Department of Energy
Ohio Field Office
West Valley Demonstration Project
10282 Rock Springs Road
West Valley, NY 14171-9799

June 3, 2003

Mr. Chad J. Glenn
U.S. Nuclear Regulatory Commission
TWFN, Room 7 F25, MS-7-F25, NMSS/DWM/DCB
Washington, DC 20555-0001

SUBJECT: Response to Comments on the Draft Process Hazard Analysis (PHA) for the Remote Handled Waste Facility (RHWF)

Dear Mr. Glenn:

Enclosed are West Valley Nuclear Services Company's (WVNSCO) responses to the U.S. Nuclear Regulatory Commission (NRC) comments on the draft PHA for the RHWF at the West Valley Demonstration Project (WVDP). The comments were provided by Ms. Anna Bradford via electronic mail on March 20, 2003. There is no requirement for U.S. Department of Energy (DOE) to respond to these comments, nor is there a requirement for NRC to review these responses. However, DOE recognizes that the quality of the Safety Analysis Report (SAR) will be improved if there are interactions with NRC before the formal SAR review.

My staff has also sent a copy of a proposed SAR review schedule to the NRC. I understand that this schedule is under review and you are determining what resources are needed to support the review schedule. Please continue to work with Mr. Bryan Bower of my staff on the review schedule. If needed, my staff can provide an overview or briefing of the proposed project. We recommend that this presentation be held at the WVDP, and combined with a tour of the facility, however, we can make this presentation at a location of your choice.

If you have any questions regarding the enclosed responses, the review schedule, or the proposed briefing, please contact Bryan Bower of my staff at (716) 942-4368.

Sincerely,

Alice C. Williams

Alice C. Williams, Director
West Valley Demonstration Project

Enclosure: WVNSCO Responses to NRC Review on the PHA for the RHWF

cc: See Page 2

BCB/sdm

Rc 3.26

cc: R. W. Everson, OH/OCS, OSE-330, w/o enc.
T. J. Vero, OH/WVDP, WV-DOE, w/o enc.
M. J. Cain, WVNSCO, WV-53, w/o enc.
L. J. Chilson, WVNSCO, WV-AA3, w/o enc.

BCB/sdm

Attachment 1
WVNSCO Responses to NRC Review on the PHA for the RHWF

NRC Comment:

1) It is interesting to note that the risk matrix described PSAR Table 9.1-1 is consequence weighted. There is no justification for the consequence weighing versus weighing consequences and likelihood evenly. It appears that the "real" risks for this type of facility lie in the anticipated (high-frequency, low-consequence) events. Consider providing justification for the use of this type of risk matrix, as this risk matrix is critical to the calculation of the PHA's "overall" risk factor (i.e., "..., credible events were identified in the PHA as having a risk factor greater than or equal to three (3).").

WVNSCO Response:

RHWF DSA PHA is consequence weighted according to the process mandated by 10 CFR 830.204 (a):

> "The contractor responsible for a hazard category 1, 2, or 3 DOE nuclear facility must obtain approval from DOE for the methodology used to prepare the documented safety analysis for the contractor uses a methodology set forth in Table 2 of Appendix A to this Part."

Table 2 of Appendix A states, "The contractor responsible for... (2) A DOE non-reactor nuclear facility... May prepare its documented safety analyses by ... using the method in DOE STD-3009, Change Notice No. 1, January 2000, Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports, July 1994, or successor document." Chapter 3, "Hazard and Accident Analyses" of DOE-STD-3009 provides guidance on the accepted methodologies to be used for identifying hazards and performance of accident analysis. Guidance for hazard and accident analysis is not based on probabilistic risk assessment (PRA).

DOE-STD-3009 defines the evaluation guideline (EG) as, "The radioactive material dose value that the safety analysis evaluates against. The Evaluation Guideline is established for the purpose of identifying and evaluating safety-class structures, systems, and components. On-site Evaluation Guidelines are not required for adequate documentation of a safety basis utilizing the overall process of this Standard." As defined, the EG specified in the DOE guidance is an upper bound to be compared to the consequence of an analyzed accident. Appendix A of DOE-STD-3009 further states:

> The EG value is not release frequency dependent, ..., the determination of need [for SC SSC designation is necessary] is solely driven by the bounding consequence potential. In addition, calculation of frequencies and consequences of various release scenarios involve accounting for large uncertainties on both scales .... Moreover, requiring frequency-based calculations would result in enlarging the paper process, thus undermining DOE's emphasis on comprehensive hazard analysis, without significant payback in safety assurance on the operating floor."

