Safety Evaluation Report
on the West Valley Demonstration Project Safety Analysis Report
for the Remote-Handled Waste Facility

A Review of
WVNS-Safety Analysis Report (SAR)-023, Rev. 1, Draft D,
Safety Analysis Report for the Remote-Handled Waste Facility

Prepared by the
U.S. Nuclear Regulatory Commission

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The Office of Nuclear Material Safety and Safeguards
Safety Evaluation Report of WVNS-SAR-023, Rev.1, Draft D
Safety Analysis Report for the Remote-Handled Waste Facility
for the West Valley Demonstration Project

1.0 INTRODUCTION

On July 23, 2003, the U.S. Department of Energy (DOE) transmitted WVNS-SAR-023, Rev. 1, Draft D, "Safety Analysis Report for the Remote-Handled Waste Facility" to the U.S. Nuclear Regulatory Commission (NRC) for review. The DOE transmittal letter states that the purpose of this Safety Analysis Report (SAR) is to document the extent to which this facility can be safely operated. The SAR considers impacts of operation of the Remote-Handled Waste Facility (RHWF) to workers and the public. NRC's Safety Evaluation Report (SER) documents the staff's review of the SAR. The purpose of the SER is to evaluate potential radiological hazards and impacts the RHWF will have on public health and safety.

2.0 BACKGROUND

The West Valley Demonstration Project (WVDP) was authorized through the 1980 West Valley Demonstration Project Act (Act). The Act gave the DOE the responsibility to solidify, transport, and dispose of the high-level waste (HLW) at the site, and decontaminate and decommission the HLW storage and solidification facilities. This site was the only site to commercially reprocess spent nuclear fuel in the United States. In September 2002, DOE completed the solidification of liquid HLW. The DOE WVDP is now preparing for decommissioning which involves the decontamination and removal of project facilities and equipment, and the processing of various waste forms for disposal. Many of these wastes are not suitable for contact handling and must therefore be processed and packaged remotely. The RHWF will serve this purpose. One of NRC's roles under the Act, and other agreements, is to review and comment on SARs for WVDP facilities to identify any danger to the public health and safety.

On July 21, 2000, NRC transmitted comments to DOE on the Preliminary Safety Analysis Report (PSAR). The PSAR served as the principal safety basis for DOE's decision to authorize construction of this facility. In that review, the staff concluded that the construction of the RHWF, as designed, meets the needs of the WVDP, and as designed will not negatively impact the public's health and safety. On March 20, 2003, the staff also provided DOE with comments on the draft Process Hazards Analysis (PHA) for the RHWF. On June 3, 2003, DOE transmitted responses to the staff's comments on the draft PHA.

3.0 EVALUATION METHODOLOGY

As indicated above, this SER evaluates potential radiological hazards and impacts of the RHWF on the public health and safety. As such, the staff's review focused on radiation protection, criticality safety, fire hazards, and accident analysis. NRC staff also evaluated the extent to which DOE addressed previous staff comments (See Appendix). The appendix includes past NRC comments along with a request for additional information (RAI) on this SAR, and DOE's responses to those comments/RAIs. In this appendix, Section A evaluates DOE's responses to NRC comments on the PSAR, Section B evaluates DOE's responses to NRC

comments on the draft PHA, and Section C evaluates DOE's responses to NRC RAIs on this SAR.

The staff review also included a site visit and tour of the RHWF to gain further insights on the layout and planned operation of the RHWF. The RHWF is presently under construction. Construction completion is forecast for December 2003 with RHWF operation forecast for Spring 2004. The site visit allowed the staff to confirm assumptions in facility design and DOE's analyses, and interact with DOE and contractor personnel. No outstanding issues were identified a result of this visit.

4.0 EVALUATION

4.1 FACILITY DESCRIPTION

The RHWF was designed to receive high activity radioactive solid waste and mixed waste from other locations on the WVDP site. The RHWF will remotely handle waste items that have relatively high dose rates. These waste items will be size reduced, radiologically analyzed and repackaged into standard waste containers.

The RHWF comprises nine areas: the Receiving Area; Buffer Cell; Work Cell; Waste Packaging Area; Load Out/Truck Bay; Operating Aisle; Sample Packaging and Screening Room; Radiation Protection Operations Area; and Contact Maintenance Area. This facility also has an Exhaust Ventilation Filter Room, Exhaust Ventilation Blower Room, Mechanical Equipment Area (which includes the Stack Monitoring Room) and an adjoining Office Building.

Waste containers will be brought into the Receiving Area and placed on a remote-controlled Power Roller System (PRS). The Receiving Area is normally uncontaminated and isolated from the Buffer Cell by shield doors which aid in the control of contamination. After the waste container is placed on the PRS, the shield doors between the Receiving Area and Buffer Cell are opened and the waste container is moved into the Buffer Cell via the PRS. Once the waste container is inside the Buffer Cell, the shield doors between the Receiving Area and Buffer Cell are closed.

The Buffer Cell serves as a buffer between the uncontaminated Receiving Area and contaminated Work Cell. The Buffer Cell can also be used to repackage waste containers which do not need to be handled remotely. There are shield doors between the Buffer Cell and Work Cell, which are opened to move the waste container into the Work Cell via the PRS. Once the waste container is in the Work Cell, the shield doors are closed before work begins on the waste container.

The Work Cell is a reinforced concrete room and is the primary work area for remote handling, surveying, size-reducing, decontamination and repackaging activities at the RHWF. All remote-handling actions are controlled from the Operating Aisle. After waste items have been processed in the Work Cell, they are repackaged in either a B-25 box liner or a 208 liter (55 gal.) drum liner, which fit into standard shipping containers.

