

STATE OF NEW HAMPSHIRE

INTER-DEPARTMENT COMMUNICATION

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DATE: March 12, 1999



AT(OFFICE): Permitting and Design Review Section

FROM: *Je* John Cotton, Hydrogeologist
through John Regan, Supervisor
Hazardous Waste Remediation Bureau

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SUBJECT: **BETHLEHEM - North Country Environmental Services (NCES); Review of Recent Documents and Status of Water Quality Monitoring Sites (DES #198704033)**

TO: P&DRS File through Pamela H. Sprague, Supervisor
Permitting and Design Review Section

Richard S. Reed, Administrator
Solid Waste Management Bureau

This memo includes comments on the following documents pertaining to the NCES facility off Trudeau Road in Bethlehem:

1. November 1998 Water Quality Monitoring Results, received January 12, 1999
2. Addendum to 1998 Summary of Water Quality Monitoring, received February 1, 1999
3. Stage II - Phase I Sodium Bromide Application Report, received February 2, 1999
4. Draft Logs for MW-801 through MW-805, received February 8, 1999
5. Construction Quality Assurance; Stage II/Phase II, received March 3, 1999

This memo also briefly reviews water quality monitoring sites which are included in the Groundwater Management and Release Detection Permit (Permit). These reviews provide background information that may be useful in considerations of Stage II/Phase II and Stage III.

Items in this memo requiring further work by NCES were discussed with NCES and SHA at a meeting on March 4, 1999.

November 1998 Water Quality Monitoring Results and Review of Management Sites

1. The three Ammonoosuc River sites at the downgradient boundary of the Groundwater Management Zone (GMZ) for the former unlined landfill were not scheduled to be sampled in November 1998. However, no VOCs were detected in 7 previous sampling rounds.

TOWN: Bethlehem
 PROJECT: NCES
 LETTER/DATA/PERMIT/FA/OTHER:

2. The eastern edge of the GMZ is monitored by well MW-603 and spring S-101. These sites were not scheduled to be sampled in November 1998. However, no VOCs were detected in two previous sampling rounds of MW-603 or in three previous rounds of S-101.
3. The western edge of the GMZ is monitored by well MW-604 and springs S-108 and S-109 (which are in the GMZ). These sites were not scheduled to be sampled in November 1998. However, no VOCs were detected in four previous rounds from MW-604. In three previous sampling rounds of S-108 and S-109, 1,1-DCA (AGQS of 81 ug/L) has been detected at concentrations at 5 ug/L or less. Dichlorodifluoromethane (AGQS of 1,000 ug/L) was detected in both springs in July 1998 at concentrations less than 3 ug/L.
4. At S-1 (the "Main Seep" within the GMZ), the only VOC detected last November was dichlorodifluoromethane (2.9 ug/L). This was the lowest total VOC concentration measured since July 1993. As usual, no VOCs were detected in SF-1 (surface flow from the spring at a point near the river).
5. BTEX, chlorinated and ketone compounds have historically represented most of the VOCs identified in the 100 series wells (management wells), just downgradient of the former unlined landfill.
6. VOC concentrations in the 100 series wells had increased dramatically because of the removal of that landfill. However, concentrations have also dramatically decreased since about 11 months following the completion of that work in October 1993. No AGQS violations have occurred since April 1997 when exceedances of acetone (AGQS of 700 ug/L) and methyl ethyl ketone (AGQS of 170) were detected in B-101. Even with the recently expanded list of individual VOCs now tested, total VOC concentrations in the 100 series wells last November were typical of those measured in the mid 1980s. Further, total VOC concentrations last November in wells B-102 and B-103 were the lowest ever measured since testing began in 1984.
7. NCES needs to address this item. SDWA metals were not scheduled to be tested last November. Generally these metals have not been detected, except for cadmium before 1997 and lead before July 1996. However, arsenic concentrations have generally exceeded AGQS (0.05 mg/L) in the 100 series wells (except B-103) since April 1997. Except for the November 1995 results, arsenic concentrations prior to 1997 had generally been below the detection limit of 0.01 mg/L. Arsenic concentrations in MW-602U (within the landfill footprint) have also ranged from 0.04 to 0.05 mg/L for three rounds. One possible cause of the recent arsenic detections might be the nearby large temporary excavation that extended below the water table in late 1996 to early 1997. (Material from that excavation was used for cover material for Stage I, and the excavation was filled with material, including boulders, that had been stockpiled in the southeast part of the property.) However, probably

