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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
JOHN F. KENNEDY FEDERAL BUILDING
BOSTON, MASSACHUSETTS 02203-0001

October 16, 1995

Mark Evans, Remedial Project Manager
U.S. Department of the Navy
Naval Facilities Engineering Command
Northern Division
10 Industrial Highway
Code 1823, Mail Stop 82
Lester, PA 19113-2090

Re: Area A Landfill Remedial Design - Leachate Modeling Study Work Plan

Dear Mr. Evans:

Thank you for the opportunity to review the Leachate Modeling Study Work Plan for the Area A Landfill Remedial Design, dated September 6, 1995 and the addendum sent in response to the discussions held on September 27, 1995.

Since the investigations at the Area A Landfill have been principally focused on source control, there is an incomplete database of groundwater level measurements and interpretation. Bedrock groundwater flow directions and the movement of groundwater at the Area A Landfill is not understood well enough to use a 3-D groundwater model (*see also* letter dated April 7, 1995). In fact, some contours are up to 30 feet apart.

In order to determine the success of a groundwater modeling effort, the model result should be compared to the known conditions. Since there are insufficient piezometric data to conceptualize the current groundwater head distribution at the Area A Landfill, there are not enough data to construct a 3-D MODFLOW groundwater flow model for the Area A Landfill. EPA believes that the proposed wells should be relocated as several locations within the assumed model boundary require piezometric data and other areas are already sufficiently covered.

The Work Plan and addendum do not provide enough information to assess the modeling proposal and the proposed data collection program. In particular, the Work Plan should clearly state the following details regarding the groundwater flow model: dimensions of model (2-D or 3-D); size of model grid; location of model grid; number of layers to be modeled; dimensions of grid cells; cell types (active, river, constant head, constant flux, etc.); number and location of calibration points and calibration threshold; contaminants of concern to be modeled; decay parameters; and the software to be used for transport modeling. Additionally, EPA requested copies of the geoprobe logs at the September 27, 1995 meeting that still need to be provided.

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Most of the SOPs appear to be incomplete. For example, SOP GH-2.5 begins with Section 5.0 on page 3 of 10. Additionally, this SOP does not include any information on contour mapping.

I look forward to working with you on this issue. Please do not hesitate to contact me at (617) 573-5777 should you have any questions or wish to arrange a meeting.

Sincerely,

Kymberlee Keckler, Remedial Project Manager
Federal Facilities Superfund Section

Attachment

cc: Mark Lewis, CTDEP, Hartford, CT
Andy Stackpole, NSBNL, Groton, CT
Joan Miles, USEPA, Boston, MA
Patti Lynne Tyler, USEPA, Boston, MA
Dale Weiss, TRC, Lowell, MA

ATTACHMENT A

Page	Comment
p. 1, ¶4	Add "determining how to dewater the saturated waste material" as an objective.
p. 4	Indicate that a model sensitivity analysis will be performed before the model simulations.
p. 6, ¶3	Demonstrate that the data needs were developed after consideration of existing data and data gaps. The resulting data collection effort is not adequate to support a 3-D groundwater flow model. It is not clear why 2LMW31F is proposed, given that two monitoring wells screened in the fill are located within 80 feet (2LMW8S and 1MW2S). Similarly, it is unclear why there is a proposed monitoring well at location 2LMW29F, since the pump test well (2LPW1S), screened in the fill is located less than 50 feet away. The monitoring well proposed at location 2LMW28F is located within 100 feet of four wells screened in the fill (2LOW1S, 2LOW2S, 2LOW3S, and 2LPW1S). The monitoring well at location 2LMW33F is located within 100 feet of well 2LMW20S, also screened in the fill layer. Lastly, the need for the two upgradient bedrock wells is not clear, and it appears that bedrock wells located within the model boundary would provide more relevant information for the groundwater flow model construction and calibration. As a result, the 3-D distribution of piezometric data points for the hydrostratigraphic layers to be modeled should be reassessed. Additional wells or piezometers should be installed where there is not sufficient data to interpret the current water level elevations. EPA suggests the following locations for additional monitoring points: approximately four monitoring points should be installed in the fill at locations between transects B-B' and C-C'; and additional bedrock water level monitoring points should be added near 2LTB27, 2LMW30 (proposed location), 2LPZ30S (proposed location), GP22, and GP3. Although the Work Plan did not specify how many layers will be modeled, we discussed that the dredged material would be included as a model layer. If the dredged material is modeled as a separate layer (rather than treating the dredged material using leakance between the fill and bedrock), then a significant amount of piezometric information is needed. Currently, there are no wells screened solely in the dredged material, yet only four wells are proposed. The Work Plan does not include a map showing the extent and thickness of the dredged material. The boring logs and cross sections indicate that the dredged material is extensive and it

