Comments on Groundwater Assessment Plan
Curtis Bay Depot, Baltimore, MD

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Introduction

Prior to starting this review, I visited with the Curtis Bay Project Manager, Nick Orlando. Nick provided an outstanding briefing on the background and regulatory history of this decommissioning site. This is the kind of briefing that the technical staff need to get familiar with important issues at decommissioning sites. The following documents were provided by the project manager for this review:

Soil and Ground-Water Quality Assessment Work Plan (6/94)
Appendix A: Site Safety and Health Plan
Appendix AA: Radiation Protection Plan
Appendix B: Geological Data Acquisition Plan
Appendix C: Chemical Data Acquisition Plan
Appendix D: Monitoring Well Installation Plan
Preliminary Groundwater Evaluation of Curtis Bay Site (6/15/93)
Staff Review of Preliminary Groundwater Evaluation (10/25/93)
Radiological Survey of Portions of the Curtis Bay Depot, General Services Administration, Baltimore, MD (Adams and Payne, 1992)

The U.S. Army Defense Logistics Agency (DLA) previously performed a groundwater assessment for the site. This four-page assessment was sent to the NRC on June 15, 1993. The NRC staff completed a review of that assessment and sent it to DLA on October 25, 1993. The staff letter to DLA from D. Orlando presented a simple, five-step approach to resolve the review comments. The five steps were:

1) Identify past and present potential sources of groundwater contamination;

2) Install a limited number of boreholes in the locations of the potential sources of groundwater contamination; collect and analyze soil samples and groundwater samples in these boreholes to establish a contaminant profile;

3) Estimate, if thorium released from the potential sources was mobile, where such contamination would be found today using simple calculations of groundwater transport rates using best probable values for hydrogeologic variables; drill and sample a limited number of boreholes in the locations to determine thorium concentrations;

4) Integrate existing knowledge of the hydrogeologic characteristics of the Curtis Bay site with existing literature of the hydrogeology of the surrounding area; and

5) Determine the construction and completion details for the existing monitoring wells at the site and confirm that they provide representative samples of groundwater and water levels.

The above steps provide clear guidance for performing and completing the site groundwater assessment. Unfortunately, the assessment plan does not address all of these steps, which must be performed to properly assess the extent of thorium contamination. It appears that DLA intends to address some of these steps while performing the site activities.

General Comments

The following comments discuss each of the five steps outlined above:

1. Sources of contamination: The NRC staff believe that reasonable efforts and plans have been made to identify the sources of contamination within (and beneath) the warehouses and up to a distance of 10 m outside the warehouses.

2. Install boreholes at locations of contamination: DLA proposes to drill 13 hollow-stem auger holes. Eight of these would be drilled at warehouse locations, two at the "railcar washdown" area (see additional comments), and three to detect a theoretical contaminant plume. Figure 2 shows the locations of the eight auger holes near eight warehouses. These eight warehouses were found to have thorium contamination that exceeded NRC guidelines. The proposed auger locations occur on the eastern sides of the warehouses (Figure 2), but these apparent sampling locations may simply reflect limitations in the graphical routine used by DLA to generate Figure 2. In any event, the assessment plans are unclear about the proposed locations for drilling auger holes. DLA has not provided a rationale for selecting locations for these auger holes.

3. Estimate of thorium transport, and drilling and sampling of new boreholes: The DLA plan does not contain a conceptual model of groundwater flow at the site. Such a model is needed to help estimate the locations and areal extent of hypothetical plumes of thorium. This information is needed to determine where to drill the three auger holes that are intended to search for contaminant plumes.

   DLA has committed to drilling a number of boreholes. Page C-13 states that "Two borings will be drilled in the immediate vicinity of the railcar washdown area (TBD). One or more soil samples from each boring will be submitted for laboratory analysis. Additionally, one ground-water sample from each boring, one ground-water sample from each of three down-gradient borings, and existing well "F" will be

submitted for lab analysis." Also, "Details of the sampling and analytical program are provided in Table C-1."

4. **Relate site hydrogeology to that of surrounding area:** An effort was made by DLA to describe the site hydrogeology in relation to that of the surrounding area. Two of the references cited on page 11 refer to water and groundwater resources in the area. However, the assessment plans contain no cross-sections of the local geology and hydrostratigraphy. All that can be concluded from the plans is that the site exists in coastal plain terrain with an upper alluvial aquifer of unknown thickness. Page 3 provides some hydrogeologic data for the Patapsco Formation, which underlies the site. "Large diameter wells completed in the Patapsco Formation average about 210 gallons per minute. Average transmissivities are about 31,600 gallons per day per foot. Storage Coefficients range from 5×10^{-5} to 0.003 (Otton and others, 1964)." It is stated (p. 3) that the Patapsco Fm. at the site is underlain by the Arundel Clay, which ranged from 9 to 24 ft thick in two wells completed in the western part of the Curtis Bay depot. However, information is needed about the thickness of the uppermost aquifer to develop a conceptual model of groundwater flow.

   The work plan does contain a commitment to review reports of previous soil and groundwater assessments. Page 6 states that "This information, if available, will be integrated with existing information to further quantify the geologic/hydrogeologic conditions that exist beneath the site." However, the NRC staff consider that that kind of information is needed to identify basic data needs. Therefore, the DLA work plan does not contain enough background information to show that the proposed work activities will adequately characterize the site.

5. **Construction details for existing wells:** DLA has committed (page 6) to review the completion details of existing wells to "determine if they provide representative ground-water samples and water-level information." However, this work should have been performed prior to finalizing the work plan, because changes in the plan will be needed if existing wells are inadequate. In fact, DLA appears to have assumed that the wells may be adequate. It is stated on page D-1 that "...no permanent monitoring wells have been proposed..." DLA also has assumed that the groundwater samples collected in 1993 are acceptable, because, based on Table C-1, only one of the existing wells (F) will be sampled (in addition to the HydroPunch samples). The "F" well had not been sampled during the 1993 DLA study.