the deepest part of this excavation was adjacent to B-103 and B-103D, and while arsenic concentrations in B-103 (the shallow well) have increased, they have not exceeded 0.025 mg/L. The 100 series wells are scheduled to be sampled for arsenic (along with barium, cadmium, chromium and lead) in July 1999. I suggest that water samples from the 100 series wells also be analyzed for arsenic in April 1999. NCES should review the occurrence of arsenic and all potential sources of arsenic in these wells.

November 1998 Water Quality Monitoring Results and Review of Release Detection Sites

1. Wells MW-601U&L and MW-602U&L (within the footprint of the former unlined landfill and Stage II/Phase II) were decommissioned during the initial construction of Stage II/ Phase II and, therefore, could not be sampled in November 1998. These two couplets were installed in 1995 in order to monitor groundwater directly beneath the former unlined landfill and for short term monitoring of Stage II/Phase I. Six rounds of samples were analyzed for these four wells. Total VOC concentrations fluctuated considerably but decreased dramatically from 1995 through April 1998. In 1997 and 1998, no VOCs were detected in the two lower wells (except for 2.4 ug/L of dichlorodifluoromethane in MW-601L in April 1998). And by April 1998, total VOC concentrations decreased to 14 ug/L in MW-601U and 62 ug/L in MW-602U.
2. In November 1998, no VOCs were detected in MW-701, the shallow well at Detention Pond #2. No VOCs have been detected in the four sampling rounds of this well.
3. In November 1998, no VOCs were detected for Detention Ponds #2 and #3. However, 14 ug/L of tetrahydrofuran (AGQS of 154 ug/L) and 1 ug/L toluene (AGQS of 1,000 ug/L) were detected for Detention Pond #1. No VOCs were detected in the three ponds in April or July 1998.
4. In November 1998, no VOCs were detected in downgradient detection wells MW-402U&L, MW-403U&L and MW-404L. VOCs have not been detected in 30 sampling rounds of these wells, except for five scattered "hits" (three prior to August 1990, one in April 1993 and one in July 1997).
5. NCES needs to address this item. In November 1998 at MW-404U, two VOCs were detected - dichlorodifluoromethane (AGQS of 1,000ug/L) at 14 ug/L and trichlorofluoromethane (AGQS of 2,000 ug/L) at 1.4 ug/L. These concentrations were essentially the same as detected in April 1998 (the only other time these two VOCs have been detected). However, these two VOCs were not included in the analytical list of VOCs prior to November 1997. The recent groundwater level contour map for stratified drift indicates that MW-404U is down hydraulic gradient from the area that was overfilled between Stage I and Stage II (as well as the

southwesternmost part of the former unlined landfill). Dichlorodifluoromethane has been detected in four of the five 100 series wells, MW-406U and MW-601U&L. However, these two VOCs have not been detected in the nearest upgradient wells MW-405U&L, which are about 300 feet away from MW-404U. NCES should review the occurrence and possible source(s) of these VOCs in MW-404U. VOCs are scheduled to be analyzed for all wells in April 1999.

