LKH:FY1

TOWN: BETHLEHEM
PROJECT: NCES - STAGE II LANDFILL
LETTER/DATA/PERMIT/FA/OTHER

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# STATE OF NEW HAMPSHIRE

Inter-Department Communication

FROM John M. Regan, Supervisor JMR 11/10/94
Groundwater Protection Bureau

DATE 10 November 94
AT (OFFICE)
Water Supply and
Pollution Control Division

SUBJECT North Country Environmental Services Landfill
Water Quality Evaluation and Release Detection Permit Modification

TO Pamela Sprague, Supervisor
PDSR/WMD

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***This is the final version of the draft memo dated 2 November 1994. GPB will incorporate portions of this memo into a written response to NCES/SHA's request to modify the groundwater release detection permit. Based on our 8 November meeting, no substantial changes have been made. If there are any specific items you want incorporated into our response, please contact me by November 10, 1994. As we discussed GPB's letter will sent by November 14, 1994.***

The Groundwater Protection Bureau has reviewed the following documents submitted by Sanborn, Head & Associates (SHA) submitted on behalf of North Country Environmental Services (NCES):

1. SHA letter to Mr. John M. Regan, dated October 5, 1994, Re: Groundwater Permit GWP-87-0433-B-001, North Country Environmental Services, Inc., Stage II Expansion. This letter contains a request to modify the existing groundwater release detection permit. The modification request includes a proposal to use bromide as a tracer, the installation of additional monitoring wells and the decommissioning of well MW-405U & L and MW-406U & L.

2. SHA letter to Ms. Pamela Sprague, dated October 5, 1994, Re: North Country Environmental Services Facility, Bethlehem, New Hampshire. This letter contains an evaluation of the water quality trends at the site, including the elevated concentrations of VOCs detected in the "100" series wells and the seep.

3. SHA letter to Mr. John M. Regan, dated October 7, 1994. This letter contains water quality time series plots for the monitoring wells and the seep.

Our review has consisted on two primary issues; a) the source of the recent water quality increases and b) the modification of the groundwater release detection permit to monitor the proposed Stage 2 lateral expansion. The release detection permit

modification will also continue to monitor the existing Stage I double lined landfill and the contaminated groundwater plume originating from the unlined and single lined landfill areas which were removed from December 1991 through October 1993.

## Review Of Water Quality Data

From our review we conclude that the increases in contaminant concentration are from the unlined and single lined landfill areas and due to action involved with removing the waste in these areas. Water quality data dating back to 1984 indicate that the unlined landfill has had an impact on groundwater quality at least since 1984. The presence of VOCs in groundwater since 1984 is consistent with the Department's experience with other unlined landfill sites. Removal of the unlined and single lined landfill areas was conducted to remove the existing "source" of groundwater contamination. Our experience at other "source" removal projects has been that a short term release of contaminants occurs during excavation of the source material. This is true of landfill closures, where a significant waste relocation/regrading effort is part of closure, and at underground storage tank removal projects. While we have documentation on this general pattern of a release during source removal, the other projects were of less magnitude (quantity of source material removed) and shorter duration (days or a few months versus 22 months) than the NCES landfill removal project.

Several factors would have contributed to increased infiltration and, consequently, increased leachate generation during the removal work. First, the landfill mass was exposed to precipitation for a long length of time. Secondly, it is also our understanding, from WMD representatives who observed the landfill during the removal work and the SHA letters, that the landfill was internally drained, with respect to surface runoff, during removal. Both factors would result in increased infiltration compared to the antecedent condition consisting of a sloped landfill surface with a intermediate soil cover.

There have been several DES projects where a similar increase in VOCs occurrence has been observed. An increase in VOCs concentrations in groundwater was detected at the Bennington landfill immediately after the closure work began. The increase in VOC concentrations were shown to be short term. In comparison, the magnitude of the Bennington work, which consisted primarily of regrading, was a much smaller project and shorter duration than the NCES landfill removal project. In addition, the concentration of total VOCs detected at the Bennington landfill are substantially less than VOCs levels at NCES. Increases in contaminant concentrations have also been observed at several LUST sites following the removal of tanks and soil. In those instances, the increases in VOC concentrations were short term, which is probably because work was performed over a short time. The water quality trends observed over time at NCES are consistent with our experience at other sites, and probably should have been anticipated given the length of the removal project and the expected increase in infiltration through the landfill mass. As SHA indicates in their letters the

increased infiltration through the landfill during the removal work is also expected to produce an increase in water moving (flushing) through the soils underlying the landfill. As with other landfills the "source" is the landfill mass unless there is a discrete source (e.g. containerized liquids or highly contaminated soils) within the landfills. At NCES the landfill mass and soil immediately beneath the landfill was removed. No "source" was detected in the remaining soils beneath the landfill, although undoubtedly there is some "residual" contamination contained in soil pore water in the unsaturated zone, sorbed to the soil and dissolved in the groundwater beneath the landfill. This "residual" contamination is insignificant in total mass when compared to the landfill "source", although concentrations of VOCs can be expected until the "residual" contamination attenuates.