Once a box or drum liner is filled and the lid installed, it is lowered into a waste disposal container through the Waste Transfer System. The transfer system is the interface between the Work Cell and the Waste Packaging Area. In the Waste Packaging Area, filled waste containers are remotely surveyed for radiation levels and external removable contamination.

The containers are then moved on transfer carts from the Waste Packaging Area to the Survey and Spot Decontamination Area. After a waste disposal container is released from the Survey and Spot Decontamination Area, it is moved to the Load Out/Truck Bay for transport to an on-site interim storage facility or an off-site disposal facility.

The following table lists the waste streams that will be processed at the RHWF.

Waste Stream ID #	Description	Anticipated Waste Category
12	CPC Jumper Containers	TRU
13	CPC Jumper Containers	LLW
14	CPC Dissolver Vessels	TRU
15	CPC Vessel Containers	TRU
16	CPC Vessel Containers	LLW
17	Vent Filter Containers	TRU
18	Vent Filters in Cement	TRU
19	Shield Containers CPC WSA	TRU
20	Shielded Containers with Dry Activated Waste	LLW
21	Shielded Resin Tank	LLW
22	Shielded Containers	LLW
23	Waste Tank Farm Pumps	LLW
24	Head End Cell Closure Wastes	LLW

Waste streams 12 through 16 are considered to contain the bounding source term or material at risk for the waste material to be processed through the RHWF. The waste items contained in waste streams 12 through 16 are made up of components and debris generated from the disassembly and removal of various components from the Chemical Process Cell (CPC). The CPC was used to dissolve spent nuclear fuel and waste from the CPC is generally expected to be contaminated with a distribution of radionuclides found in spent nuclear fuel.

4.2 RADIATION PROTECTION

The RHWF SAR and Radiological Control Manual WVDP-010 describe the programs in place at the RHWF and WVDP to limit the radiation exposure to workers and the public. Exposures to radiation from all aspects of RHWF operations and maintenance are to be maintained as low as reasonably achievable (ALARA). The ALARA program is described in WVDP-010 and WVNS-SAR-001. Shielding (including walls, windows and doors), remote handling and processing of waste streams, work planning, administrative controls and decontamination are some of the methods used at the RHWF to keep occupational exposures ALARA.

Confinement of radioactive material processed at the RHWF will be accomplished by the following methods:

1. Using sufficiently air-tight physical boundaries to keep contamination as close to the source as possible,
2. Using multiple barriers, such as cells, walls, and double-walled piping, and
3. Maintaining pressure differentials between each confinement zone so that air flows from areas of lesser contamination potential to areas of greater contamination potential.

Workers at the facility have an administrative occupational radiation dose limit of 500 mrem/yr. The facility was designed so that the maximum radiation dose for a full-time occupancy area is 0.1 mrem/hr. A full time occupancy area is defined as one in which an individual may be expected to spend all or most of a work day based upon a 40-hour week. It is also designed so that the maximum radiation dose rate for a full-time access area is 1.0 mrem/t, where "t" is the maximum average time in hours/day that the area is expected to be occupied by any one individual.

Workers at the RHWF will be trained in the elements of radiation protection and industrial hygiene programs appropriate for a worker's responsibility. The training qualifications for the Radiation Control Technician and the Radiation Control Supervisor are identified in WVDP-010.

Special actions are to be taken when Waste Tank Farm (WTF) pump boxes are transferred from the Receiving Area through the Buffer Cell into the Work Cell. The WTF pump boxes are longer than the Buffer Cell. Therefore, to move the WTF pump boxes into the Work Cell, the shield doors between the Work Cell and the Buffer Cell must be open, in addition to the shield doors between the Receiving Area and Buffer Cell being open. To prevent the spread of contamination from the Work Cell to the Receiving Area, a special containment structure will be installed to allow the transfer of the WTF pump boxes while reducing the potential for contaminating the Buffer Cell and Receiving Area.

Gaseous secondary wastes from the RHWF are processed through the Heating, Ventilation, and Air Conditioning (HVAC) System. Gaseous waste is processed through this system through multiple High Efficiency Particulate Air (HEPA) filter stages, and discharged through the RHWF exhaust stack. The stack discharge is monitored by the Stack Effluent Radiation Monitoring System to demonstrate compliance with 40 CFR Part 61, Subpart H - National Emission Standards for Hazardous Air Pollutants.

DOE performed a dose assessment (URS Calculation 2001-356) to demonstrate gaseous effluent releases for the RHWF would comply with 40 CFR Part 61, Subpart H. This dose assessment identified the potential air emissions from the facility and calculated the effective dose equivalent (EDE) to the maximally exposed off-site individual (MEOSI). The estimated potential EDE to the MEOSI from realistically abated facility emissions would be 0.0029 mrem/yr. The limit in 40 CFR Part 61 is 10.0 mrem/yr.

4.3 CRITICALITY SAFETY

The criticality safety analysis for the RHWF was provided in WVNS-NCSE-005. Based upon the information presented in WVNS-NCSE-005, an inadvertent criticality event is not a credible event due to the nature of the waste streams which are proposed to be processed through the RHWF. An inadvertent criticality is not credible because: (a) of the limited amount of fissile

material estimated to be present in the waste streams; (b) fissile material will be distributed through a very large volume and mass of waste material, while only a small percentage will be in the RHWF at any given time; (c) fissile material in the waste streams are essentially physically and/or chemically bound to the waste items being processed; and (d) there are no normal operations or accident conditions which have the potential to aggregate and redistribute a significant amount in a moderated (water) environment.