6. NCES needs to continue to address the following items. VOCs continue to be detected in the well couplets MW-405U&L and MW-406U&L adjacent to the former unlined landfill and the area that was overfilled between Stage I and Stage II. Only low levels of VOCs have been detected in MW-405U&L, but high levels have been detected in MW-406U&L.
 - a. Methylene chloride has been detected in three of these four wells, but has not been detected (at least since July 1995) in any of the 100 series management wells, MW-601U&L and MW-602U&L. (The only other analytical results I have checked were from 1984 and 1985. During that time methylene chloride was detected at concentrations up to 30 ug/L in the 100-series wells.) Thus, this VOC is not presently included in the "VOC signature" for the former unlined landfill. In November 1998, methylene chloride was detected in MW-805, one of the new 800 series wells.
 - (1) Since April 1995 at MW-405U, only two VOCs have been detected. Methylene chloride (AGQS of 5 ug/L) concentrations have ranged from BDL to 10 ug/l. 1,1-dichloroethane (AGQS of 81 ug/L) concentrations have ranged from BDL to 5 ug/L. In November 1998, only 1,1-dichloroethane was detected at 0.6 ug/L.
 - (2) At MW-405L, only two VOCs have been detected. In April 1997, tetrachloroethene was detected at 0.6 ug/L. 1,1-dichloroethane was detected at 2 ug/L in April 1997 and at 0.5 ug/L last November.
 - (3) From July 1993 to April 1998 at MW-406U, 13 VOCs have been detected at various times. Since July 1995, Methylene chloride concentrations ranged from 5.9 to 38 ug/L. Concentrations were <1.0 in July 1998 and 1.6 ug/L last November. 1,1-dichloroethane and tetrachloroethene have also been detected, and along with the other detected VOCs form a similar suite of VOCs found in the 100 series wells.
 - (4) Since April 1996 at MW-406L, 14 VOCs have been detected at various times. Methylene chloride was at 7 ug/L in April 1997 and 2.1 ug/L in April 1998. Acetone was detected at about 500 ug/L in April 1997 and 300 ug/L in July 1998. 1,1-dichloroethane and

tetrachloroethene have also been detected, and along with the other detected VOCs form a similar suite of VOCs found in the 100 series wells.

- b. The two high concentrations of acetone in MW-406L noted above for April 1997 and July 1998 contrast with analytical results for acetone for other sampling rounds. Acetone concentrations were reported as less than 50 ug/L for the three rounds prior to April 1997, less than 10 ug/L for two rounds between April 1997 and July 1998, and 0.6 ug/L in November 1998. The two occurrences of high concentrations of acetone might indicate pulses of acetone release. The source(s) of such releases might have been during removal(s) of waste overflow of Stage I, from leachate breakouts, from Stage I or from Stage II/Phase I. VOCs are scheduled to be analyzed in April 1999. To date, NCES and SHA have stated that the most probable sources were the overflowing of Stage I and landfill gas condensate. NCES should continue to investigate potential sources. This should include comparison of the times of removal(s) of waste beyond the Stage I anchor berm, leachate breakouts, and secondary liner flows with the times of high acetone concentrations in MW-406L.

November 1998 Water Quality Monitoring Results - New 800 Series Wells

1. Five wells (MW-801 -MW-805) were installed to provide additional release detection wells for Stage II/Phase II. Groundwater from all of these wells should/could be impacted by the former unlined landfill because they are immediately adjacent to the footprint of the former landfill.
2. Wells MW-804 and MW-805 were completed in September 1998 and sampled for the first time on November 16 and 17. Wells MW-801, MW-802 and MW-803 were completed on November 20 to 24, 1998, and sampled for the first time on November 30. Thus, for the last three wells, sampling was conducted sooner than the desired two week waiting period.
3. Groundwater in MW-801, MW-802 and MW-803 is within the plume from the former landfill. These wells are located on the northerly side of Stage II/Phase II between B-102 and B-101. Analytical results reported only low VOC concentrations: 4 ug/L of toluene in MW-801, no VOCs in MW-802, and 1.1 ug/L of dichlorodifluoromethane and 11 ug/L of acetone in MW-803. There is a possibility that water samples from these wells included water used during well installation as well as formation water. Review of the next round of VOC analyses will allow comparison with the first round.
4. MW-804 and MW-805 are located on the northwesterly side of Stage II/Phase II between B-101 and MW-404. Groundwater in these wells should be impacted by the

former landfill. For MW-804, the analytical results indicated low levels of four chlorinated compounds and five BTEX compounds. For MW-805, the results indicated low levels of six chlorinated compounds. Methylene chloride at 2.6 ug/L was detected in MW-805 (see comments above). Except for methylene chloride, these VOCs are similar to those presently found in the 100 series wells.

