediately with implementation of control strategies occurring if gulls become an issue as defined in Section 9.0

15. 1 EPA CONTAMINATION INDEX

US ENVIRONMENTAL PROTECTION AGENCY

POTENTIAL SOURCES OF DRINKING WATER CONTAMINATION INDEX

This chart lists some potential facilities and activities where one might find the contaminants referred to as primary and secondary drinking water standards. The listing of a contaminant does not mean that it will always occur at the associated source, nor does it encompass all contaminants that may be present. Sources are divided into four major categories:

- **Commercial/Industrial**
- **Residential Municipal**
- **Agricultural/Rural**
- **Miscellaneous**

This list is intended as a resource guide for creating an inventory list. A state or local community may have different sources of concern from the list below, based on local variability such as existing industrial activity, and known contaminant occurrence information.

POTENTIAL SOURCE	CONTAMINANT
Commercial / Industrial	
Above-ground storage tanks	Arsenic, Barium, Benzene, Cadmium, 1,4-Dichlorobenzene or P-Dichlorobenzene, cis 1,2-Dichloroethylene, trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride, Lead, Trichloroethylene (TCE), Tetrachloroethylene or Perchlorethylene (Perc)
Automobile, Body Shops/Repair Shops	Arsenic, Barium, Benzene, Cadmium, Chlorobenzene, Copper, cis 1,2-Dichloroethylene, trans 1,2-Dichloroethylene, 1,4-Dichlorobenzene or P-Dichlorobenzene, Lead, Fluoride, 1,1,1-Trichloroethane or Methyl Chloroform, Dichloromethane or Methylene Chloride, Tetrachloroethylene or Perchlorethylene (Perc), Trichloroethylene (TCE), Xylene (Mixed Isomers)

Boat Repair/Refinishing/Marinas	Benzene, Cadmium, cis 1,2-Dichloroethylene, Coliform, Cryptosporidium, Dichloromethane or Methylene Chloride, Giardia Lambia, Lead, Mercury, Nitrate, Nitrite, trans 1,2-Dichloroethylene, Tetrachloroethylene or Perchlorethylene (Perc), Trichloroethylene (TCE), Vinyl Chloride, Viruses
Cement/Concrete Plants	Barium, Benzene, Dichloromethane or Methylene Chloride, Ethylbenzene, Lead, Styrene, Tetrachloroethylene or Perchlorethylene (Perc), Toluene, Xylene (Mixed Isomers)
Chemical/Petroleum Processing	Acrylamide, Arsenic, Atrazine, Alachlor, Aluminum (Fume or Dust), Barium, Benzene, Cadmium, Carbofuran, Carbon Tetrachloride, Chlorobenzene, Copper, Cyanide, 2,4-D, 1,2-Dibromoethane or Ethylene Dibromide (EDB), 1,2-Dichlorobenzene or O-Dichlorobenzene, 1,4-Dichlorobenzene or P-Dichlorobenzene, 1,1-Dichloroethylene or Vinylidene Chloride, cis 1,2 Dichloroethylene, Dichloromethane or Methylene Chloride, Di(2-ethylhexyl) adipate, Di(2-ethylhexyl) phthlate, 1,2-Dichloroethane or Ethylene Dichloride, Dioxin, Endrin, Epichlorohydrin, Ethylbenzene, Hexachlorobenzene, Hexachlorocyclopentadiene, Lead, Mercury, Methoxychlor,Polychlorinated Biphenyls, Selenium, Styrene, Sulfate, Tetrachloroethylene or Perchlorethylene (Perc), Toluene, 1,2,4-Trichlorobenzene, 1,1,1-Trichloroethane or Methyl Chloroform, Trichloroethylene (TCE), Vinyl Chloride, Xylene (Mixed Isomers), Zinc (Fume or Dust)
Construction/Demolition	Arsenic, Asbestos, Benzene, Cadmium, Chloride, Copper,Cyanide, cis 1,2-Dichloroethylene, trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride, Fluorides, Lead, Selenium, Tetrachloroethylene or Perchlorethylene (Perc), 1,1,1-Trichloroethane or Methyl Chloroform, Trichloroethylene (TCE), Turbidity, Xylene (Mixed Isomers), Zinc (Fume or Dust)
Dry Cleaners/Dry Cleaning	Tetrachloroethylene or Perchlorethylene (Perc), 1,1,1-Trichloroethane or Methyl Chloroform, 1,1,2-Trichloroethane
Dry Goods Manufacturing	Barium, Benzene, Cadmium, Copper, Dichloromethane or Methylene Chloride, Di(2-ethylhexyl) phthlate, Lead, 1,1,1-Trichloroethane or Methyl Chloroform, Polychlorinated Biphenyls, Tetrachloroethylene or Perchlorethylene (Perc), Toluene, Trichloroethylene (TCE), Xylene (Mixed Isomers)
Electrical/Electronic Manufacturing	Aluminum (Fume or Dust), Antimony, Arsenic, Barium, Benzene, Cadmium, Chlorobenzene, Copper, Cyanide, Carbon Tetrachloride, 1,2-Dichlorobenzene or O-Dichlorobenzene, 1,2-Dichloroethane or Ethylene Dichloride, cis 1,2-Dichloroethylene, trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride, Di(2-ethylhexyl) phthlate, Ethylbenzene, Lead, Mercury, Polychlorinated Biphenyls, Selenium, Styrene, Sulfate, Tetrachloroethylene or Perchlorethylene (Perc), 1,1,1-Trichloroethane or Methyl Chloroform, 1,1,2-Trichloroethane, Trichloroethylene (TCE),