is not possible to determine the fluid potential without a more extensive spatial distribution of piezometric data.

p. 8, ¶4 The Work Plan needs to include the following details regarding the groundwater flow model: dimensions of model (2-D or 3-D); size of model grid; location of model grid; number of layers to be modeled; dimensions of grid cells; cell types (active, river, constant head, constant flux, *etc.*); number and location of calibration points and calibration threshold; and target groundwater elevation maps for each layer used for calibration.

The model should be oriented northwest-southeast and should extend at least 300 to 500 feet south of the landfill boundary. Cell dimensions should be no larger than 20 feet in the area of the landfill because the landfill is only 200 feet wide, and water levels vary more than ten feet over the landfill width. Larger cells may be used in the buffer areas at the edge of the model. Constant head nodes should not be used in the model since there are no water bodies (such as a lake or large river) which would serve as an infinite supply of water. Use constant flux cells where possible. If flow from the seep is significant, use a drain node to simulate the seep. The model discretization should be fine enough to allow simulation of the interception trench and the toe drain.

p. 9, ¶1 The plan should also acknowledge that the sensitivity analysis will determine how sensitive the model is to an inaccurate selection of key parameters (*e.g.*, recharge, vertical and horizontal hydraulic conductivity, *etc.*).

p. 10, ¶3 The Work Plan suggests that the fate and transport model will attempt to simulate the *natural decay of contaminants*. However, if biodegradation or some other *natural process* is modeled, then information regarding the decay rates and other fate parameters must be provided and referenced.

The plan for modeling contaminant transport is not clearly discussed. The Work Plan mentions using both MT3D (page 9) and performing a simpler estimation using mass-flux equations (Section 5.1.2).

p. 10, ¶5 Since the objective of this modeling study is to "predict the impact upon the flow rate and quality of the groundwater/leachate discharge (page 1)," the Work Plan should develop a conceptual model for contaminant transport to identify data gaps.

p. 10, ¶7 The calibration plan is not adequate. The Work Plan proposes to calibrate to within the range of observed water levels, that have historically varied as much as 7 feet. The model should select a target calibration data set (*e.g.*, April 1994), and calibrate the model to match the target groundwater elevations within one foot. The calibration error should be less than one foot everywhere, and should not be

compared to an average error. In addition, the gradient should be calibrated if possible to an acceptable value (*e.g.*, ±20%).

The model should be calibrated to a conservatively high water level scenario, as typically occurs in the spring.

p. 11, ¶6 — The Work Plan should indicate which contaminants of concern will be used in the transport model. Contaminants selection should be based on toxicity, mobility, and type of contaminant. Clarify what is meant by "most significant Contaminants of Concern."

p. 19, ¶1 — The report for this study needs to include the following: elevation maps for all hydrostratigraphic units modeled, including posted data points; target piezometric maps for each layer; calibrated piezometric maps for each layer; input parameter maps for hydraulic conductivity, cell type, recharge, *etc.*; difference maps for modeled minus target heads for each layer; predicted piezometric maps for all layers; difference maps for predicted minus modeled (or target) heads for each layer; and particle tracking, if performed.

p. 19, ¶4 — As discussed on September 27, 1995, the two to three proposed meetings held during the modeling process at critical decision points (*e.g.*, after model conceptualization; after model calibration and sensitivity analysis; after selection of contaminants of concern/prior to transport modeling) may be conference calls as long as they are supplemented with a hard copy of the current modeling results.

p. A-4, ¶4 — Field Sampling and Analysis Plan: Obtain bedrock cores at several locations to evaluate the groundwater flow network in bedrock. Bedrock cores will help determine the extent of fracturing and the degree of anisotropy.