4.4 FIRE HAZARDS

Fire Hazards Analysis (FHA) - Remote-Handled Waste Facility, WVNS-FHA-014, provides the technical basis to support the conclusions in WVNS-SAR-023. The FHA concludes that the fire protection features of the RHWF will provide sufficient protection against the hazards associated with the facility. It also concludes that there is a very low fire occurrence risk in the Work Cell, Buffer Cell, or Contact Maintenance Area due in part to the facility's low combustible loading and minimal ignition sources. Further, the use of non-combustible filter elements in the work cell exhaust system, and the presence of heat detection capability connected to the ventilation system, combined with administrative controls to limit the amount of combustible loading, will limit the spread of any potential fire.

4.5 ACCIDENT ANALYSIS

A process hazards analysis (PHA) was performed to identify accidents which present the greatest risk to on-site workers and the off-site public. The accident scenarios determined to have the greatest risks based on accident consequences and frequency considerations and evaluated further are:

1. Damage to Exhaust System Filters Located in the Work Cell: All the exhaust ventilation system filter houses located in the Work Cell are crushed. (Rated - extremely unlikely).

2. Waste Container Rupture: Container rupture, breach, or fluid leak resulting in a substantial release occurring in the Receiving Area, Buffer Cell, or an external area such as the Chemical Process Cell Waste Storage Area (Rated - anticipated)

3. Fire/Explosion in the RHWF: Fire or explosion resulting in a substantial release occurring in the Receiving Area, Buffer Cell, Work Cell, Waste Packaging Area, or Load Out/Truck Bay Area. (Rated - unlikely)

4. Fire in an Area External to the RHWF (CPC WSA): Fire resulting in a substantial release occurring in an external area such as the Chemical Process Cell Waste Storage Area (Rated - extremely unlikely).

Two beyond design basis accidents (BDBAs) were also further evaluated. They are:

1. Beyond Design Seismic Event: Seismicity is considered as an initiating event in the PHA for events in RHWF.

2. Beyond Design Basis Natural Gas Explosion in the Work Cell: An explosion in the Work Cell resulting in a substantial release, hypothesized to occur due to entrance of natural gas into the Work Cell and entailing the complete destruction of the RHWF.

The results of the accident analyses for these six scenarios are discussed in detail in the RHWF SAR. The results of the accident analyses demonstrate that the consequences of the postulated accidents are within DOE's Evaluation Guidelines. As such, the operation of the facility as designed and evaluated does not pose an undue danger to public health and safety.

5.0 CONCLUSION

The staff reviewed the SAR (WVNS-SAR-023, Revision 1, Draft D), supporting documents and calculations, and DOE's responses to staff comments/RAIs related to the RHWF. Based on this review, the staff finds that the hazard and accident analyses documented in the SAR have adequately identified and evaluated the hazards inherent to the operation of this facility. The staff also finds that DOE has established a Radiation Control Program to monitor radiation exposures in accordance with DOE regulatory limits and ALARA. Further, the staff determined that DOE adequately identified the waste streams that will be processed in the RHWF. Therefore, based on this review, staff has determined there is reasonable assurance the RHWF will be operated in a safe manner and does not present any undue danger to the public's health or safety.

6.0 REFERENCES

The following documents were reviewed during staff's evaluation of the RHWF:

- Safety Analysis Report for the Remote-Handled Waste Facility, WVNS-SAR-023, Rev. 1, Draft D (ML033000147).
- Safety Analysis for Waste Processing and Support Activities, WVNS-SAR-001, Rev. 8.
- Radiological Control Manual, WVDP-010, Rev. 19.
- Site Treatment Plan, WVDP-299, Rev. 5.
- Planning for Waste Treatment, Storage and Disposal, WV-227, Rev. 5.
- Nuclear Criticality Safety Evaluation for the Remote Handled Waste Facility, WVNS-NCSE-005, Rev. 0 (draft).
- Section C.9.0, Hazard and Accident Analysis, WVNS-SAR-003, Rev. 9, Draft B.
- Fire Hazards Analysis - Remote-Handled Waste Facility, WVNS-FHA-014, Revision 2.
- URS calculation, Summary of Dose Assessment, Approval Request Number 2001-356, August 21, 2001.

APPENDIX

Section A. Resolution of NRC Comments on the PSAR for the RHWF

This section evaluates DOE's responses to NRC's July 21, 2000, comments (ML003726695) on the PSAR. It includes extracted NRC comments, DOE responses (via July 9, 2003 facsimile) on how the comments are addressed in the SAR, and staff's comment resolution status.

Comment 1: "Staff considered waste stream 21 to represent the greatest risk for unanticipated risks." Staff noted that waste stream 21 consists of dry resin that may be capable of producing explosive gases. The PSAR indicates that the shielded boxes (resins) may potentially be gas tight. This suggests the possibility of an explosive mixture buildup in the waste package. The staff noted that the design features of the RHWF appear adequate for handling a waste package of this type, but added that the possibility of an explosive scenario should be further investigated prior to the beginning of radiological operations of the RHWF or at the very least prior to handling and repackaging of these wastes.

