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Subject: Comments On Plan For Customizing HLW Tank Heel Removal Processes

The subject plan is laid out in the slides that were transmitted to me on September 15, 1999, and discussed with you and Fred Damerow by telephone on the next day as you had requested. In order to prepare these comments I reviewed the slides and a number of other documents related to closure of high-level waste (HLW) tanks. My comments are made in the context of expecting the Nuclear Regulatory Commission (NRC) to publish soon, perhaps by mid-October, a draft policy statement on the Commission decision on the West Valley Demonstration Project (WVDP) decommissioning criteria for a 60-day public comment period. Having read the NRC Staff Requirements Memorandum of June 3, 1999, and the Commission vote sheets, I expect that the draft policy statement will solicit public comment on the application of incidental waste criteria in the closure of the HLW tanks at West Valley. I believe that the WVDP should prepare cogent comments for that draft policy statement based on this proposed plan and the technical basis developed by work so far in the WVDP. I believe that the WVDP should consider the content of the new DOE Order 435.1 and its supporting Manual and guidance, as well as the HLW tank experience at other DOE sites in preparing its comments. I would be happy to assist you in the preparation of those comments when the time comes. Meanwhile, I believe these comments will be useful then, as well as in your consideration of current plan changes.

COMMENTS ON THE PLAN

When the WVDP began you evidently took an integrated approach to extracting and processing the HLW in two of the four tanks in the vaults. The small amount of acid waste was combined with the large volume of neutralized waste in 8D-2. All four HLW tanks, two large and two small, were worked into the waste processing system. Extraction from 8D-2 has been quite successful, bringing you close to a point at which you may justifiably declare that the residue in 8D-2 is clearly incidental waste, and 8D-2 is ready for closure by grouting, etc. I assume in this comment that separate considerations of site stability, resistance to large scale erosion and site monitoring will conclude that *in situ* disposal of waste is acceptable at West Valley. However, the greater present waste content in 8D-1, particularly of bulk zeolite with Cs-137, would complicate closure steps for 8D-2 if you follow the current process of transferring the recycled waste stream from 8D-1 to 8D-2 before extraction.

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As I understand the new Plan, it is to make modifications to the systems now so that the large tanks can be dealt with separately rather than in series. Then, the WVDP can concentrate on final sludge, and transuranics, removal directly from 8D-2 without the introduction of extraneous solid material from 8D-1 that would complicate the process. That is an excellent plan; I understand that it can be achieved at modest cost and worker exposure. I believe the WVDP should promptly make these modifications and pursue this alternate path to conduct final extraction from 8D-2 directly to ready that tank for final closure by grouting, etc. I presume these modifications to the system may involve an assumption on whether or not oxalic acid, or some other aggressive solvent might be used. The data now available in the slides indicate that water-based hydraulic extraction should be able to satisfy the criteria for tank closure as discussed later in this letter.

An important benefit of the Plan revision is that it focuses on removing transuranics while the melter is still operable. The WVDP has already removed and vitrified much of the HLW that requires vitrification. If the melter should fail at this, now late stage, it would have a strong impact on the cost-benefit of further extraction. It is prudent to avoid the dilemma that melter failure would pose. There is, of course, the risk that 8D-1 may still hold a significant quantity of transuranics.

The slides presenting the plan, particularly slide #4, analyze the stabilization volume required to achieve classification as Class C for the radioactive residue in the tanks. The key to judging adequate removal of HLW from a tank is not the fraction removed, but the fraction remaining as residue. The initial contents of the tank can be established quite well from the historical records. The amount of waste extracted can be established well from assay of the extracted waste streams. The residue is the small difference between these relatively large numbers. It is very difficult to determine the amount and assay of the residue in the tanks after many extraction attempts, since the residue is not homogeneous or well located. I recommend that you conduct uncertainty analyses of how well you know the current contents of the tanks and the final residues. These uncertainties should be considered in your plans for further processing and application of classification criteria to the stabilized final residue.

I endorse the plan to modify the system, engage in direct transfers and extractions from 8D-2, and to develop a plan for subsequent separate treatment of 8D-1. I recommend that, when DOE determines that 8D-2, and later 8D-1 are ready for closure by grouting, etc., that those tanks be held in readiness for those irreversible steps until there is sufficient consensus that they are ready for closure.