The evaluation guidelines of hazards associated with other WVDP facilities have been developed to facilitate the safety analysis process as described in WVNS-SAR-001 Section 9.1.3 and were based on the following distinctions:

1. Whether the event (Accident) is manmade or caused by natural phenomena;
2. Whether the hazard is radiological or toxicological; and
3. Whether the population at risk is the public or on-site worker

The EGs in themselves give equal weight to consequence and frequency. For those events that fall below the risk factor threshold of 3 and are not formally compared to the EGs, such as an anticipated operator error initiated event, the preventative features implemented through safety management programs are relied upon to identify hazards and implement required hazards controls for worker safety. The DOE position is further stated in Appendix A, DOE-STD-3009, "for operational accidents there is no explicit need for a frequency component to the unmitigated release calculations, since the determination of need is solely driven by the bounding consequence potential."

This methodology was selected to ensure continuity with the methodology used to develop the existing site Documented Safety Analysis, WVNS-SAR-001. The 3X3 matrix used in the draft PHA is modified from Figure 3-3 of DOE-STD-3009-94. DOE-STD-3009-94 states that the source of this matrix is EPA Technical Guidance for Hazards Analysis. The process hazards analysis technique, which was the technique selected for this analysis since the RHWF is considered a low-complexity facility, identifies those events/scenarios that pose the greatest consequences associated with operation of the facility and provides a mechanism for comparison of risk among facilities throughout the DOE complex. The RHWF DSA PHA is consistent with the PHA guidance given in Chapter 3 of DOE-STD-3009-94, *Preparation Guide for U.S. Department Of Energy Nonreactor Nuclear Facility Safety Analysis Reports*, which is specifically cited in 10 CFR 830. The methodology stipulated in this Standard has been extensively implemented in the DOE complex, since the alternative is to develop a methodology and obtain DOE approval. Addition of more "anticipated" events with negligible consequences is considered to add length without value to the PHA. (It is recognized that several such events can be identified.) It is noted that such "anticipated" events should be considered as to whether they have non-negligible impacts at the on-site evaluation point (located 640 meters from the point of the uncontrolled release), not to RHWF workers. In-facility workers are protected primarily through programmatic-related efforts. WVNSCO DSAs use a more conservative approach than that given in DOE-STD-3009-94. In accordance with the standard, only events with a risk factor of 5 or higher represent "situations of concern" or "situations of major concern." WVNSCO, using a more conservative approach for DSAs, has provided detailed analysis of events with a risk factor of three (3) or higher.

Lastly, it is noted that WV-921, *Hazards Identification and Analysis*, establishes the policy and means "to conduct hazards analyses for all WVNSCO activities during the work planning process, prior to commencement of work." WV-921 provides the mechanism for the Work Originator, Work Group Supervisor, and/or Work Review Group to determine when the Hazards Controls Specialists shall be included in the work planning process at a task level. Implementation of WV-921 aids in identifying situations and work environments that could lead to abnormal and accident events that might be considered to have a relatively high frequency of occurrence associated with them (e.g., skin contamination events, a small uncontrolled airborne release of radioactive material during maintenance activities, a highly localized fire of short duration potentially involving slightly contaminated items such as tools, etc.). Through identification of potential hazards to the co-located worker, appropriate preventive actions can be taken and appropriate mitigative measures established in these task level documents to ensure worker safety.

NRC Comment

2) PHA, Table 1 does not provide a clear linkage between the initiators and events which makes it difficult to evaluate the reasonableness of the assigned frequency and therefore the risk factors.

WVNSCO Response:

The PHA table will be modified with numerical pointers that will preface tabulated initiators to allow for a correlation of initiators and events. The RHWF DSA PHA table in its current format is preferred by the primary users as discussed below:

- All of the Safety Analysis Reports (now Documented Safety Analysis [DSA]) at the site (except for the RHWF DSA) have been rolled into one DSA, namely WVNS-SAR-001. During that process of DSA consolidation, the PHAs for all facilities at the WVDP were given the same format/appearance (i.e., they were "standardized"). (The "standardized" PHA in WVNS-SAR-001 consists of 66 pages.) It is intended that the RHWF DSA will be incorporated into WVNS-SAR-001 at a later date. Every effort has been made to minimize the effort that will be required to incorporate the RHWF DSA into WVNS-SAR-001, including making the RHWF DSA PHA similar in format/appearance to the PHAs in WVNS-SAR-001.
- The RHWF DSA PHA conforms to the PHA guidance given in Chapter 3 of DOE-STD-3009-94, *Preparation Guide for U.S. Department Of Energy Nonreactor Nuclear Facility Safety Analysis Reports*. This Standard has been extensively implemented in the DOE complex. It is considered that wide latitude should be given to the PHA authors as to other aspects of the PHA's format/appearance, especially for a simple facility such as the RHWF.