> **Response:** Waste Stream 21 was evaluated in paragraph 8.2 Sources of Hazards of the Final Safety Analysis Report (SAR) and in paragraph 9.2.2.3 Fire/Explosion in the RHWF. The dose calculated from this scenario does not challenge the WVDP radiological evaluation guidelines for the maximally exposed off-site individual or a receptor at the on-site evaluation point.
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> **Comment Resolution:** As indicated in DOE's response to Comment 1, waste stream 21 is described in SAR section 8.2, Sources of Hazards, and a bounding scenario (for waste stream 21) is identified in SAR section 9.2.2.3, Fire/Explosion in the RHWF. DOE's response and the discussion in SAR sections 8.2 and 9.2.2.3 adequately address the staff's comment.

Comment 2: "For day to day operations, the greatest hazards posed by the waste are from direct exposure to penetrating radiation and from inhalation of airborne radionuclides." Staff noted that these hazards should be minimized through the use of administrative controls and ALARA practices.

> **Response:** Hazard protection features basic to the design of the RHWF are dedicated to maintaining exposures to members of the general public and the work force as low as reasonably achievable. This coupled with existing site programs provides assurance of effective control of radiation exposure. Section 8.5 WVDP Hazards Protection Programs of the SAR discusses the WVDP Hazard Protection Programs with pointers to WVNS-SAR-001, "Safety Analysis Report for Waste Processing and Support Activities," for more detailed discussion of such site programs. Additionally, the SAR contains a Process Hazards Analysis (Table 9.1-1) and a discussion in paragraph 8.3 Hazard Protection Design Features which specifically addresses the identified hazards.
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> **Comment Resolution:** As indicated in DOE's response, SAR section 8.5, WVDP Hazards Protection Programs refers to the WVDP Hazards Protection Programs provided in WVNS-SAR-001, SAR for Waste Processing and Support Activities. It should also be noted that SAR section 8.1.2, Design Considerations, specifically discusses the design considerations intended to achieve exposure levels objectives; and SAR section 8.3,

Hazard Protection Design Features, provides adequate discussion on the protective features relied on to maintain exposures ALARA.

Comment 3: "The PSAR does not address the possibility of direct radiation exposures to workers in the receiving cell area." The staff believes that with adequate physical controls and detection equipment an overexposure in the receiving area is highly unlikely.

Response: See response to Comment 2 above. Additionally, a shielded forklift (for transportation of waste packages to/from the facility) has been procured for this project which provides additional capability to reduce worker exposure.

Comment Resolution: The staff concludes that (with the use of adequate physical controls and detection equipment) an overexposure in the receiving area is highly unlikely based on DOE's response to Comment 2 (above), and the discussion provided in SAR Section 9.2.2.2, Waste Container Failure. Section 9.2.2.2, evaluates a container rupture, breach, or fluid leak resulting in a minor release and a substantial release in the receiving area. As such, DOE's response to this item is adequate and no additional information is required at this time.

Comment 4: "The amount of shielding provided by the upper roll-up doors may not be sufficient for some types of waste packages." The staff has recommended that DOE consider the possibility of a gamma radiation exposure scenario for an individual occupying the buffer cell while a high gamma emitting waste package is located in the work cell. The staff does not believe that the lack of shielding for the roll-up doors is a flaw in the design but rather an operational constraint that may need to be addressed administratively.

Response: The RHWF has been designed to meet the requirements of the site Radiological Controls Manual, which is in full compliance with 10 CFR 835 Occupational Radiation Protection. Calculations have been completed which further demonstrate compliance with the prescribed requirements.

Comment Resolution: A review of the Radiological Control Manual (WVDP-010, Rev.19) indicates that DOE has adequate criteria to design a facility so that the dose limits specified in 10 CFR 835.1002 will be met. WVDP-010 also provides adequate administrative controls so that occupational exposures, while the RHWF is operating, will remain less than the dose limits and also be ALARA.

Comment 5: "The largest dose to the member of the public would result from a criticality accident." The scenario for the criticality accident assumed a source term based on NRC's Regulatory Guide 3.33, Assumptions used for Evaluating the Potential Radiological Consequences of Accidental Nuclear Criticality in a Fuel Reprocessing Plant. This assumed source is conservative considering that the amount of fissionable material entering the RHWF through its operational lifetime is not expected to be great enough to result in a criticality even under the worst case conditions, and the probability of this type of accident is considered less than one chance in a million.

Response: A Nuclear Criticality Safety Evaluation (NCSE) for the RHWF was developed. The analyses presented within demonstrate that for the waste streams proposed to be processed through the RHWF, it is not credible for a criticality event to occur during

normal operations or because of credible accident scenarios. Section 8.7 Prevention of Inadvertent Criticality of the SAR provides a more detailed discussion on prevention of inadvertent criticality.

Comment Resolution: The nuclear criticality safety evaluation (WVNS-NCSE-005) for the RHWF was reviewed. Based upon the information provided in this document, a criticality event is not considered to be a credible event during normal operations or as result of credible accidents or abnormal operations. The nature and volume of fissile material entering the RHWF precludes the fissile material from accumulating into an unfavorable geometry.

Comment 6: "As with the buffer cell, there is a possibility of increased exposure to the worker due to gamma radiation from the work cell."

Response: See DOE response to Comment 2 above.

Comment Resolution: DOE's response to Comments 2, 3, and 4 (above) appear to adequately address the staff's comment.

Comment 7: "Of the hazard scenarios developed by DOE for the remote handled waste processing activities, only two are directly related to the RHWF. All other scenarios are accidents that could occur in situations independent of the facility and therefore the use of the facility will only help to decrease the hazard. The two exceptions are a criticality accident and a natural gas explosion in the facility resulting from the leakage of natural gas from the natural gas lines used to heat the air in the facility."

Response: See response to Comment 5 above for the criticality accident. The accident pertaining to a natural gas explosion in the work cell was evaluated and is discussed in Chapter 9 Hazards and Accident Analyses and was found to be beyond the design basis of the facility.