CRITERIA FOR CLOSURE OF HLW TANKS

The following is the line of thoughts that I believe should be addressed in WVDP and DOE comments on the forthcoming draft policy statement from the NRC. In formulating these thoughts I have relied on my very limited understanding of DOE waste management data and experience. I request that you and others in DOE challenge and change any arguments that you see are flawed. I also strongly recommend that the Office of General Counsel perform a legal analysis of the points I make below, especially in

interpretation of law. The NRC typically uses drafts for comment to solicit expert comment for issues where the NRC does not have strong expertise. Therefore, I expect that the NRC will be open to cogent arguments from DOE which has the expertise.

The Department of Energy (DOE) is facing the prospect of closing more than 200 near-surface, underground tanks that may contain or do contain radioactive waste that is high-level waste (HLW) by statute and regulation. The costs and attendant worker radiation exposures make complete removal of the contents and the contaminated tanks almost impossible. Consequently, there has been a working assumption that HLW extraction will proceed until the tank residues are sufficiently low to be ruled waste incidental to reprocessing, that may be low-level waste (LLW) or transuranic waste (TRU). If the residue is within the Class C category for LLW it may be considered for near-surface disposal *in situ* if acceptably stabilized. On February 26, 1993, the Nuclear Regulatory Commission denied a petition for rulemaking (PRM-60-4) that dealt with the process for classifying such waste at DOE facilities. In denying the petition, the NRC established three criteria for DOE to satisfy in making its determination that HLW tank residues are acceptable for *in situ* disposal as waste incidental to reprocessing. Those criteria are that; " ...DOE will assure that the waste: (1) has been processed (or will be further processed) to remove key radionuclides to the maximum extent that is technically and economically practical; (2) will be incorporated in a solid physical form at a concentration that does not exceed the applicable concentration limits for Class C low-level waste as set out in 10 CFR Part 61; and (3) will be managed, pursuant to the Atomic Energy Act, so that safety requirements comparable to the performance objectives set out in 10 CFR Part 61 are satisfied." These criteria were transmitted to DOE, with the Denial of Petition, by letter from Robert Bernero (NRC) to Jill Lytle (DOE) dated March 2, 1993.

It is important to note that these criteria are to be used in a DOE determination on the closure of DOE HLW tanks, with subsequent waste disposal management "pursuant to the Atomic Energy Act" by DOE. The tanks at West Valley are unique since they are commercial HLW tanks under an NRC license. That license is held in abeyance by the NRC since the West Valley Demonstration Act that charges DOE to decommission these tanks under informal NRC oversight. For the West Valley tanks DOE should conduct its determination and closure process in the same manner as it would at a DOE site. At a DOE site NRC has informal oversight of the closure process and can raise objections if it considers the DOE process flawed. At West Valley the informal NRC oversight must recognize that subsequent waste disposal management "pursuant to the Atomic Energy Act" will be approved later by the NRC as the responsibility of the State of New York under the NRC license.

The attention of petitioners in PRM-60-4, and the attention of the NRC in the denial of that Petition, was on the form and radioactive content of the extracted waste residues that would remain at the site in near-surface disposal. There was no explicit attention to the residues left in the tanks. It is a reasonable assumption that if the tank residues can justifiably be judged as within the Class C limits, the stabilized waste is acceptably disposed if the indicated performance standard is met. There is a unique problem for the HLW tanks at West Valley. The incidental waste criteria refer to Class C as limited by

the regulation, 10 CFR Part 61.55, that limits the transuranic content of Class C waste to 100 nCi/gm. In contrast, the statute, the West Valley Demonstration Act of 1980, sets a threshold for transuranic waste of 10 nCi/gm. If the earlier limit from the statute is held, it will be much more difficult to show satisfaction of Class C limits in the stabilized tank residues. I believe the statute chose the more restrictive limit because there was active debate at the time on whether the limit should be 10 or 100 nCi/gm, and even whether the more radioactive wastes such as Class C should be acceptable for near-surface disposal. The NRC promulgated 10 CFR Part 61 in 1982, but debate continued. Through the Low-Level Radioactive Waste Policy Amendments Act of 1985, I believe that the Congress endorsed the specific classifications of waste in Part 61.55, including the limit of 100 nCi/gm for transuranics, thereby superseding the 10 nCi/gm limit in the 1980 Act. I recommend a careful review of the legislative record that I think will support this conclusion.