	Thallium, Toluene, Vinyl Chloride, Xylene (Mixed Isomers), Zinc (Fume or Dust)
Fleet/Trucking/ Bus Terminals	Arsenic, Acrylamide, Barium, Benzene, Benzo(a)pyrene, Cadmium, Chlorobenzene, Cyanide, Carbon Tetrachloride, 2,4-D, 1,2-Dichlorobenzene or O-Dichlorobenzene, 1,4-Dichlorobenzene or P-Dichlorobenzene, 1,2-Dichloroethane or Ethylene Dichloride, cis 1,2-Dichloroethylene, trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride, Di(2-ethylhexyl) phthlate, Epichlorohydrin, Heptachlor (and Epoxide), Lead, Mercury, Methoxychlor, Pentachlorophenol, Propylene Dichloride or 1,2-Dichloropropane, Selenium, Styrene, Toxaphene, Tetrachloroethylene or Perchlorethylene (Perc), Toluene, 1,1,1-Trichloroethane or Methyl Chloroform, Trichloroethylene (TCE), Vinyl Chloride, Xylene (Mixed Isomers)
Food Processing	Arsenic, Benzene, Cadmium, Copper, Carbon Tetrachloride, Dichloromethane or Methylene Chloride, Lead, Mercury, Picloram, Tetrachloroethylene or Perchlorethylene (Perc), Toluene, 1,1,1-Trichloroethane or Methyl Chloroform, Trichloroethylene (TCE), Xylene (Mixed Isomers)
Funeral Services/Taxidermy	Glyphosate, Dichloromethane or Methylene Chloride, Nitrate, Nitrite, Total Coliforms, Viruses
Furniture Repair/Manufacturing	Barium, 1,2-Dichloroethane or Ethylene Dichloride, Dichloromethane or Methylene Chloride, Ethylbenzene, Lead, Mercury, Selenium, Trichloroethylene (TCE)
Gas Stations (see also above ground/underground storage tanks, motor-vehicle drainage wells)	cis 1,2-Dichloroethylene, trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride, Tetrachloroethylene or Perchlorethylene (Perc), Trichloroethylene (TCE)
Graveyards/Cemetaries	Dalapon, Lindane, Nitrate, Nitrite, Total Coliforms, Viruses.
Hardware/Lumber/Parts Stores	Aluminum (Fume or Dust), Barium, Benzene, Cadmium, Chlorobenzene, Copper, Dichloromethane or Methylene Chloride, Di(2-ethylhexyl)adipate, Di(2-ethylhexyl) phthlate, 1,4-Dichlorobenzene or P-Dichlorobenzene, Ethylbenzene, Lead, Mercury, Tetrachloroethylene or Perchlorethylene (Perc), 1,1,1-Trichloroethane or Methyl Chloroform, Trichloroethylene (TCE), Toluene, Xylene (Mixed Isomers)
Historic Waste Dumps/Landfills	Atrazine, Alachlor, Carbofuran, cis 1,2-Dichloroethylene, trans 1,2-Dichloroethylene, Diquat, Dalapon, Glyphosate, Dichloromethane or Methylene Chloride, Nitrate, Nitrite, Oxamyl (Vydate), Sulfate, Simazine, Tetrachloroethylene or Perchlorethylene (Perc), Trichloroethylene(TCE)
Home Manufacturing	Arsenic, Barium, Benzene, Cadmium, Chlorobenzene, Copper, Carbon Tetrachloride, 1,2-Dichlorobenzene or O-Dichlorobenzene, cis 1,2-Dichloroethylene, trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride, Di(2-ethylhexyl) phthlate,