Comment Resolution: DOE's response to this item appears to be adequate based on the response provided in Comment 5 (above) and a review of the Chapter 9 (SAR sections 9.2.2.3, Fire/Explosion in the RHWF and 9.2.3.2, Beyond Design Basis Natural Gas Explosion in the Work Cell). The natural gas explosion was determined to be beyond the design basis accident for this facility.

Section B. Resolution of NRC Comments on the draft PHA for the RHWF

This section evaluates DOE's June 3, 2003, responses (ML032940499) to NRC comments on the draft PHA. This section includes NRC comments (transmitted to DOE via electronic mail on March 20, 2003), DOE's response, and staff's comment resolution status.

Comment 1: "It is interesting to note that the risk matrix described in 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 the 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).")."

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 nonreactor 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 the 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 EGs 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 (DSA), 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 the 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.

Comment Resolution: The intent of this question was to have DOE provide a technical basis for their approach to the "risk" determination discussed in the PHA. DOE's response to this comment does that by providing discussion outlining the regulatory, programmatic, and technical bases for their stated approach to "risk" determination. This comment was developed/based on the NRC's approach to risk informed regulation and the NRC's definition of "risk" (essentially, weighing consequences and likelihood evenly rather than arbitrarily weighting one of the variables more heavily). As such, DOE's response to this comment appears to be adequate, and no additional information is required at this time.

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."

Response: The PHA table will be modified with numerical pointers that will preface tabulated initiators to allow for 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 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 in 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.

Comment Resolution: The intent of this question was to have DOE provide a clear linkage between the event, and its respective initiators, preventive features, and mitigative features. DOE response to this comment indicated that PHA table: "will be modified with numerical pointers that will preface tabulated initiators to allow for a correlation of initiators and events." However, the SAR does not have the stated changes. At this late stage of the SAR development, the changes are no longer required, they would have simply made the review of the PHA Table easier. The staff's review of the SAR was focused on relevant discussion in other sections of the SAR, including: Section 7, Waste Confinement and Management; Section 8, Hazards Protection; and Section 9, Hazard and Accident Analyses. As such, no further action is required by DOE at this time.

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 2.5 cm 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."

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 does 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-03lbs). Waste stream 23, Waste Tank Farm Pumps, is expected to be contaminated with a distribution of radionuclides consistent with high-level waste (HLW). For a given 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.

Comment Resolution: DOE provided additional discussion on the development of the radiological sources (MAR) in response to the NRC's comment. DOE indicated that the additional discussion would be included in Section 8.2 of WVNS-SAR-023, Revision 1. As discussed in Section 8.2 of WVNS-SAR-023, Revision 1, it can be inferred from analytical sampling results that much of the material processed through the RHWF will have a distribution of radionuclides similar to the distribution of radionuclides in spent nuclear fuel. Some material may have a composition that is different, however it is limited in inventory. In addition, that material which may have a different composition has been processed during removal operations such that it would not be expected to be as easily dispersed as assumed in the consequence evaluations. Therefore, the inventory of radionuclides shown in Table 8.2-1 is likely to provide a reasonably bounding estimate for material at risk.

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."

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.

Comment Resolution: DOE added the initiator "forklift or other transport vehicle" as an additional initiating event for the container breach events in the Receiving Area and the Load Out/Truck Bay. DOE's response to this comment appears to be adequate and no additional information is required at this time.

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 hazards discussed in PHA Table 1. If these scenarios have been evaluated then consider adding them as initiators."

Response: 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 the DOE Standard is contained in ANSI/ANS-5.10-1998, *Airborne Release Fractions at Non-Reactor Nuclear Facilities*.

Comment Resolution: DOE added the initiator "forklift or other transport vehicle leaks diesel fuel or hydraulic oil" as an additional initiator for a fire/explosion as discussed in the SAR sections 9.2.2.3, Fire/Explosion in the RHWF, and section 9.2.2.4, Fire in the Area External to the RHWF. DOE's response to this comment appears to be adequate and no additional information is required at this time.

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 1 m/s wind speed and Pasquill-Gifford stability class [PGSC] F. If needed, a more realistic approach could be taken for atmospheric transport."

Response: No response required.

Comment Resolution: This comment identified that DOE's approach was very conservative and could be modified through the use of a more realistic transport mechanism, if necessary. No further response is required.

Comment 7: "It is unclear why the onsite evaluation point is set at 640 m from the RHWF. Justification should be provided for this variable."

Response: The On-site Evacuation 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.

Comment Resolution: DOE provided clarification of the source of the distance for the on-site evaluation point (OEP). It was selected based on draft DOE-STD-3005, which cited NRC Regulatory Guide 4.7 as a basis for the distance. No additional information is required.

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 routine 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 further damage the HEPA ventilation system and introduce a new release pathway for airborne material as well as material trapped in the filter system. It should

also be noted that there are no sprinklers in the work cell, and the PHA and PSAR are not clear as to whether the work cell is equipped with fire detection systems."

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 a 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 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 0f 1.0 for "the impact of heat upon loaded HEPA filters." It is noted that because of the nature of 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.

Comment Resolution: DOE's response indicated that the "source capture system" is not part of the current design for this facility. As such, no further information is required at this time.

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.

Response: "Crane drops container" or "Crane drop 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.

Comment Resolution: DOE's response to this comment appears to be adequate and no further information is required at this time.

Comment 10: "The filter failure scenario assumes a radiation level of 15 R/hr at 15 cm 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."