- The graded approach to developing safety analyses is discussed in numerous DOE documents, in particular 10 CFR 830 and DOE-STD-3009-94 (which is cited in 10 CFR 830). As constructed, the PHA provides a systematic identification of those events/scenarios that pose the greatest risk for facility operation. No attempt has been made to identify all initiators for events for facility operations. In general, the listing of initiators is intended to communicate some of the more prominent mechanisms for a given event. It is also apparent that a given initiator could lead to one or more of the events.
- The frequency bin that each event is assigned to is based on the engineering judgment of the safety analyst(s). In making these judgments, consideration is given to the more likely means that could result in the undesired event occurring. Also an important factor in making these judgments is the analysts' knowledge (acquired through pertinent DOE and industry experience and data sources) of the frequency of occurrence of various accident phenomena.

NRC Comment:

3) Use of the Cs-137 activity and ORIGEN to set the Material At Risk (MAR) may be suspect if the waste stream was originally designed to serve a specific purpose (e.g., a filter such as diatomaceous earth). In addition, two of the vessels removed from the CPC have "dried, caked debris" approximately 2.5cm thick. The role the vessels served in processing of materials should be considered to evaluate potential radiological composition. Additional discussion of development of and uncertainty in the radiological sources (MAR) should be provided.

WVNSCO Response

The 13 waste streams being processed through the RHWF are shown in Table 1.1-1, *Waste Streams to be Processed in the Remote Handled Waste Facility*, provided during the review of the RHWF PHA. These waste streams provide the radiologically hazardous materials associated with the RHWF operations. As will be discussed in detail in Section 8.2 of WVNS-SAR-023, Revision 1, when submitted for review and approval, the inventory of radionuclides shown in Table 8.2-1, is considered to provide a reasonably bounding material at risk for credible accidents associated with the RHWF. This inventory was generated based on waste streams 12 through 16. Waste streams 12-16 encompass the 22 boxes of components and debris that were generated as the result of the disassembly and removal of various components from the Chemical Process Cell (CPC). The CPC was used to dissolve spent nuclear fuel, thus these waste streams are assumed to be contaminated with a spent nuclear fuel distribution of radionuclides. The nuclide distribution for the spent nuclear fuel was obtained by decay correcting (10 year decay) the data published in the *Estimation of Activity in the Former Nuclear Fuel Services Reprocessing Plant*, J. C. Wolniewicz, CN:93:0015, Dames & Moore, March 1993. The inventory in these boxes is given in Table 7.7-4 of WVNS-SAR-001 as 274.29 curies Cs-137 of activity and a fissile mass (U-235 equivalent grams estimate) of 490.81 grams based on information documented in 1986. The items associated with waste streams 17, 18, 20, 21, 22, and 24 are considered to have a limited radiological material inventory (relative to the bounding MAR presented above) in consideration of their service/function and measured dose rates. The 13 boxes associated with waste stream 19 documented in a previous analysis were estimated to contain a total of 1.2 curies of CS-137 and a fissile mass (U-235 equivalent grams estimate) of 2.15 grams (4.7E-03 lbs). Waste stream 23, Waste Tank Farm Pumps, are expected to be contaminated with a distribution of radionuclides consistent with high-level waste (HLW). For a given a quantity of radionuclides, a HLW distribution would yield a very small fraction of the actinides that a spent nuclear fuel distribution would yield. In general actinides are much more harmful to human health via the inhalation pathway than non-actinides.

This discussion and clarifications will be included in Chapter 8 of WVNS-SAR-023.

Attachment 1
WVNSCO Responses to NRC Review on the PHA for the RHWF

NRC Comment:

4) Need to add additional initiators for the container breach events for the Receiving Area and the Load Out/Truck Bay. Consider including "truck collision" as an operator error or mechanical failure, as shown in the addendum to the PSAR.

WVNSCO Response

As stated in response to NRC Comment 2 above, the PHA does not include all possible initiators for the listed events, but has listed those that represent the more prominent mechanisms for a given event. WVNSCO will add "Forklift or other transport vehicle" as another example of an initiator for the container breach events for the Receiving Area and the Load Out/Truck Bay.