5. NCES should begin summary tables of analytical results for these wells.

Addendum to 1998 Summary of Water Quality Monitoring

1. NCES and SHA have suggested in the past that the source of VOCs detected in water samples from wells MW-405U&L and MW-406U&L was not leachate from the double lined landfill because some of the VOCs were not detected in analyses of the leachate. This has not been a convincing argument. Meaningful comparisons of individual VOCs could not be made because of high detection limits for VOCs in the leachate analyses.
2. The Department requested in a letter to NCES, dated July 31, 1998, that primary and secondary leachate from Stage I/Phase I and Stage II/Phase I be analyzed for VOCs with the lowest possible detection limits. The first samples collected in August were apparently diluted incorrectly by the laboratory. The second samples were taken on November 2, 1998. SHA also had the laboratory analyze for selected inorganic parameters.
3. Analyses of the primary leachate sample from Stage I/Phase I generally had detection limits for individual VOCs of 300 ug/L (a few had higher detection limits). (Detection limits of 300 ug/L have been noted in some previous laboratory reports.) Analysis of the secondary leachate sample from Stage I/Phase I generally had VOC detection limits of 100 ug/L. Four VOCs were above detection limits in the primary leachate and the same four plus two others were above detection limits in the secondary leachate. Interestingly, the concentrations of two of those four were higher in the secondary leachate than in the primary leachate.
4. Analyses of the primary leachate sample from Stage II/Phase I generally had detection limits for individual VOCs of 300 ug/L (some had higher detection limits). Analyses of the secondary leachate had many individual detection limits of 10 ug/L; some had limits of 100 or 200 ug/L. Two VOCs were actually detected in the primary leachate and four different VOCs were actually detected in the secondary leachate.
5. Based on these four analyses and at a site like NCES, the bottom line seems to remain that statements as to the source of VOCs in groundwater cannot be based only on VOCs detected in leachate.

6. Methylene chloride was not detected in any of these four leachate samples. However, this VOC was detected in leachate samples from Phases 2 and 3 of Stage I and Phase I of Stage II in February and July 1997 as well as at other times in the past.
7. Comparisons of concentrations of VOCs and measured inorganic parameters show that concentrations of some parameters are higher in primary leachate than in secondary leachate. However, concentrations of other parameters are higher in the secondary leachate than in primary leachate.
8. Of the inorganic parameters tested, concentrations of chloride, a very mobile ion, are particularly worth noting. For both Stage I/Phase I and Stage II/Phase I, the concentrations in secondary leachate were more than an order of magnitude less than in primary leachate.
9. Concentrations of bromide (being used as a tracer in Stage II/Phase I) have consistently also been an order of magnitude lower in the secondary leachate than in the primary leachate. This fact was one of the reasons for the more detailed analyses of primary and secondary leachate discussed above. SHA has suggested that this dilution is due to drainage of water in the secondary sand at the time of emplacement. Given the time since emplacement, I believe that reason cannot presently be a factor in Stage I/Phase I. Others have suggested that the dilution may be due to condensation below the primary liner. I am uncertain about this reason. However, neither reason explain why concentrations of some constituents are greater in the secondary leachate. The Department may choose to ask for further investigation of selected parameters in leachate.
10. From an operational consideration, I concur with two SHA recommendations:
 - a. That the daily application rate of sodium bromide should be increased from about 27 pounds per day to 60 pounds per day.
 - b. That the minimum target concentration of bromide in primary leachate should be increased from 30 mg/L to 100 mg/L.

This recommendation should apply to Stage II/Phase II. The Department needs to decide about future applications to Stage I/Phase I. Future applications in Stage II/Phase I might use gas vents for access. NCES agreed with that possibility at the March 4 meeting.

11. NCES needs to provide further documentation for this item. The other topic addressed in this addendum report was the capability of measuring bromide concentration in leachate. SHA reports that SciTest Laboratory Services (SLS) affirms that the detection limit for bromide in leachate can be 2 mg/L if the titrimetric

method (EPA 320.1) is used. SLS proposes to use ion chromatography method (EPA 300) to analyze groundwater samples with a detection limit of 0.1 mg/L. *(Recent analyses of groundwater for bromide have used method SM18 4500BR with a detection limit of 0.1 or 0.5 mg/L. Earlier results have been reported with a detection limit of 0.1 mg/L.)* More documentation is needed before the Department can accept the above conclusion for leachate analyses.

