DIFFICULTY OF ISOLATING RESIDUAL HLW IN TANK(S) AT WEST VALLEY

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Statement of problem: How to show convincingly that residual high-level waste in tank 8D2 can be successfully isolated by natural and engineered barriers for the entire hazardous life of the waste. DOE claims that this can be done, but the supporting evidence is weak.

Duration of hazard and necessary isolation period

The usual assumption for nuclear waste disposal is that the waste must be isolated from the environment for as long as the waste remains dangerous. A period of 10,000 years is often used for analyzing and predicting the performance of a waste disposal site. (For example, the 1982 West Valley EIS used 10,000 years. A period of 10,000 years was also used for most of the low-level waste disposal analyses done by NYS DEC and the NYS LLW Siting Commission.)

Unfortunately, the current West Valley EIS uses a much shorter time period: only 1000 years. This period is too short and does not represent the full hazardous life of the wastes.

This unusually short time period was noted in a report that NRC submitted to DOE on November 27, 1996, as part of NRC's comments on the West Valley DEIS: "Predictions of site performance after closure of the WVDP facilities or during long-term management extend to 1,000 years in the future. Uncertainty in predicting effects of long-term erosion processes is the primary limiting factor. In contrast, the Hanford EIS evaluates performance for 10,000 years in the future..." (Tschoepe et al., Report on West Valley DEIS prepared for NRC by CNWRA under contract NRC-02-93-005, August 1996, page S-5.)

Site-specific problems in maintaining isolation

Difficulties of maintaining long-term isolation of residual high-level waste in tank 8D2 include the following:

The tank(s) and vault(s) are located in backfilled excavations on the erosion-prone North Plateau at West Valley. The underlying Lavery till that serves as the supporting foundation and impermeable lower barrier has several potential problems: It may or may not contain pods or lenses of sand. It may or may not contain incipient vertical fractures. It varies from about 15' to 30' in thickness and its slanting lower surface rests on a combination of lake-bed sediments, coarse recessional deposits, and Kent till, which in turn rest on a steeply sloping aquifer of decomposed bedrock atop a steeply sloping bedrock-valley wall which itself is highly fractured (RQD typically 0 to 16%). Slope of the buried bedrock-valley wall is about 1:4.

The natural features of the site and the proposed engineered barriers face enormous challenges in keeping wastes isolated for 1000 or 10,000 years. Details of some of these challenges are described below,

Erosion

Erosion over 1000 years is expected to be severe but will allegedly not affect the tanks and vaults within 1000 years. See DEIS, Vol. II, page N-6. I have criticized the DEIS for underestimating erosion by not taking into account such factors as gully growth, stream capture, and seismically-induced slope failures. See my comments on DEIS, esp. my comments 90-93 and 95-104.

Erosion over 10,000 years will clearly attack the tanks, vaults, and any engineered barriers placed around them. This can easily be inferred from the DEIS, Vol. II, page N-6. Note that the high topographic relief of the local Franks-Buttermilk-Cattaraugus Creek watershed will not allow the erosion rate to decrease with time. Indeed, the phenomenon of stream capture (capture of Franks by Buttermilk) will become more likely with the passage of time and will dramatically increase stream gradients and erosion rates when it happens.

Seismic effects

Earthquakes may negatively affect waste isolation in at least two ways: 1) by triggering slope failures and thereby augmenting erosion, and 2) by disrupting engineered barriers and/or natural materials in which they are emplaced due to differences in their elastic response to seismic acceleration, possibly accompanied by liquefaction of certain soil units. These need rigorous analysis for seismic accelerations expected over a period of 10,000 years.

Lavery till and underlying units

Performance of the Lavery till as an isolating barrier and stable foundation cannot be taken for granted for 1000 or 10,000 years. Potential problems include the steep slope (about 1:4) and low RQD (typically 0 to 16%) of the underlying bedrock and the ten-foot-thick bedrock-valley aquifer that lies on the sloping wall of the buried valley. The steep slope and the flow of water through the aquifer are likely to cause subsidence and/or downslope creep of the overlying Kent till, lake beds, coarse recessional deposits, and Lavery till. For general configuration of the bedrock-valley aquifer, see especially my 1994 report entitled "Geologic and Hydrologic Implications of the Buried Bedrock Valley That Extends From the Western New York Nuclear Service Center into Erie County, N.Y." This report is included in our Geology Reports of the Coalition on West Valley Nuclear Wastes, 1994, pp. 62-88.