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 0.496 rem. Post analysis review indicates these values are below the radiological EGs for an extremely unlikely accident and further support the selection of this frequency.

Comment Resolution: DOE indicated that the basis for selecting 15 R/hr as the value for the filter radiation levels was a combination of operating experience in similar facilities at

the WVDP as well as Section 3.6 of Specification 79303-236-01, *In-Cell Filters Specification*. This document specifies a 15 R/hr maximum dose rate over 20 years. DOE had indicated in their response that it is difficult to identify a credible accident-related mechanism that would simultaneously damage all 24 in-cell filter houses. The selection of extremely unlikely for the frequency of this event is considered to be reasonable. Regardless of the frequency of the event, the maximum Total Effective Dose Equivalent (TEDE) at the on-site evaluation point from this accident scenario was estimated as 0.797 rem. The TEDE for the maximally exposed off-site individual was estimated as 0.498 rem. No further information is required at this time.

Section C. Resolution of NRC comments on the SAR for the RHWF

This section evaluates DOE's October 21, 2003, response (ML032970571) to NRC comments on the SAR. It includes NRC comments (transmitted to DOE via electronic mail on August 29,2003), DOE responses, and staff's comment resolution status.

Comment 1: "Section 4.1.1, RHWF Feeds and Section 7.8, Hazardous and Mixed Wastes: Section 4.1.1 indicates that some of the waste may be contaminated with lead, mercury and PCBs. Section 7.8 only indicates that radioactive mixed wastes that cannot be treated either on-site or off-site are identified in WVDP-299. However, there is no indication in the SAR how these mixed wastes are to be handled. Please provide a description of how mixed wastes will be handled and stored."

Response: The discussion in WVNS-SAR-001 provided in Section 7.8.3 provides the description of how mixed wastes at the WVDP are handled and stored. A detailed description of the development, review, and approval of operating procedures to ensure safe execution of WVDP work activities, handling and storage of mixed wastes, inclusive, is contained in WVNS-SAR-001, Section 10.4.1.

WVNSCO has an established policy, WV-227, "Planning for Waste Treatment Storage and Disposal," for planning the treatment, storage, and disposal (TSD) of wastes (radioactive, hazardous, mixed, industrial, and sanitary) prior to the commencement of any work that will generate such waste. All mixed waste at the WVDP is managed under the WVDP Site Treatment Plan (STP), WVDP-299. The STP is updated annually. WV-227 and WVDP-299 have been provided to NRC electronically.

Waste containers that are processed through the RHWF may contain mixed waste. Mixed waste will be identified, segregated, sampled, packaged, and handled per RHWF operating procedures. Processed mixed waste with a path to treatment and disposal will be characterized and shipped off-site per Waste Management procedures. Mixed waste with no immediate path to treatment and disposal will continue to be managed under the WVDP STP.

Comment Resolution: DOE's response adequately addressed Comment 1. Documents WVNS-SAR-001, WV-227, and WVDP-299 were reviewed. Based upon this review, it appears that DOE has the appropriate controls in place for the RHWF to adequately handle, store and ship mixed waste.

Comment 2: "Section 5.2.2, Receiving Area: Due to the length of the Waste Tank Farm (WTF) pump boxes, the door from the Receiving Area to the Buffer Area must be open at the same time the door from the Buffer Area to the Work Area is open. Both Buffer Area doors opened at the same time provide an opportunity for either a staff overexposure or the contamination to be spread from the Work Area. Specify what precautions will be in place to prevent an overexposure to staff and the spread of contamination when WTF pump boxes are moved through the Buffer Area into the Work Cell."

Response: As stated in Section 5.2.2, a temporary confinement structure that effectively extends the Receiving Area, and additional administrative controls (in particular radiation protection controls as given and implemented by radiation protection personnel) will be

used for processing the pump boxes. Concerns with this activity are considered to be dominated by localized (immediate worker) radiological protection, not potential airborne doses to onsite personnel (evaluated at 640 meters) or offsite receptors. Localized worker radiological safety concerns are addressed/remedied by the radiation protection program. Additionally, the pumps will be contaminated with high-level waste, which, for a given quantity, has only a small fraction of the actinides (e.g., 0.01) associated with a spent nuclear fuel distribution (as used in the accident analyses in Chapter 9) or waste with significant TRU contaminants. (Actinides are the dominant dose contributors via the inhalation pathway.) Hence, the analysis provided in Chapter 9 is considered to readily bound accident concerns associated with the pumps. It is noted that the construction of temporary confinement structures for airborne material control for relatively short term jobs is routinely performed throughout the nuclear industry. It is also noted that, as shown on Figure 5.4-2 of WVNS-SAR-023, all Buffer Cell air flows into the Work Cell under normal operating conditions, and nearly all (96.2%) Buffer Cell air comes from the Receiving Area under normal operating conditions.

The Work Cell was sized to accommodate the handling, size-reduction, and packaging of the WTF pumps. However, it was determined during the design phase that sizing the Buffer Cell and the Receiving Area to accommodate this one waste stream was not economical. The use of a temporary containment structure for transferring WTF pump boxes into the Work Cell would provide adequate protection to the workers, the public, and the environment, which is supported by the safety analysis as discussed above.

Comment Resolution: DOE's response adequately addressed Comment 2. In addition to reviewing WVNS-SAR-023, WVDP-010, Radiological Control Manual was also reviewed. DOE has adequate controls in place to limit and minimize the exposure to occupational workers while working on the WTF pumps.