	Ethylbenzene, Lead, Mercury, Selenium, Styrene, Tetrachloroethylene or Perchlorethylene (Perc), 1,1,1-Trichloroethane or Methyl Chloroform, Trichloroethylene (TCE), Toluene, Turbidity, Xylene (Mixed Isomers)
Industrial Waste Disposal Wells (see UIC for more information on concerns, and locations)	Acrylamide, Arsenic, Atrazine, Alachlor, Aluminum (Fume or Dust), Ammonia, Barium, Benzene, Cadmium, Carbofuran, Carbon Tetrachloride, Chlorobenzene, Copper, Cyanide, 2,4-D, 1,2-Dibromoethane or Ethylene Dibromide (EDB), 1,2-Dichlorobenzene or O-Dichlorobenzene, 1,4-Dichlorobenzene or p-Dichlorobenzene, 1,1-Dichloroethylene or Vinylidene Chloride, cis 1,2 Dichloroethylene, Dichloromethane or Methylene Chloride, Di(2-ethylhexyl) adipate, Di(2-ethylhexyl) phthlate, 1,2-Dichloroethane or Ethylene Dichloride, Dioxin, Endrin, Epichlorohydrin, Hexachlorobenzene, Hexachlorocyclopentadiene, Lead, Mercury, Methoxychlor, Oxamyl (Vydate), Polychlorinated Biphenyls, Selenium, Styrene, Sulfate, Tetrachloroethylene or Perchlorethylene (Perc), Toluene, 1,2,4-Trichlorobenzene, 1,1,1-Trichloroethane or Methyl Chloroform, Trichloroethylene (TCE), Vinyl Chloride, Xylene (Mixed Isomers), Zinc (Fume or Dust)
Junk/Scrap/Salvage Yards	Barium, Benzene, Copper, Dalapon, cis 1,2-Dichloroethylene, Diquat, Glyphosate, Lead, Polychlorinated Biphenyls, Sulfate, Simazine, Trichloroethylene (TCE), Tetrachloroethylene or Perchlorethylene (Perc)
Machine Shops	Arsenic, Aluminum (Fume or Dust), Barium, Benzene, Boric Acid, Cadmium, Chlorobenzene, Copper, Cyanide, Carbon Tetrachloride 2,4-D, 1,4-Dichlorobenzene or P-Dichlorobenzene, 1,2-Dichloroethane or Ethylene Dichloride, 1,1-Dichloroethylene or Vinylidene Chloride, cis 1,2-Dichloroethylene, trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride, Di(2-ethylhexyl) phthlate, Ethylbenzene, Fluoride, Hexachlorobenzene, Lead, Mercury, Polychlorinated Biphenyls, Pentachlorophenol, Selenium, Styrene, Tetrachloroethylene or Perchlorethylene (Perc), Toluene, 1,1,1-Trichloroethane or Methyl Chloroform, 1,1,2-Trichloroethane, Trichloroethylene (TCE), Xylene (Mixed Isomers), Zinc (Fume or Dust)
Medical/Vet Offices	Arsenic, Acrylamide, Barium, Benzene, Cadmium, Copper, Cyanide, Carbon Tetrachloride, Dichloromethane or Methylene Chloride, 1,2-Dichloroethane or Ethylene Dichloride, Lead, Mercury, Methoxychlor, 1,1,1-Trichloroethane or Methyl Chloroform, Radionuclides, Selenium, Silver, Tetrachloroethylene or Perchlorethylene (Perc), 2,4,5-TP (Silvex), Thallium, Xylene (Mixed Isomers)
Metal Plating/Finishing/Fabricating	Antimony, Aluminum (Fume or Dust), Arsenic, Barium, Benzene, Cadmium, Carbon Tetrachloride, Chlorobenzene, Chromium, Copper, Cyanide, 1,4-Dichlorobenzene or P-Dichlorobenzene, cis