The water quality data from the 400 series wells strongly supports the conclusion that the Stage I double lined landfill is not the source of increased contaminant levels detected in the monitoring wells and seep down gradient of the unlined and single lined landfill areas. The water quality assessment complements the Waste Management Division's review of the leachate collection system flow data that indicates the flows in the primary and secondary liner systems are within the range expected for double lined landfills. A review of the historic information for the "400" series wells indicates that the water quality for Stage 1 has been in compliance with the groundwater release detection permit provisions. The recent trend of low level VOCs detected in MW-406U is coincident with the completion of the landfill removal work. MW-406U is located down gradient of Stage I and up gradient of the excavated landfill areas. However, it is located within 10 to 20 feet of one side of the removed landfill and in an area where the ponding of water was observed on the landfill surface during the removal work. The magnitude of the waste location, in conjunction with the timing of the waste removal work, and the low concentrations of VOCs support the conclusion that MW-406U is impacted by the waste removal work and not by a release from the Stage I double landfill. Historically, the water samples collected from the "400" series wells have been below detection levels. There have been a few isolated, low level concentrations of VOCs detected in the "400" series well, but the results are not consistent with an ongoing release. The preponderance of the data indicates there is no ongoing release from Stage I. We believe the "400" series monitoring well are located and screened appropriately to detect to effectively detect releases from Stage I.

The persistence of the impact on groundwater is a concern. We concur that the "source" of groundwater contamination has been dealt with by virtue of the landfill removal. We believe the contamination remaining is "residual", relatively low concentrations contained in the soil and dissolved in the groundwater plume. Thus, the contaminant concentrations should begin to diminish. Prediction of precise future contaminant concentrations in groundwater is difficult due the variability in the soils' ability to store and transmit water. At a minimum the impact would be expected to last the length of the removal work (22 months) plus a lag for the travel time required for groundwater to migrate from the point of release to the individual monitoring wells. The movement of contaminants dissolved in groundwater is usually retarded further by sorption of the contaminants to soils. This retardation factor varies for specific

chemicals. The idealized view of contaminant movement (i.e. the period of impact is equal to the release period plus the travel time for groundwater to move from the release point as modified by a retardation factor) is a fairly good approximation in uniform materials (e.g. same hydraulic conductivity and effective porosity). The hydraulic properties of the unconsolidated geologic units at NCES are highly variable which means that some pathways have significantly faster velocities than the average velocities while other pathways have significantly lower velocities. The retardation factor of the chemicals and the variability of the geologic units tend to distribute the mass of contaminants over a longer period of time. The effect is that the contaminant plume can persist after the "source" has been removed. This effect has been observed at a number of sites, such as the New London and Jaffrey municipal landfills, LUST sites and hazardous wastes sites where groundwater is being monitored over time.

If the landfill material which was removed is not the source of the increased VOC concentrations, the only other possible explanation is a release from the Stage I double lined landfill. As mentioned above, the water quality data from MW-405U & L and MW-406U & L indicate there has been no release from Stage I. This conclusion is supported by WMD's finding that the observed flows in the primary and secondary liner systems are typical of a double lined facility. Additionally, if Stage I was the source of the recent increase in contaminants, the concentrations detected in the "400" series monitoring wells should be significantly greater than the concentrations detected in the "100" series wells. However, the concentrations detected in MW-406U are much less than the concentrations observed in the "100" series wells.

In summary, we generally agree with SHA conclusions that the landfill excavation and removal work is the cause of the increases in contaminants observed in the "100" series wells, the seep and MW-406U. There is no remaining "source" , but there will be a period of time when the groundwater remains impacted due to the "residual" contamination retained in the soil pore water, adsorbed to the soil and dissolved in the groundwater plume. It is difficult to predict with certainty what time will be required for the contamination peak to diminish and at what point the groundwater quality will be restored. Conversely, the information indicates there is no release from the Stage I operation.