It was recognized in the March 2, 1993, letter that it might become apparent in a DOE evaluation that some wastes may be subject to NRC licensing. If DOE has such a concern it was advised to communicate that concern to NRC "...to determine what form of pre-licensing interactions, analogous to repository site characterization, would be needed to define the appropriate disposition of these wastes." This evidently refers to the possibility that significant quantities of HLW might remain in the tank, so that the three criteria for incidental waste are not met. My recollection is that it addressed the possible encounter of intractable crusts or large chunks of HLW sludge, masses that are evidently high-level waste. The advice to DOE is to notify and to consider the first steps toward licensing a near-surface repository for HLW. That passage does not address residues that, due to uncertainty of measurement, may be over the Class C limit, or might require concentration averaging with most of the inert fill in the tank. If the call is that close, 10 CFR Part 61 may provide useful control and guidance.

Preliminary results from HLW tank extractions conducted to date indicate that more than 95%, perhaps even more, of the waste can be extracted using water-based hydraulic extraction methods. Basing economic and technical practicality on the fraction extracted alone might indicate that Criterion 1 can be satisfied. However, the tank residues foreseen may be so high in activity that it is not possible to meet Class C limits for the average concentration without taking credit in the average for very deep quantities of grout poured over the residue. Thus, satisfaction of Criterion 2, applied to the tank residue, becomes an important corollary to satisfying Criterion 1. Satisfaction of Criterion 2 depends on the technique chosen for concentration averaging in the waste tank, and that technique may impose significant limits on the performance models chosen to address Criterion 3.

The first problem in analyzing the residue against Criterion 2 is to obtain a reasonable estimate of the form, the amount and the location of the residue. Subtraction of the estimates of the waste extracted from the original inventory in the tank based on the records can give a baseline estimate of the amount. However, that estimate will be based on the small difference between large numbers and carries significant uncertainty. The

form and the location of the residue can be assessed from the processing record and the limited ability to inspect and sample the tank. All of these uncertainties must be considered in the development of an appropriate concentration average for the waste residue when it is stabilized in the tank.

The second problem in assessing the residue classification is the use of existing regulation and guidance for the consideration of classifying *in situ* waste residues. The very title of 10 CFR Part 61, Licensing Requirements For Land Disposal of Radioactive Waste, indicates that the requirements and standards are explicitly directed to the classification of generated wastes that are intended for authorized disposal, after necessary treatment packaging and transport to the disposal site. The supporting guidance in the NRC Branch Technical Position on Concentration Averaging and Encapsulation is even more explicitly directed to waste *in hand*, referring to concentrated source capsules, package sizes, etc. That explicit direction of Part 61 must be kept carefully in mind when the requirements of Part 61 are shifted to *in situ* wastes and decommissioning. For example, the original version of Part 61.55, at 61.55 (a)(2)(iv) identified wastes exceeding the limits of Class C, Greater-Than-Class-C (GTCC), as generally unsuitable for near-surface disposal and offered to consider specific proposals for NRC approval under Part 61.58. It was important at that time to have a clear disposal responsibility since GTCC was already *in hand* in the form of old source capsules, wastes from decommissioning facilities that supported the breeder reactor program, etc. The Congress recognized this in 1985 when, in Section 2021c.(b)(1)(D) of the Low-Level Radioactive Waste Policy Amendments Act, it assigned responsibility to the Federal Government for disposal of "waste with concentrations of radionuclides that exceed the limits established by the [Nuclear Regulatory] Commission for class C radioactive waste, as defined by section 61.55...".