	1,2-Dichloroethylene, trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride, Di(2-ethylhexyl) adipate, Ethylbenzene,Lead, Mercury, Polychlorinated Biphenyls, Pentachlorophenol, Selenium, Styrene, Sulfate, Tetrachloroethylene or Perchlorethylene (Perc), , Thallium, Toluene, 1,1,1-Trichloroethane or Methyl Chloroform, 1,1,2-Trichloroethane, Trichloroethylene(TCE), Vinyl Chloride, Xylene (Mixed Isomers), Zinc (Fume or Dust)
Military Installations	Arsenic, Barium, Benzene, Cadmium, Chlorobenzene, 1,2-Dichlorobenzene or O-Dichlorobenzene, 1,2-Dichloroethane or Ethylene Dichloride, cis 1,2-Dichloroethylene, trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride, Hexachlorobenzene, Lead, Mercury, Methoxychlor, 1,1,1-Trichloroethane or Methyl Chloroform, Radionuclides, Selenium, Tetrachloroethylene or Perchlorethylene (Perc), , Toluene, Trichloroethylene (TCE)
Mines/Gravel Pits	Lead, Selenium, Sulfate, Tetrachloroethylene or Perchlorethylene (Perc), 1,1,1-Trichloroethane or Methyl Chloroform, Turbidity
Motor Pools	cis 1,2-Dichloroethylene, trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride,
Motor Vehicle Waste Disposal Wells (gas stations, repair shops) See UIC for more on concerns for these sources http://www.epa.gov/safewater/uic/cv-fs.html	Arsenic, Barium, Benzene, Cadmium, Chlorobenzene, Copper, cis 1,2-Dichloroethylene, trans 1,2-Dichloroethylene, 1,4-Dichlorobenzene or P-Dichlorobenzene, Lead, Fluoride, 1,1,1-Trichloroethane or Methyl Chloroform, Dichloromethane or Methylene Chloride, Tetrachloroethylene or Perchlorethylene (Perc), Trichloroethylene (TCE), Xylene (Mixed Isomers)
Office Building/Complex	Barium, Benzene, Cadmium, Copper, 2,4-D, Diazinon, 1,2-Dichlorobenzene or O-Dichlorobenzene, Dichloromethane or Methylene Chloride, Diquat, 1,2-Dichloroethane or Ethylene Dichloride, Ethylbenzene, Glyphosate, Lead, Mercury, Selenium, Simazine, Tetrachloroethylene or Perchlorethylene (Perc), 1,1,1-Trichloroethane or Methyl Chloroform, Trichloroethylene (TCE), Vinyl Chloride, Xylene (Mixed Isomers)
Photo Processing/Printing	Acrylamide, Aluminum (Fume or Dust), Arsenic, Barium, Benzene, Cadmium, Carbon Tetrachloride, Chlorobenzene, Copper, Cyanide, 1,1-Dichloroethylene or Vinylidene Chloride, cis 1,2-Dichloroethylene, trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride, Di(2-ethylhexyl) phthlate, 1,2-Dichlorobenzene or O-Dichlorobenzene, 1,4-Dichlorobenzene or P-Dichlorobenzene, 1,2-Dichloroethane or Ethylene Dichloride, 1,2-Dibromoethane or Ethylene Dibromide (EDB), Heptachlor epoxide, Hexachlorobenzene, Lead, Lindane, Mercury, Methoxychlor, Propylene Dichloride or 1,2-Dichloropropane, Selenium, Styrene, Tetrachloroethylene or Perchlorethylene (Perc), 1,1,1-Trichloroethane or Methyl Chloroform, Toluene, 1,1,2-