NRC Comment:

5) The PHA does not appear to consider the additional fuel loading introduced by the use of a truck on the Load Out/Truck Bay and/or Receiving Area. Is there a significant difference between the analyzed fuel loading of the forklift and that of the transport truck? Has a forklift/truck collision been considered? It is not clear that the truck has been considered as the initiator or event for any of the hazards discussed in PHA Table 1. If these scenarios have been evaluated then consider including them as initiators.

As discussed during the interactive review of the PHA on February 19, 2003, "Forklift or other transport vehicle" will be identified in the PHA as an example of a "Mechanical or electrical failure/malfunction" initiator for a fire/explosion. "Operator error" and "Mechanical or electrical failure/malfunction" could occur in association with the "forklift or other transport vehicle." Fuel loading is not considered germane to the analysis of consequences of a fire in the Receiving Area or Load Out/Truck Bay Area, because the airborne release fraction (ARF) and respirable fraction (RF) are much larger for an explosion than for the thermal stressing of non-combustible materials. In the analysis, the ARF and RF associated with an explosion were used in this scenario to represent the worst case for an unmitigated release. A fire/explosion resulting in a substantial release is postulated in the PHA as an "unlikely" accident scenario in the RHWF (e.g., in the Receiving Area or Load Out/Truck Bay Area). ARFs and RFs provided in DOE-HDBK-3010-94, *Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities*, were used in the accident analyses in the RHWF DSA. Much of the information in this DOE Standard is contained in ANSI/ANS-5.10-1998, *Airborne Release Fractions at Non-Reactor Nuclear Facilities.*

NRC Comment:

6) The on-site and off-site consequences are likely to be very conservative and therefore bounding due to the use of the NRC-recommended 1m/s wind speed and Pasquill-Gifford stability class (PGSC)F. If needed, a more realistic approach could be taken for atmospheric transport.

WVNSCO Response

No response required.

NRC Comment:

7) It is unclear why the onsite evaluation point is set at 640m from the RHWF,(e.g., PSAR sections 2.5 and 9.2.1.4).

WVNSCO Response

The On-site Evaluation Point (OEP) (0.4 miles [640 meters]) was chosen based on draft DOE-STD-3005, which was released in February 1994. DOE endorsed 0.4 miles in that Standard for the OEP, and cites NRC Regulatory Guide 4.7 as the basis for that distance.

NRC Comment:

8) It is not clear that the event "source capture system fire" as the result of "ignition of combustible waste by size reduction, ..." has been considered. During routing operating conditions the "source capture system" may collect saw dust and/or metal shavings and other flammable particulate matter or waste materials (e.g., wood) initiated by cutting/resizing operations. This localized fuel loading coupled with numerous ignition sources (in close proximity) has the potential to result in an increased probability for localized fires. This scenario also has the potential to further damage the HEPA ventilation system and introduce a new release pathway for airborne material as well as materials trapped in the filter systems. It should also be noted that there are no sprinklers in the work cell, and the PHA and the PSAR are not clear as to whether the Work Cell is equipped with fire detection systems.

WVNSCO Response

At this time, a source capture system is not part of the RHWF design, and is not mentioned in the RHWF DSA. However, it may be part of a cutting/shearing/sawing operation eventually performed in the Work Cell. Regardless of whether a source capture system is used, the designation of "unlikely" for a "fire resulting in a minor release" in the Work Cell, and the designation of "unlikely" for a "fire resulting in a substantial release" in the Work Cell are deemed appropriate.

Heat detection devices are installed in the ventilation stream of each of the four ventilation exhaust system filter banks in the Work Cell. Upon actuation, the condition is alarmed to operators, and the operating ventilation train will be dampened and the variable speed drive for the fan will be adjusted to reduce the air flow. This will reduce the supply of air to a potential fire while maintaining a negative cell pressure for contamination control.

For the RHWF DSA accident involving damage to the in-cell filter houses, the bounding ARF of 5.0E-04 and RF of 1.0 for "crush-impact stresses" on high efficiency particulate air (HEPA) filters were taken from Section 5.4.4.1 of DOE-HDBK-3010-94. It is noted that the ARF value is larger than that for the thermal stress of HEPA filters. Section 5.4.1 of DOE-HDBK-3010-94 provides a bounding ARF of 1.0E-04 and RF of 1.0 for "the impact of heat upon loaded HEPA filters." It is noted that because of the nature of the construction of high efficiency filters, hot particulate matter (e.g., hot metal shavings) would have a very limited impact in terms of creating "bypass" air flowpaths.