**Release Detection/ Separate Monitorability**

We believe that it is possible to modify the groundwater release detection permit to distinguish between releases from Stage I and the proposed Stage II lateral expansion of the double lined landfill. This can be accomplished through the combination of; use of a bromide tracer in the lateral expansion of Stage II, installation of additional monitoring wells at the down gradient edge of Phase I, Stage II and continued monitoring of the existing wells. ***As we discussed at the 8 November 1994 meeting the bromide tracer is to detect releases from the Stage II lateral expansion so that, if necessary, corrective action can be taken. Our policy has been to require a tracer where a lined landfill overlies an***

***existing plume and the analysis of conventional release detection parameters (e.g. VOCs) is no longer effective. The use of a tracer provides a comparable independent check of the liner flow data. The GPB believes application of the bromide tracer to Stage I is unnecessary because Stage I does not overly contaminated groundwater (therefore the analysis of conventional release provides the independent check of the liner system information).*** The details of the bromide tracer (e.g. application procedures) are being worked out, but the approach is technically sound and reasonable. Bromide has been extensively used as a tracer in groundwater studies because it is a non-reactive, conservative ion. The details do not need to be resolved at this moment, but approval of the tracer application procedures will be a requirement prior to the placement of waste in Phase I, Stage II.

The release detection permit modification also requires a revision to the monitoring well network. NCES has requested permission to decommission monitoring wells MW-405U & L, and MW-406U & L. These monitoring wells are immediately down gradient of the Stage I double lined landfill and up gradient of the removed landfill. The data from these wells have been critical to support the conclusion that the increased concentrations of VOCs is from the landfill removal work and not a release from the Stage I landfill. ***While we are reasonably confident that data support the Stage I landfill has no release, the continued monitoring of MW-405U & L and MW-406U & L will provide the information to confirm the conclusion that a Stage I release did not cause the increased concentrations of VOCs*** The proposed wells (MW-601U & L and MW-602 U & L, previously shown as MW-501U & L and MW-502U & L in the SHA letter dated October 5, 1994) would be located 350 feet down gradient of Stage I. Monitoring for bromide in these new wells provides a means to detect a release from the Phase I, Stage II lateral expansion. The typical water quality data provide an effective means of detecting releases from Stage I, if the increased concentrations resulting from the landfill removal work is clearly diminishing. At this time the trends in the "100" series wells and MW-406U are increasing, and, although we expect the concentrations will ultimately decrease over time, the prediction of future trends is difficult to ascertain with a reasonable degree of certainty. Based on the information that we have to date, we will require revisions to NCES' proposal. There are a couple alternatives which may address our concerns.

<u>Option 1</u>

Monitoring wells MW-405U & L and MW-406U & L are included in the permit until Stage I (including the Stage II overlay on the Phase I footprint) is closed and capped. This is the most straight forward way to separately monitor the impact from Stage I and Stage II. The water quality information collected from these wells are expected to show below detection levels or low, decreasing concentration of VOCs over time. Our preferred option, if feasible, is to bury these wells beneath the landfill and still access the wells for sampling through lateral extension of the casings to the margin of the landfill.

**Option 2**

The installation of two monitoring wells in addition to MW-601U & L and MW-602U & L to collect more information on the water quality trends for the groundwater plume beneath the Phase I, Stage II lateral expansion. If monitoring wells are located further away from Stage I and in the known plume, they must provide timely and reliable data on the performance of the Stage I landfill area. Stage II performance will be monitored by the detection of the bromide tracer. The trends in the conventional release detection parameters (e.g. VOCS) must show a clear deceasing trend to confirm that the impacts are associated with the "residual" contamination resulting from the landfill removal work and not the result of release from Stage I. The additional wells provide for the compilation of a larger database faster than possible with the proposed two couplet wells. The determination of water quality trends can be made with greater confidence with the larger database. If the trends are not decreasing than NCES will be required to undertake corrective action per Env-Ws 410.16.

**Summary**

We concur with the SHA letter reports that the increased concentrations of VOCs are related to the landfill removal work. The water quality of the groundwater is expected to improve, sooner rather later, but precise predictions are difficult given the duration of the period of increased infiltration and the variability of the geologic units. We also concur that water quality data indicates that the Stage I double lined landfill is not the source of the increased VOC concentrations. At this time Stage I is in compliance with the provisions of the groundwater release detection permit. We believe that technical approach outlined in SHA release detection permit modification letter provides for the capability to separately monitor for releases from Stage 1 and the proposed Stage II lateral expansion. Several specific details (e.g. the application procedures of the bromide tracer) of the groundwater release detection permit modification must be finalized prior to the placement of waste in the lateral expansion. We are reasonably satisfied that the SHA letter addresses the issue of *can it be done* and we are working on clarifying the specifics of *how it will be done*. The specific details on the how it will be done must be resolved prior to the placement of waste in Phase I, Stage II lateral expansion. We believe it is reasonable to proceed given that the current technical issues appear to be resolvable within the expected time frame before the lateral expansion. We plan to send a letter to NCES/SHA with our specific comments. You will receive an internal draft prior to transmittal. If you have any questions please contact me at 3744 or John Cotton at 6573.

cc
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