TECHNICAL EVALUATION REPORT

Background

Decommissioning of the West Valley Demonstration Project (WVDP) is conducted under the 1980 West Valley Demonstration Project Act (WVDP Act). The WVDP Act requires the U.S. Department of Energy (DOE) to decontaminate and decommission, in accordance with any requirements prescribed by the U.S. Nuclear Regulatory Commission (NRC), the waste storage tanks and facilities used in the solidification of high-level radioactive waste, along with material and hardware used in connection with the WVDP. The NRC responsibilities under the WVDP Act include the prescription of decommissioning criteria, informal review and comment, and monitoring.

Under the authority of the WVDP Act, NRC prescribed its License Termination Rule (LTR) as the decommissioning criteria for the WVDP in a Policy Statement issued on February 1, 2002, (67 FR 5003). NRC prescribed the LTR as the decommissioning criteria for the WVDP, reflecting the fact that the applicable decommissioning goal for the entire NRC-licensed site is in compliance with the requirements of the LTR. For purposes of this report, the NRC-licensed site is considered to be the West Valley Site excluding the State-licensed disposal area. DOE is obligated under the WVDP Act and associated DOE-NRC Memorandum of Understanding (MOU) to submit a Project Plan for NRC review and comment. DOE previously submitted a portion of the Project Plan which did not include post-operation decontamination and decommissioning of project facilities. The Phase 1 Decommissioning Plan (DP) for WVDP is considered part of the Project Plan. Specific provisions of the MOU provide that the plan "… contain the level of detail generally associated with conceptual design of structures, systems, and components" and "[a]s the project continues and more precise information is developed, that information will be submitted to the NRC prior to the beginning of project activities for which the information is relevant." The MOU also provides that "[i]n preparing its comments, the NRC will specify with precision its objections to any provision of the plan."

The proposed action in the Phase 1 DP is based on the preferred alternative (Phased Decisionmaking) in the *Environmental Impact Statement for Decommissioning and/or Long-Term Stewardship at the West Valley Demonstration Project and Western New York Nuclear Service Center* (DOE, 2008b and 2010) (EIS). In general, the preferred alternative involves near-term decommissioning and removal actions where there is agency consensus and undertakes characterization work and studies that could facilitate future decisionmaking for the remaining facilities and areas. Under the preferred alternative, decommissioning would be accomplished in two phases. Phase 1 decisions would include removal of all Waste Management Area (WMA) 1 facilities, the source area of the North Plateau Groundwater Plume, and the lagoons in WMA 2 (see Figure 1). Phase 1 activities would also include additional characterization of site contamination and studies to provide information in support of the technical approach to complete site decommissioning. Phase 2 decisions involving decommissioning or long-term management decisions for remaining facilities including the Waste Tank Farm and support facilities, non-source area of the plume, and disposal areas would be made within 10 years of the EIS Record of Decision (ROD) if the Phased Decisionmaking Alternative is selected. If a different alternative is selected, the WVDP DP would need to be revised and re-submitted for NRC review.

Enclosure

This Technical Evaluation Report (TER) documents NRC staff's comments on the Phase 1 DP for WVDP. The TER also includes NRC's determination of whether the proposed action in the Phase 1 DP satisfies the decommissioning criteria. As such, NRC's review of the Phase 1 DP focuses on information relevant to assessing whether the decommissioning criteria have been met (such as, planned decommissioning activities, radiological status of facilities, dose modeling, and final status surveys). In this review, NRC specifically evaluated how previous request for additional information (RAI) have been addressed in the revised Phase 1 DP (Revision 2). Each section of the TER describes NRC's evaluation and conclusion. In some cases, comments are identified for DOE to address in the course of Phase 1 decommissioning activities. NRC also recognizes, based on past discussion with DOE, that certain operational matters related to decommissioning are appropriately addressed by DOE regulations and Orders and are not within the scope of NRC's review. These operational areas include DOE programs related to project management and organization, health and safety, environmental management and control, and management of radioactive waste.

1.0 Executive Summary and Introduction

Executive Summary and Introduction - Evaluation

The "Executive Summary" section provides an overview of the requirements of the WVDP Act, and the proposed decommissioning approach for the WVDP Site (Project Premises). It includes general information on the decommissioning criteria, the licensee and owner of the site, WVDP facilities, and nature and extent of contamination of those facilities. It also provides general information on As Low as Reasonably Achievable (ALARA) evaluations, the time frame for the initiation and completion of Phase 1 decommissioning activities, and post remediation monitoring activities.