p. A-6, ¶2 — The bedrock hydraulic conductivity testing should be determined using packer tests or pumping tests, because the data analysis method for slug tests does not account for the non-homogenous conditions in the bedrock aquifer.

p. 2, ¶3, Addendum — Although EPA agrees that the resolution needed to accomplish the stated objectives is not as high as that needed to evaluate pumping scenarios, minimum amount of information describing the current groundwater flow system is necessary to attempt a model simulation. If there are not enough data to develop a confident interpretation of piezometric elevations and hydrostratigraphy, then it will not be possible to determine if the model is an accurate representation of the real system. Currently, it is not clear what is meant by "low resolution," so it is not possible to determine whether a sufficiently detailed approach is proposed. However, a series of well planned 2-D cross-sectional models may be more useful

and reliable. As discussed above, additional model specifics are needed to evaluate the current proposal.

p. 3, ¶2, Addendum — Simply measuring the head difference between two wells will not demonstrate that there is flow between the two units. Two-dimensional flow diagrams or a 3-D model must be used to evaluate such behavior.

p. 3, ¶3, Addendum — The Work Plan also indicates that the bedrock hydraulic conductivity will be measured.

p. 3, ¶4, Addendum — The addendum indicates that "several overburden and bedrock well clusters . . . currently exist along the upgradient portion of the landfill," but there appear to be only two clusters (2LMW8, 2LMW20).

p. 4, ¶1, Addendum — It is not clear that water levels in the wetland will be unchanged by landfill capping. Presumably, the leachate outflow will be eliminated, possibly resulting in lower water levels in the wetland near the landfill.

p. 4, ¶2, Addendum — There are not sufficient piezometric data to understand the current groundwater flow system, and therefore there are not sufficient data to calibrate a 3-D flow model. There are only three wells that are screened solely in the fill layer, and seven wells that are screened more than 50 percent in the fill. It is not clear how the wells that are not screened solely in the fill can be used to measure the piezometric surface in the fill unit. Even if all ten wells can be used they are not distributed evenly across the landfill. Five of these wells are clustered around the pumping test well. There are no wells screened solely in the dredged material, so there is no piezometric data for this layer. There are 12 wells that are open in bedrock, and these are well distributed across the landfill, although the opened intervals range greatly in depth. There are a few areas where additional bedrock piezometric data are needed, but the data needs for the fill and dredged material are more critical.

p. 4, ¶3, Addendum — Use of water levels from the fall of 1995 will result in a less conservative estimate of leachate flow since water levels are considerably higher in the spring (also, the summer of 1995 was considerably dry). Propose an approach to develop a more conservative calibration target.

The potentiometric maps presented in the Phase II RI are not adequate for this modeling task. Potentiometric maps were not prepared for the fill and bedrock separately, and the existing maps do not provide sufficient detail to allow calibration to within one foot. The existing potentiometric maps use contours ranging from 10 feet to 30 feet. Although the Navy has committed to revising these maps, EPA has not yet reviewed these maps.

p. 5, ¶1, Addendum	It is unclear what is meant by "triangulated data" in this sentence. Contour maps need to be prepared by hand in order to properly interpret geologic influence on groundwater flow and on unit thicknesses. Computer contoured maps of model output will be acceptable since they will be prepared from a grid of data points.
p. 5, ¶3, Addendum	It is unclear how the hydraulic conductivity test results from the dredged material Shelby tube samples will be used. These results should be used to estimate vertical hydraulic conductivity in the dredged material, or leakance between the fill and bedrock.
p. 5, ¶4, Addendum	The approach presented in this paragraph is unclear. The Work Plan proposes to construct a 3-D model to calculate QS, QD, QI, and QF; yet this paragraph discusses estimation of these values using the field data. Since a 3-D model is planned, it is unclear why estimation of these values is necessary.
p. 6, ¶1, Addendum	As indicated above, a 3-D model needs to be based on a sufficiently complete 3-D database of hydrologic and geologic data. The proposal to collect data along three 2-D cross sections, in some cases duplicating existing well locations, is not consistent with the data needed to develop a 3-D model. The data collection plan should be reevaluated in light of the data needed to complete the proposed 3-D model.