	Trichloroethane, Trichloroethylene(TCE), Vinyl Chloride, Xylene (Mixed Isomers), Zinc (Fume or Dust)
Synthetic / Plastics Production	Antimony, Arsenic, Barium, Benzene, Cadmium, Carbon Tetrachloride, Chlorobenzene, Copper, Cyanide, 1,2-Dichlorobenzene or O-Dichlorobenzene, 1,4-Dichlorobenzene or P-Dichlorobenzene, 1,2-Dichloroethane or Ethylene Dichloride, cis 1,2-Dichloroethylene, trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride, Di(2-ethylhexyl) adipate, Di(2-ethylhexyl) phthlate, Ethylbenzene, Hexachlorobenzene, Lead, Mercury, Methyl Chloroform or 1,1,1-Trichloroethane, Pentachlorophenol, Selenium, Styrene, Tetrachloroethylene or Perchlorethylene (Perk), Toluene,, Trichloroethylene (TCE), Vinyl Chloride, Xylene (Mixed Isomers), Zinc (Fume or Dust)
RV/Mini Storage	Arsenic, Barium, Cyanide, 2,4-D, Endrin, Lead, Methoxychlor
Railroad Yards/Maintenance/Fueling Areas	Atrazine, Barium, Benzene, Cadmium, Dalapon, 1,4-Dichlorobenzene or P-Dichlorobenzene, cis 1,2-Dichloroethylene, trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride, Lead, Mercury, Tetrachloroethylene or Perchlorethylene (Perc), Trichloroethylene (TCE).
Research Laboratories	Arsenic, Barium, Benzene, Beryllium Powder, Cadmium, Carbon Tetrachloride, Chlorobenzene, Cyanide, 1,2-Dichloroethane or Ethylene Dichloride, 1,1-Dichloroethylene or Vinylidene Chloride, cis 1,2-Dichloroethylene, trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride, Endrin, Lead, Mercury, Polychlorinated Biphenyls, Selenium, Tetrachloroethylene or Perchlorethylene (Perc), Thallium, Thiosulfates, Toluene, 1,1,1-Trichloroethane or Methyl Chloroform, Trichloroethylene (TCE), Vinyl Chloride, Xylene (Mixed Isomers)
Retail Operations	Arsenic, Barium, Benzene, Cadmium, 2,4-D, 1,2-Dichloroethane or Ethylene Dichloride, Lead, Mercury, Styrene, Tetrachloroethylene or Perchlorethylene (Perc), Toluene, 1,1,1-Trichloroethane, Vinyl Chloride
Underground Storage Tanks	Arsenic, Barium, Benzene, Cadmium, 1,4-Dichlorobenzene or P-Dichlorobenzene, cis 1,2-Dichloroethylene, trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride, Lead, Tetrachloroethylene or Perchlorethylene (Perc), Trichloroethylene (TCE).
Wood Preserving/Treating	cis 1,2-Dichloroethylene, trans 1,2-Dichloroethylene, Lead, Sulfate
Wood/Pulp/Paper Processing	Arsenic, Barium, Benzene, Cadmium, Carbon Tetrachloride, Copper, Dichloromethane or Methylene Chloride, Dioxin, 1,2-Dichloroethane or Ethylene Dichloride, Ethylbenzene, Lead, Mercury, Polychlorinated Biphenyls, Selenium, Styrene, Tetrachloroethylene or Perchlorethylene (Perc), Trichloroethylene (TCE), Toluene, 1,1,1-Trichloroethane or Methyl Chloroform, Xylene (Mixed Isomers)