Comment 3: "Section 6.1.3.2, Criticality Prevention and Section 8.7, Prevention of Inadvertent Criticality: Section 6.1.3.2 states that Table 7.7-4 of WVNS-SAR-001 provides an estimate of the Cs-137 activity in each of the 22 waste boxes. Section 8.7, states, "Analyses contained in the RHWF WVNS-NCSE-005 show that the 274.20 curies of Cs-137 estimated to be contained in the 22 boxes provide the basis for calculating a fissile material inventory of 461 grams (1.02 lbs.)" Explain how the amount of Cs-137 can be used to estimate the amount of fissile material in the waste."

Response: The distribution of radionuclides associated with spent nuclear fuel that was processed by Nuclear Fuel Services at the West Valley site has been documented. Quantities of uranic and transuranic radionuclides were "scaled" to the quantity of Cs-137 using this distribution. The calculation contained in WVNS-NCSE-005 provided in response to Comment #9 has additional details on this scaling.

Comment Resolution: DOE's response adequately addressed Comment 3. WVNS-NCSE-005 provides an adequate description as to the methodology used to determine the scaling factors for determining the amount of fissile material which may be processed through the RHWF.

Comment 4: “Section 8.6, Off-Site Dose Assessment: Explain what "realistic abated" facility emissions means and how the effective dose equivalent (EDE) to the maximally exposed off-site individual was determined.”

Response: "Realistic abated" calculations are not required by 40 CFR 61, *National Emissions Standards for Hazardous Air Pollutants*. (The other two shown in Table 8.6-1, namely "maximum abated" and "realistic unabated," are required.) "Realistic abated" has historically been added in WVNSCO’s calculations to give the U.S. Environmental Protection Agency (EPA) an indication of the actual releases expected. Approval Request Number 2001-356, "Summary of Dose Assessment," which is cited in Section 8.6 as providing the basis for numbers reported in the SAR, is being provided to the NRC.

Comment Resolution: DOE’s response adequately addressed Comment 4. The document, URS Approval Request Number 2001-356 was reviewed. This document provides a summary of the dose assessment and the calculation of the RHWF potential air emissions source term, in addition to the CAP-88PC output for demonstrating NESHAP compliance. Based on the information in this document, DOE has adequately identified and characterized potential airborne emissions from this facility.

Comment 5: “Section 9.1.3, Evaluation Guidelines: Explain how the Public and Onsite Radiological Evaluation Guideline (EG) criteria for both manmade design basis accidents or evaluation basis accidents and for natural phenomena were developed.”

Response: Public and on-site EGs used at the WVDP were developed in the 1993 to 1994 time frame. WVNS-SAR-003, which addressed the Vitrification Facility and has been archived, contained a substantial discussion as to why various EGs where selected. Relevant pages from archived WVNS-SAR-003 are enclosed. Regarding public radiological EGs, Appendix A to DOE-STD-3009-94 stipulates 25 rem for operational accidents, regardless of frequency.

Comment Resolution: DOE’s response adequately addressed Comment 5. Section C.9.0, Hazard and Accident Analysis from WVNS-SAR-003, Rev. 8 was reviewed to determine how the hazard classifications and evaluation guidelines (EGs) for the RHWF were determined. The information presented in this document indicates that the EGs for this facility were developed in accordance with the accepted DOE guidance.

Comment 6: “Section 8.2, Sources of Hazards: In its comments on the PSAR, NRC staff considered Waste Stream 21 to represent the greatest risk for unanticipated accidents. Staff stated that the potential to generate explosive gases should be further investigated before operating the RHWF, or at least before handling and repackaging of these wastes. Section 8.2 of the SAR states that these containers are to be opened in a manner that minimizes the likelihood of an energetic event involving hydrogen during opening of the containers and associated tanks. Describe the planned steps, or procedure DOE will use to open and process waste stream 21 containers to minimize the risk of an energetic event.”

Response: Waste Stream 21 consists of diatomaceous earth, clay absorbents, Zeolon 100 and water that were originally packaged in 175 gallon steel tanks in 1983. The steel tanks were subsequently overpacked into concrete boxes in 1993. The steel tanks each have a 20" manhole cover and two 2" penetrations in the top of the 14-gauge steel tank.

One of the 2" penetrations was cut off with a saw and sealed with a plug so that the tank would fit into the overpack. The manhole cover has a bolted flange and gasket of unknown material. The attached URS calculation (#BUF-2003-091) indicates that this waste has the potential to contain hydrogen above the lower explosive limit if the steel tanks are sealed air-tight. First, the 20"D gasket that has seen 20 years of service is very likely to be seriously degraded to the point that it certainly is not air-tight. In addition, the penetration sealed with a plug is also very likely not air-tight. Therefore, engineering judgement indicates that the assumption that the tanks are air-tight is not reasonable. Second, the plan is to transfer these container into the Work Cell of the RHWF and open/vent them to the cell prior to processing the waste. This venting can be accomplished in several ways: a) unbolt the manhole flange and remove the cover; b) remove the plug from the 2" penetration; c) punch a hole in the shell of the tank with a non-sparking tool modified for remote use; and d) a combination of a, b, and/or c. Third, any operation performed on these containers will be governed by a work instruction package (WIP) in addition to the standard operating procedures for the in-cell processing equipment. The WIP will provide specific instructions to the operators regarding the sequence of operations and the tools to use to perform the work safely.

Comment Resolution: DOE's response adequately addresses Comment 6. SAR section 8.2, adequately identifies and characterizes the hazards associated with waste stream 21. SAR section 9.2.2.3, Fire/Explosion in the RHWF, identifies this scenario as "unlikely." Further, the bounding dose to the receptor at the on-site evaluation point due to a fire/explosion in the RHWF is below the radiological evaluation guidelines for an unlikely event.