- a. Leachate from the double lined landfill in Lebanon is analyzed for bromide by both of the above methods. Comparisons of those results for primary leachate indicate great variations (sometimes an order of magnitude) with the higher value usually (but not always) being determined by method 300. Results for secondary leachate seem to indicate a higher value using method 320.1.
- b. ChemServe Laboratories in a letter dated July 10, 1997 concludes that EPA method 320.1 is not reliable for determining bromide concentrations in leachate from the Lebanon landfill. That lab concluded that method 300 was the preferred method. Communication between these two laboratories might help resolve their different conclusions.
- c. The Department should require further documentation on analytical procedures. In addition, the Department should require that both listed test methods be used for duplicate/split leachate samples until such time that analytical uncertainties are resolved.
- d. The Department can probably approve the use of bromide as a tracer for Stage II/Phase II provided that more frequent submission of the application record and analytical data.

Stage II - Phase I Sodium Bromide Application Report

1. This report includes a summary table of bromide analyses for primary and secondary leachate from June 1996 through December 1998. Bromide concentrations in primary leachate seldom reached the minimum target concentration of 30 mg/L. Concentrations of bromide in secondary leachate generally were below the various detection limits of 0.1, 0.5 and 1 mg/L. This is basis for the concerns that have been addressed in the Addendum report and reviewed in the last section.
2. Conceptually, the approach has been that if there were a significant leak in the primary liner, bromide concentration would increase in secondary leachate. And if a significant leak were also to develop in the secondary liner, bromide concentration in groundwater would increase above background levels of about 0.1 mg/L.

3. The report includes a table of dates of sodium bromide application. Operational protocol restricted daily application when the active area was in marginal parts of Stage II/Phase I or within the Stage I overlay. Over the last six months as remaining space of this Phase was filled, the active areas were frequently in the above areas. Thus, no application of sodium bromide occurred during three weeks in August, about two weeks in both September and October, and three weeks in November. Daily application was conducted in December. This reduction in application added to the problem of low bromide concentrations in primary leachate. The Department will have to revise the operational protocol for Stage II/Phase II.
4. NCES needs to address this item. For September 10, 1998, bromide concentrations in primary and secondary leachate are reported in the summary table as less than 0.1 mg/L, but the enclosed laboratory sheets for that date are for the 600 series wells. This needs to be checked. In addition, all analytical results need to be added to the application summary sheets.

Logs and Well Construction for 800 Series Wells

1. Along the northerly margin of Stage II/Phase II, monitor wells MW-801, MW-802 and MW-803 penetrated about 12 feet, 36 feet and 37 feet of sandy bouldery fill, respectively. This was the area of deep excavation referred to above with respect to a possible cause of recent occurrence of arsenic in the 100 series wells. Water samples were not analyzed for arsenic in November 1998. Arsenic, barium, cadmium, chromium and lead should be analyzed in April 1999.
2. All five well screens are in shallow groundwater in sandy stratified drift. About five feet of till is reported above the stratified drift in MW-805. In the log for this well, the lower till boundary needs to be lowered about two feet.
3. NCES needs to address this item. The data for MW-804 and MW-805 shall be added to Cross Section C-C'. The data for MW-801 shall be added to Cross Section E-E'. A new Cross Section (I-I') shall be constructed from B-102S and B-102(D), through MW-801, B-103(S) and B-103D, MW-802, MW-803 and B-101 to MW-604. These cross sections should be included with the next technical report to the Department.

Communication of Unresolved Issues or Required Items

The issues and items that need to be addressed were discussed with NCES and SHA at the meeting with the Department on March 4, 1999. These issues and items will also be included in letters to NCES, and will be distributed in the following manner:

1. I will write a letter requesting reasons for the occurrence of arsenic in 100-series monitor wells and VOCs in monitor wells MW-404U, MW-406U and MW-406L; for

data on the past and present distribution of methylene chloride; for tables of individual VOCs in the 800-series monitor wells; for updating two cross sections; and for the construction of a new cross section.

2. The Operational Approval for Stage II/Phase II will include the protocols for application of sodium bromide, the target concentration of bromide in primary leachate, and sampling of primary and secondary leachate.
3. A letter from PDRS will provide requirements on the continued application of sodium bromide in Stage II/Phase I.

Reviews of Additional Facility Activities

I will provide separate Department memos relative to the proposed Stage III Hydrogeologic Study and the proposed modifications to the Transfer Station.

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