Residential / Municipal	
Airports (Maintenance/Fueling Areas)	Arsenic, Barium, Benzene, Cadmium, Carbon Tetrachloride, cis 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride, Ethylbenzene, Lead, Mercury, Selenium, Tetrachloroethylene or Perchlorethylene (Perc), 1,1,1-Trichloroethane or Methyl Chloroform, Trichloroethylene (TCE), Xylene (Mixed Isomers)
Apartments and Condominiums	Atrazine, Alachlor, Coliform, Cryptosporidium, Dalapon, Diquat, Giardia Lambia, Glyphosate, Nitrate, Nitrite, Picloram,Sulfate,Simazine, Vinyl Chloride, Viruses
Camp Grounds/RV Parks	Benomyl, Coliform, Cryptosporidium, Diquat, Dalapon, Giardia Lambia, Glyphosate, Isopropanol, Nitrate, Nitrite, Picloram,Sulfate,Simazine, Turbidity, Vinyl Chloride, Viruses
Cesspools - Large Capacity (see UIC for more information)	Atrazine, Alachlor, Carbofuran, Coliform, Cryptosporidium, Diquat, Dalapon, Giardia Lambia, Glyphosate, Nitrate, Nitrite, Oxamyl (Vydate), Picloram,Sulfate,Simazine, Vinyl Chloride, Viruses
Drinking Water Treatment Facilities	Atrazine, Benzene, Cadmium, Cyanide, Fluoride, Lead, Polychlorinated Biphenyls, Toluene, Total Trihalomethanes, 1,1,1-Trichloroethane or Methyl Chloroform
Gas Pipelines	cis 1,2-Dichloroethylene, trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride, Tetrachloroethylene or Perchlorethylene (Perc), Trichloroethylene or TCE
Golf Courses and Urban Parks	Arsenic, Atrazine, Benzene, Chlorobenzene, Carbofuran, 2,4-D, Diquat, Dalapon, Glyphosate, Lead, Methoxychlor, Nitrate, Nitrite, Picloram, Simazine, Turbidity
Housing developments	Atrazine, Alachlor, Coliform, Cryptosporidium, Carbofuran, Diquat, Dalapon, Giardia Lambia, Glyphosate, Dichloromethane or Methylene Chloride, Nitrate, Nitrite, Picloram, Simazine, Trichloroethylene (TCE), Turbidity, Vinyl Chloride, Viruses
Landfills/Dumps	Arsenic, Atrazine, Alachlor, Barium, Benzene, Cadmium, Carbofuran, cis 1,2 Dichloroethylene, Diquat, Glyphosate, Lead, Lindane, Mercury, 1,1,1-Trichloroethane or Methyl Chloroform, Dichloromethane or Methylene Chloride, Nitrate, Nitrite, Picloram, Selenium, Simazine, Trichloroethylene (TCE)
Public Buildings (e.g., schools, town halls, fire stations, police stations) and Civic Organizations	Arsenic, Acrylamide, Barium, Benzene, Beryllium Powder, Cadmium, Carbon Tetrachloride, Chlorobenzene, Cyanide, 2,4-D, 1,2-Dichlorobenzene or O-Dichlorobenzene, 1,4-Dichlorobenzene or P-Dichlorobenzene, Dichloromethane or Methylene Chloride, Di(2-ethylhexyl) phthlate, 1,2-Dichloroethane or Ethylene Dichloride, Endothall, Endrin, 1,2-Dibromoethane or Ethylene Dibromide (EDB), Lead, Lindane, Mercury, Methoxychlor, Selenium, Toluene, 1,1,1-Trichloroethane or Methyl Chloroform, Trichloroethylene (TCE), Vinyl Chloride, Xylene (Mixed Isomers)
Septic Systems	Atrazine, Alachlor, Carbofuran, Coliform, Cryptosporidium, Diquat, Dalapon, Giardia Lambia, Glyphosate, Nitrate, Nitrite, Oxamyl

	(Vydate), Picloram, Sulfate, Simazine, Vinyl Chloride, Viruses
Sewer Lines	Coliform, Cryptosporidium, Diquat, Dalapon, Giardia Lambia, Glyphosate, Nitrate, Nitrite, Oxamyl (Vydate), Picloram,Sulfate,Simazine, Vinyl Chloride, Viruses
Stormwater infiltration basins/injection into wells (UIC Class V), runoff zones	Atrazine, Alachlor, Coliform, Cryptosporidium, Carbofuran, Chlorine, Diquat, Dalapon, Giardia Lambia, Glyphosate, Dichloromethane or Methylene Chloride, Nitrate, Nitrite, Nitrosamine, Oxamyl (Vydate), Phosphates, Picloram, Simazine, Trichloroethylene(TCE), Turbidity, Vinyl Chloride, Viruses
Transportation Corridors (e.g., Roads, railroads)	Dalapon, Picloram, Simazine, Sodium, Sodium Chloride, Turbidity
Utility Stations	Arsenic, Barium, Benzene, Cadmium, Chlorobenzene, Cyanide, 2,4-D, 1,4-Dichlorobenzene or P-Dichlorobenzene, 1,2-Dichloroethane or Ethylene Dichloride, cis 1,2-Dichloroethylene, trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride, Lead, Mercury, Picloram, Toluene, 1,1,2,2- Tetrachloroethane, Tetrachloroethylene or Perchlorethylene (Perc), Trichloroethylene (TCE), Xylene (Mixed Isomers)
Waste Transfer /Recycling	Coliform, Cryptosporidium, Giardia Lambia, Nitrate, Nitrite, Vinyl Chloride, Viruses
Wastewater Treatment Facilities/Discharge locations (incl. land disposal and underground injection of sludge)	Cadmium, Coliform, Cryptosporidium, cis 1,2-Dichloroethylene, trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride, Fluoride, Giardia Lambia, Lead, Mercury, Nitrate, Nitrite, Tetrachloroethylene or Perchlorethylene (Perc) Selenium, sulfate,Trichloroethylene (TCE), Vinyl Chloride, Viruses
Agricultural / Rural	
Auction Lots/Boarding Stables	Coliform, Cryptosporidium, Giardia Lambia, Nitrate, Nitrite,Sulfate,Viruses
Animal Feeding Operations/ Confined Animal Feeding Operations	Coliform, Cryptosporidium, Giardia Lambia, Nitrate, Nitrite, Sulfate, Turbidity, Viruses
Bird Rookeries/Wildlife feeding /migration zones	Coliform, Cryptosporidium, Giardia Lambia, Nitrate , Nitrite , Sulfate, Turbidity, Viruses
Crops - Irrigated + Non-irrigated EXIT disclaimer	Benzene, 2,4-D, Dalapon, Dinoseb, Diquat, Glyphosate, Lindane, Lead, Nitrate, Nitrite , Picloram, Simazine, Turbidity
Dairy operations	Coliform, Cryptosporidium, Giardia Lambia, Nitrate , Nitrite,Sulfate,Turbidity, Viruses
Drainage Wells, Lagoons and Liquid Waste Disposal - Agricultural EXIT disclaimer	Atrazine, Alachlor, Coliform, Cryptosporidium, Carbofuran, Diquat, Dalapon, Giardia Lambia, Glyphosate, Nitrate, Nitrite, Oxamyl (Vydate), Picloram,Sulfate,Simazine, Vinyl Chloride, Viruses
Managed Forests/Grass Lands	Atrazine, Diquat, Glyphosate, Picloram, Simazine, Turbidity
Pesticide/Fertilizer Storage Facilities	Atrazine, Alachlor, Carbofuran, Chlordane, 2,4-D, Diquat, Dalapon, 1,2-Dibromo-3-Chloropropane or DBCP, Glyphosate, Nitrate,