Sand lenses, incipient vertical fractures, and thin (15-30 feet) areas in the Lavery till may act as planes or locations of weakness in the till, especially if the till is stressed by subsidence or other differential movement of underlying layers. Sand lenses, incipient vertical fractures, and thin areas in the Lavery till may also gradually become flow pathways for water and/or contaminants. The problem of occasional (usually discontinuous) sand lenses in the till is well known. For incipient vertical fractures, see my 1992 report entitled "Review and Discussion of Vertical Fractures Reported at WV Site: Working Draft", in Geology Reports, op. cit., pp. 1-18, and the work of Fakundiny and others cited therein. For thickness of the undisturbed Lavery till beneath the tanks and vaults, see Teifke, Geology EID, WVDP-EIS-004, 1993, Plate 3, and/or Dames & Moore, Draft RFI Report on High-Level Waste Storage and Processing Area, WVDP-RFI-024, Figure 2-9.

Characterization of underlying fractures and/or faults

The existence of fractures in soil units and underlying bedrock at the West Valley Demonstration Project is well-documented. Some of the relevant sources are cited in my "Review and Discussion of Vertical Fractures...", Geology Reports, op. cit., pp. 1-18, and in my comments on DEIS, esp. comments 83-84.

The presence of major NW-trending fractures under the site is less well documented but has been put forth as a hypothesis based on several types of evidence. See Vaughan & McGoldrick, "Structural Evidence for Northwest-Trending Fractures Under the Western New York Nuclear Service Center," Geology Reports, op. cit., pp. 31-37. My unpublished geologic field work and well log reviews over the past few years show probable offset of 30 to 40 feet, down on the SW, in the vicinity of line 2B indicated in Vaughan & McGoldrick, Figure 2. In other words, there is evidence for NW-trending fractures and/or faults under the West Valley site. Small faults, possibly related, are clearly visible in the walls of the nearby Cattaraugus Creek gorge, as indicated in Geology Reports, op. cit., pp. 41 and 47. To date, DOE has done no field work to investigate, corroborate, or refute our work in this area.

Some evidence exists for faults under or adjacent to the

Western New York Nuclear Service Center, as indicated in my comments on the DEIS, especially comments 63-82. Work is needed to either characterize these faults or disprove their existence.

Characterization of fractures and/or faults is an essential part of any defensible claim that residual high-level waste in tank 8D2 can be successfully isolated for 1000 or 10,000 years. Unfortunately, DOE has refused to do full site characterization and has taken the position that full characterization is unnecessary for an existing site such as West Valley. See my comments on DEIS, especially Appendix C, page C2, §1 and §2.

Fractures and faults may negatively affect waste isolation in at least two ways. First, they are planes of weakness along which gradual movement may occur as a result of tectonic stress, glacial rebound, downslope plastic flow, subsidence, etc. Second, they may serve as preferential flow pathways for groundwater and/or contaminants. These two effects may act in combination with each other as groundwater flowing through fractures in underlying units will tend to erode soil particles from overlying units, gradually producing a linear zone of subsidence in the overlying units.

Characterization of fractures in soil units and underlying bedrock requires not only mapping of such fractures but also <u>an understanding of how they were created</u>. Understanding their origin and their evolution is an essential part of their characterization and is needed for any defensible prediction of future site performance. In particular, it is important to know whether and how new fractures will be created and evolve in the future.

<u>Summary</u>

This is a brief review of some of the modes of failure that would need to be addressed in showing that residual high-level waste can be successfully isolated in tank 8D2 at West Valley. To date, DOE has paid little or no attention to these modes of failure and the supporting field work, performance assessments, etc., that would need to be done. Showing that waste can be successfully isolated in tank 8D2 remains an enormous challenge, due in part to the same geologic features that make the site unsuitable for low-level waste disposal under either 10 CFR 61 or 6 NYCRR 382.

For copies of any of the references cited above, including our <u>Geology Reports</u> and my comments on the West Valley DEIS, please contact Sonja Allen of West Valley Nuclear Services at (716) 942-2152 or contact me at the address shown on page 1.

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