NRC comment:

9) It is not clear that the PHA or PSAR evaluate crane failures in the Receiving Area/Buffer or Work Cells, or Load Out/Truck Bay. These scenarios should be bounded by the "waste container lift failure, ..." However, the link is not discussed.

"Crane drops container" or "Crane drops item(s)" is specifically cited in the PHA for the Receiving Area, Buffer Cell, and Work Cell. There is no crane in the Load Out/Truck Bay Area. "Crane drops container" and "Crane drops item(s)" are given as specific examples of "Mechanical or electrical failure/malfunction." Use of the crane to lift containers in the Buffer Cell is considered an infrequent operation since movement of the container through this cell is primarily using the conveyor/roller system. The planned modification of the PHA table should assist the user and the reviewer in making necessary links between events and initiators, see response to NRC Comment 2 above.

NRC Comment:

10) The filter failure scenario assumes a radiation level of 15 R/hr at 15cm from all filters with inadequate discussion to assess the reasonableness of this assumption. In addition, it is unclear what the initiators may be and why this scenario is extremely unlikely.

WVNSCO Response:

To determine a reasonably bounding MAR in the 24 filter housings, the two filters contained in each filter housing were modeled as one filter that has a dose rate of 15 R/hr at 15.24 cm (6 in) from the midpoint of the filter's face. From this modeling, which entailed the use of the computer code MicroShield 5.05, a Cs-137 loading was calculated, which in turn was used to calculate the amount of activity of other radionuclides on the filter. (In equilibrium, for each curie of Cs-137, a beta particle emitter, there exists 0.946 curies of Ba-137m, a gamma ray emitter.) A factor in selecting the analyzed dose rate was operating experience in similar facilities at the WVDP. Another factor is that Section 3.6 of Specification 79303-236-01, *In-Cell Filters Specification*, stipulates a design operating environment for the filters of "15 R/hr maximum dose rate over 20 years." If a filter is producing a dose rate of 15 R/hr at a distance of 15.24 cm (6 in) from its face, the filter media is being exposed to a substantially higher dose rate. In consideration of these facts, and the fact that the accident is postulated to affect all 24 filter housings, modeling 48 filters (i.e., the medium efficiency filter and high efficiency filter within each of the 24 filter housings) with a dose rate of 15 R/hr at 15.24 cm (6 in) as the basis for the MAR is considered extremely conservative. It was determined through the use of MicroShield 5.05 that one curie of Cs-137 (0.946 curies of Ba-137m) produces a dose rate of 6.54 R/hr, and hence 2.29 curies of Cs-137 (2.17 curies of Ba-137m) would produce a dose rate of 15 R/hr. Twenty-four filters multiplied by 2.29 curies of Cs-137 per filter yields 54.96 curies of Cs-137. To determine the MAR in 24 filter housings, 54.96 curies of Cs-137 was divided by the Cs-137 activity (181 curies) shown in Table 8.2-1. That value, 0.304, was multiplied by the activity given for each of the other 80 radionuclides shown in Table 8.2-1. Hence, the MAR in the 24 filter houses corresponds to 30.4% of the activity estimated to be present in the 22 boxes of CPC components and debris (discussed in Chapter 8).

The bounding ARF of 5.0E-04 and RF of 1.0 for "crush-impact stresses" on high efficiency particulate air (HEPA) filters are taken from Section 5.4.4.1 of DOE-HDBK-3010-94. It is noted that the ARF value is larger than that for the thermal stress of HEPA filters. Section 5.4.1 of DOE-HDBK-3010-94 provides a bounding ARF of 1.0E-04 and RF of 1.0 for "the impact of heat upon loaded HEPA filters."

It is considered difficult to identify a credible accident-related mechanism that would simultaneously damage all 24 in-cell filter houses. However, initiators considered include a (rarely carried) long and large load is dropped from the Work Cell crane onto the in-cell filter banks, or perhaps a major ventilation system pressure transient occurs that ruptures the filters.

Based on factors including but not limited to the location and design of the filters, auxiliary equipment, operating definitions and loads considered in the facility and the engineering judgment of the analyst, the selection of "Extremely unlikely" for the frequency of this event is considered reasonable. Even so, the detailed analysis of this event resulted in the maximum Total Effective Dose Equivalent (TEDE) at the on-site evaluation point from this accident scenario has been calculated to be 0.797 rem. The TEDE received by the maximally exposed off-site individual has been calculated to be 0.498 rem. Post analysis review indicates these values are below the radiological EGs for an extremely unlikely accident and further supports the selection of this frequency.