	Nitrite, Oxamyl (Vydate), Picloram, Simazine, 2,4,5-TP (Silvex)
Rangeland/Grazing lands EXIT disclaimer	Coliform, Cryptosporidium, Giardia Lambia, Nitrate, Nitrite, Sulfate, Turbidity, Viruses
Residential Wastewater lagoons	Atrazine, Alachlor, Carbofuran, Coliform, Cryptosporidium, Diquat, Dalapon, Giardia Lambia, Glyphosate, Nitrate, Nitrite, Oxamyl (Vydate), Picloram,Sulfate,Simazine, Vinyl Chloride, Viruses
Rural Homesteads	Atrazine, Alachlor, Carbofuran, Coliform, Cryptosporidium, cis 1,2-Dichloroethylene, trans 1,2-Dichloroethylene, Diquat, Dalapon, Giardia Lambia, Glyphosate, Nitrate, Nitrite,Oxamyl (Vydate), Picloram, Sulfate, Simazine, Vinyl Chloride, Viruses
MISCELLANEOUS SOURCES	
Abandoned drinking water wells (conduits for contamination)	Atrazine, Alachlor, Coliform, Cryptosporidium, Carbofuran, Diquat, Dalapon, Giardia Lambia, Glyphosate, Dichloromethane or Methylene Chloride, Nitrate, Nitrite, Oxamyl (Vydate), Picloram, Simazine, Trichloroethylene (TCE), Turbidity, Vinyl Chloride, Viruses
Naturally Occurring	**Arsenic, Asbestos, Barium, Cadmium, Chromium, Coliform, Copper, Cryptosporidium, Fluoride, Giardia Lambia, Iron, Lead, Manganese, Mercury, Nitrate, Nitrite, Radionuclides, Selenium, Silver, Sulfate, Viruses, Zinc (Fume or Dust)**

Last updated on Monday, February 14th, 2005
URL:
http://www.epa.gov/safewater/swp/sources1.html

11.1 APPENDICES

APPENDIX A

LOCATION & SITE ASSIGNMENT

APPENDIX B

CHRONOLOGY

APPENDIX C

PHASE 1 - ISSUES OF CONCERN

APPENDIX D

GAS ANALYTICALS

APPENDIX E

PHASE 2 – ISSUES

APPENDIX F

LETTERS

APPENDIX G

MAPS

APPENDIX H
PHOTOS

APPENDIX H
LANDFILL GAS (LFG) ADVISORIES & MONITORING REPORTS