There is an interesting footnote that follows this passage immediately in the 1985 Act. Section 2021c.(b)(2) states: "All radioactive waste designated a Federal responsibility pursuant to subparagraph (b)(1)(D) that results from activities licensed by the Nuclear Regulatory Commission under this chapter, shall be disposed of in a facility licensed by the Nuclear Regulatory Commission that the Commission determines is adequate to protect the public health and safety.". That proviso is in part the basis of the later rulemaking by NRC to change Part 61.55 (a)(2)(iv) to read: "Waste that is not generally applicable for near-surface disposal is waste for which form and disposal methods must be different, and in general more stringent, than those specified for Class C waste. In the absence of specific requiremens in this part, such waste must be disposed of in a geologic repository as defined in Part 60 of this chapter unless proposals for disposal of such waste in a disposal site licensed pursuant to this part are approved by the Commission.". I would argue that if the waste residue in the West Valley tank(s) is judged to be greater than Class C, it is possible for acceptable disposal *in situ* to be demonstrated, with NRC having no current objection and readiness to approve such disposal with restricted release later when the West Valley license is reinstated. The NRC has already presented criteria for restricted release at licensed sites in 10 CFR Part 20.1403.

Another aspect of residue classification is the evaluation of the type and amount of the grout or other stabilizing material that will fix the residue "in a solid physical form" in the tank. Some materials, such as reducing grouts can have a stabilizing chemical effect on the residue, but they are not likely to dissolve the residue and distribute it widely in the first pour over the residue. At large sites with many tanks, the cost of extensive grout formulation and pouring facilities may be part of an economically practical approach. At sites such as West Valley, with only a few tanks, simpler grouting facilities may be necessary. Some have suggested use of the guidance in the NRC Branch Technical Position On Concentration Averaging and Encapsulation, that was most recently issued on January 17, 1995. Unfortunately, that guidance is not useful here because it addresses only waste in different forms which is readily accessible and being considered for direction to a licensed LLW disposal site.

The waste tank configuration in its vault must be considered in developing the approach to concentration averaging for the residue and for the models appropriate to performance assessment in both the water pathway and the intruder scenarios. These tanks are typically large, round, flat-bottomed vessels set in underground vaults. The radioactive residue lies within the bottom of the tank, much of it caught in the edges and corners formed by the many mechanical stiffeners inside the tank bottoms. Some of the contamination, particularly in the carbon steel tanks is in an adherent corrosion film along the walls and the bottom. The tanks are very large, typically 600,000 gal. up to 1,300,000 gal. in volume. Some of the underground vaults have open annular space around the tanks that can be filled with inert material to inhibit water transport into or out of the tanks. There is little, poorly accessible space under the tanks for any filler material. When the tanks are closed they will certainly be filled with inert material, but how does one model the inert material that can be considered as encapsulating the waste as distinct from the inert material that is filled on top of the stabilized waste?

There are two scenarios of interest in modeling the performance of the closed tank, the first is the pathway of water leaking in, dissolving or suspending the waste, and carrying it out into the biosphere. The second is the intruder scenario where someone digs or drills into the stabilized tank. The intruder scenario is not likely to be at all controlling given the size of the tank, the fact that the tank will be filled with solid material, and the waste residue is imbedded in the lowest few feet, down in the bottom of the tank. Primary attention can be given to the model for water access to the waste residue and then transport of the waste out of the system.

A conservative model for the water pathway would not take credit for every foot of inert barrier piled on top of the waste. Rather, the model would describe the waste residue as a disk of the radioactive material along the bottom of the tank, capped by only a few feet of grout whether it was placed in single or multiple pours. The few feet of barrier would not be treated as leak tight, recognizing the presence of cracks in the material or weaker paths along the cold joints between pours. The model would treat water access to the waste and out along any and all of the pathways, from above and from the side along the more readily corroded shell of the tank. Thus, the performance models suggest that only a few feet of grout or other stabilizing material should be considered in the concentration

average for waste classification calculations. Given the uncertainties in estimating the quantity of waste that should be considered, it is not a significant difference if the "few feet" amount to 3 feet or 6 feet, or whether they are made in a single pour or not. Depending on the specific details, multiple pours of grout may even offer a means of optimizing waste extraction from the tank. It is possible for the moving face of the poured grout to move the liquid heel in the tank, with some of the residue, toward the extraction point, further enhancing waste extraction. Evidently, the residue not so moved would be covered by the grout and fixed to the tank floor.

I look forward to discussing these points with you and offering whatever assistance I can provide to your address of these important questions.

Sincerely,

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