   DLA has committed (p. B-15, B-16) to properly survey the locations and elevations of the six existing wells.

Additional Comments

1. D. Orlando (NRC) has confirmed that the so-called "railcar washdown" area is located on the active side of the depot, and is not situated within the decommissioning site. DLA should be informed of this finding.

2. The HydroPuncn tool that is proposed to sample groundwate. could lead to groundwater contamination. If the tool is used to sample groundwater in areas where deep soil contamination is found, then the act of pushing the tool below the water table could transport contaminants from the soil down to the groundwater. This problem might be addressed by extracting sufficient amounts of groundwater to reduce turbidity prior to sampling. It is apparent that the principal value of the HydroPunch tool is in detecting buoyant and immiscible contaminants such as gasoline or oil, which would float on the surface of the water table. It is quite possible that a hypothetical, migrating plume of thorium would remain undetec ed by a sample collected only from the upper part of the saturated zone. This concern could be addressed if geologic conditions allow the tool to be intermittently advanced to greater depths, permitting groundwater samples to be collected over several depth intervals below the water table.

3. Hydrologic tests (slug tests) are discussed on pages D-15 to D-19. However, there is no commitment to actually do any tests in the existing wells. Page 7 of the work plan states that "Hydraulic conductivity values obtained from published information will be used in conjunction with the hydraulic gradient data to calculate ground-water flow velocities." The NRC staff will require that hydrologic tests be performed in those wells that have acceptable integrity and construction characteristics. The test results can be compared to generic hydraulic data from surrounding areas. If existing wells should prove inadequate, then additional wells may have to be installed.

4. The following statement appears on page D-4: "Well casings will extend at least 2.5 ft above the ground surface, unless well casings must be completed at surface level." The NRC staff point out that it is not acceptable to complete a well with its top of casing flush with the ground surface. That would invite contamination of the well.

Recommendations

1. DLA should fully address the comments previously received from the NRC staff (October 25, 1993). If DLA requires clarification of those comments, a meeting should be arranged between NRC and DLA staff to discuss them. Such a meeting would provide an opportunity for DLA to address some

of these comments, and to clarify planned work activities.

2. DLA should clarify the actual locations of auger holes. Based on Figure 2, the auger locations appear to be adjacent to the eastern sides of eight warehouses, and outside the footprint of each warehouse. The NRC staff need to know the planned locations of auger holes before the work plans can be deemed acceptable.

3. The DLA should identify the rationale used to select locations of auger holes. One criterion that the NRC staff recommends is to drill auger holes at locations of highest known thorium contamination. Auger holes should be drilled after the warehouses have been dismantled. Then the drilling crew(s) would have direct access to the footprint areas of the warehouses, which is where most of the contamination sites were found. DLA also needs to provide a rationale for selecting auger locations to detect possible contaminant plumes.

4. Measurements taken at buildings M-421 and M-422 showed the highest contamination levels detected at the site (total beta activities of 400,000 and 590,000 dpm/100 cm^2, respectively) (Adams and Payne, 1992). Auger holes should definitely be drilled at these two contamination points to show the soil depth to which the contaminants may have migrated.

5. DLA should drill a minimum of one new borehole to confirm the site-specific thickness of the alluvial aquifer and the variability of the sediments. This borehole should be completed as a monitoring well, and be located downgradient from the sites of highest known thorium contamination. The new well should have a well casing that extends at least 2.5 ft above the ground surface.

6. The DLA should prepare a geologic cross-section of the site, along with a map or sketch of the water table that shows the apparent directions of groundwater flow. This information is needed by DLA to estimate the locations of hypothetical plumes of thorium. Also, at least one water-level recorder should be installed in a well for a period of several weeks. The data will verify whether any significant water-level fluctuations are occurring in the area.

7. The DLA should describe the number and kind of hydrologic tests that are planned to be run in the existing wells. At a minimum, at least one hydrologic test should be run in each of the existing wells and in the new well to be constructed. If the local, uppermost aquifer is unconfined, then the NRC staff recommend that the slug-test method of Bouwer and Rice (1976) be used. This method is applicable for unconfined aquifers with completely or partially

penetrating wells. This is one of the methods discussed in Appendix D of the assessment plan.

8. Before proceeding with drilling and groundwater sampling work, the DLA should confirm the integrity and construction details of all pre-existing wells. After these wells are re-surveyed, new water-table elevations should be obtained. The DLA should also examine existing wells located near the decommissioning site. If DLA can gain access to such wells, it would be possible to refine the water-table map for the site. Construction details would have to be available for these wells, and their elevations would have to be surveyed.

9. In using the HydroPunch tool, DLA should not collect samples for analysis until enough groundwater is extracted to minimize turbidity. Particular care should be taken in any auger holes where thorium contamination is found at depth, near the water table.

10. DLA should be notified that the so-called "railcar washdown" area is not located within the decommissioning site. Therefore, all proposed work related to the washdown site can be deleted from the decommissioning plan.

References

Adams, W. C. and J. L. Payne, 1992. Radiological Survey of Portions of the Curtis Bay Depot, General Services Administration, Baltimore, MD. Prepared for Division of Industrial and Medical Nuclear Safety, U. S. Nuclear Regulatory Commission, Region I Office, 50 p.

Bouwer, H. and R. C. Rice, 1976. A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells. Water Resources Research, Vol. 12, pp. 423-428.

Otton, E. G., R. O. R. Martin, and W. H. Durum, 1964. Water Resources of the Baltimore Area, Maryland. Geological Survey Water-Supply Paper 1499-F.