Comment 7: "Section 1.2, Facility Description, Section 7.2, Low-Level, and TRU Wastes, and Section 8.2 Sources of Hazards: Section 1.2 refers to Table 1.1-1. This table lists: waste streams to be processed in the RHWF, anticipated waste category (TRU, LLW), and waste dimension. Section 7.2 states that "DOE 435.1 is used for the characterization of radioactive waste prior to NRC classification of LLW." Section 8.2 states the "Waste streams 12 through 16 encompass the containers 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. Hence, CPC components are generally expected to be contaminated with a distribution of radionuclides that is consistent with the distribution of radionuclides that is found in spent fuel." Waste stream 23 consists of Waste Tank Farm HLW transfer and mobilization pumps. These pumps are contaminated with a distribution of radionuclides consistent with HLW. Has DOE conducted any Waste Incidental to Reprocessing (WIR) determinations in categorizing waste streams 12 through 16, and waste stream 23 identified in Table 1.1-1? Are there any other anticipated waste streams that will be processed through the RHWF that should be added to Table 1.1-1? Would wastes from the D&D of the Vitrification Facility be a candidate waste stream for this table?"

Response: Waste Incidental to Reprocessing (WIR) determinations will be accomplished on waste streams processed through the Remote Handled Waste Facility in accordance with WV-929, "Waste Incidental to Reprocessing Determination." The WIR evaluation for the mobilization and transfer pumps from Tanks 8D-1 and 8D-2 (i.e., waste stream 23) was performed and provided to DOE in WVNSCO Letter WD:2001:0720, dated November 1, 2001. Other waste streams that may be proposed at a later date for processing through the RHWF will be evaluated through the site's Unreviewed Safety Question Process as

stated in Note 3 of Table1.1-1 of WVNS-SAR-023, Rev. 1, Draft D. These additional waste streams would also be evaluate in accordance with WV-929.

Comment Resolution: DOE's response to this item appears to be adequate in relation to the RHWF. No additional information is required at this time.

Comment 8: "Section 5.3.2, Fire Suppression System: This section indicates that the sprinkler system, will not be installed in the Work Cell, Buffer Cell, or Contact Maintenance Area. Explain why the sprinkler system for fire suppression will not be installed in Buffer Cell, Work Cell, and Contact Maintenance Area. What procedure or planned measures will be used to minimize fire hazard from the buildup of combustible materials from size reducing and repackaging activities in the Work Cell?"

Response: The possibility of fire in the Buffer Cell, Work Cell and Contact Maintenance Area was evaluated in the Fire Hazard Analysis. The FHA states that the Buffer Cell, Work Cell, and Crane Maintenance Area were exempted from having sprinkler systems for fire protection based on the low risk of a fire in these areas, low combustible loading, greater than 2-hour fire separation provided by shield walls, and inaccessibility for testing and maintaining an installed in-cell system. A fire in these areas is expected to self-terminate and be contained by the significant passive boundaries. The consequences and difficulties associated with installing a system that will introduce water into a highly contaminated area outweigh the fire protection benefits. During facility design reviews it was determined that the potential for a fire in these areas could be effectively minimized by controlling the amount of combustible materials present and by providing non-combustible filters (UL-586) for the cell exhaust system. The FHA also addressed the guidelines in DOE O 420.1, *Facility Safety*, NFPA 801, Standard for Facilities Handling Radioactive Material and other related NFPA standards. In section 5.1.2 of the FHA, special criteria are provided for operations in these limited access areas. The Standard Operating Procedure (313-14) for RHWF Sorting will include precautions and limitations to address the minimization of combustible materials in-cell. Furthermore, operator Emergency Response Procedures are being developed to respond to an in-cell fire.

Comment Resolution: DOE's response adequately addressed Comment 8. WVNS-FHA-014, Fire Hazards Analysis - Remote-Handled Waste Facility, provides the necessary technical basis to support the conclusions "that there is a very low fire occurrence risk" and that "a fire in the work cell will self-terminate" as stated in SAR section 5.3.2, Fire Suppression System. Further, the use of non-combustible filter elements (or pre-filters) in the cell exhaust system and the presence of heat detection capability connected to the ventilation system, combined with administrative controls to limit the amount of combustible loading further addresses initial staff concerns with operations in the work cell.

Comment 9: Many of the details for the various safety programs are located in other documents that are referenced in this SAR. Please provide the following documents referenced in the SAR:

- Fire Hazards Analysis Remote-Handled Waste Facility (WV-report number);
- WVDP Hazard Protection Program provided in WVNS-SAR-001;

- Radiological Controls Manual (WVNS-010) and “associated calculations”; and
- NCSA/NCSE (WVNS-NCSE-005).

Response: The above requested documents that could be forwarded electronically were sent on August 29, 2003. The “associated calculations” and information listed as follows was also provided:

•AR 2001-356, Assessment of Potential Radioactivity Emissions to the Atmosphere from the RHWF, dated August 21, 2001;

•WVNS-SAR-003, Rev. 9 (Draft B), Section C.9.1.1;

•URS Calculation No. BUF-2003-091, Rev. 0, “On the Generation of Hydrogen in Diatomaceous Earth Wastes, “ dated May 9, 2003; and

•WVNS-SAR-001, Rev. 8, “Safety Analysis Report for Waste Processing and Support Activities.” (CD)

Comment Resolution: DOE’s adequately addressed this comment, and no additional information is needed at this time.