An "Introduction" section provides background information pertaining to the WVDP. It addresses the purpose and scope of the Phase 1 DP, its relationship with the EIS and the general responsibilities of the organizations involved. It also introduces the content of this DP, site conditions at the start of Phase 1 decommissioning work, and describes the relationship between Phase 1 and Phase 2 decommissioning.

Executive Summary and Introduction - Conclusion

NRC has completed a qualitative assessment of information in the "Executive Summary" and "Introduction" sections of the Phase 1 DP for the WVDP Site located at the Western New York Nuclear Service Center (West Valley Site) according to the Consolidated Decommissioning Guidance, Volume 1, Section 16.1 (Executive Summary). Based on this assessment, NRC concludes that the Executive Summary and Introduction sections provide useful background and overview information that serves to introduce subsequent sections that contain more detailed information.

Comment: Subject to the EIS ROD, DOE expects Phase 1 decommissioning activities to begin in 2011 and to last approximately 8-10 years. To meet this aggressive schedule, Phase 1 evaluations and studies need to be identified, scoped and implemented early in Phase 1 to ensure that results are available in a time frame that supports making a technically sound Phase 2 decision. NRC expects to be able to provide

recommendations on the scope of the evaluations and studies and to be kept abreast of the results of the analyses as they become available.

2.0 Facility Operating History

Facility Operating History - Evaluation

This section provides a summary of (1) the license history including the radionuclides present and how they were used both under the license and under WVDP activities; (2) previous decontamination and remediation activities and those planned activities to be completed prior to the start of Phase I decommissioning; (3) previous radioactive spills or releases, and (4) prior onsite burials of radioactive materials within the scope of this plan.

Facility Operating History - Conclusion

NRC has reviewed the information in the “Facility Operating History” section of the Phase 1 DP for the WVDP Site according to the Consolidated Decommissioning Guidance, Volume 1, Section 16.2 (Facility Operating History). Based on this review, NRC concludes that DOE has provided sufficient information on the facility operating history to serve as a basis for evaluating the accuracy of the descriptions of the radiological status of the WVDP Site.

3.0 Facility Description

Facility Description - Evaluation

This section provides site-specific information describing the facility and environs relevant to DOE’s estimation of impacts of: (i) the doses to onsite and offsite populations from Phase 1 decommissioning activities; (ii) the proposed decommissioning activities on the site and surrounding areas; and (iii) the environment on the site (e.g., in the events of floods, tornados, and earthquakes).

This section provides information on the location and description of the WVDP Site and environs. This information includes a description of: (i) the current population distribution; (ii) summary of current and potential land uses; (iii) site meteorology and climatology; surface water and groundwater hydrology, geology and seismology; and (iv) the natural resources in the area.

Facility Description - Conclusion

NRC has reviewed the information in the “Facility Description” section of the Phase 1 DP for the WVDP facility according to the Consolidated Decommissioning Guidance, Volume 1, Section 16.3 (Facility Description). Based on this review, NRC concludes that DOE has provided sufficient information on the description of WVDP Site and environs to serve as a basis for evaluating DOE’s estimated doses from Phase 1 decommissioning activities.

4.0 Radiological Status of Facility

Radiological Status of Facility – Evaluation

The WVDP Phase 1 DP presents characterization data resulting from a 2004 West Valley Nuclear Services Company “Characterization Management Plan for the Facility Characterization Project.” Several inventory reports and data from routine radiological protection surveys were also used to identify radiologically impacted areas of the WVDP Site.

Characterization data for environmental media were provided based upon routine reports from WVDP Environmental Monitoring and Groundwater Monitoring programs. Additional site status information has been provided in the “West Valley Demonstration Project North Plateau Background Soil Characterization Report (WVDP-493, Rev. 2).” To support Phase 1 decommissioning, DOE states that additional environmental characterization will be performed in accordance with the “Characterization Sample and Analysis Plan (CSAP)” currently under development. Section 7 “Planned Decommissioning Activities” and Section 9 “Facility Radiation Surveys” of the Phase 1 DP define the outline for additional environmental characterization. NRC understands that the CSAP will provide further details on characterization of soil, stream beds, and banks, and will support waste management activities to be performed at the WVDP Site.

Radiological Status of Facility - Conclusion

NRC has reviewed the information in the “Radiological Status of Facility” section of the Phase 1 DP for the WVDP according to the Consolidated Decommissioning Guidance (NUREG-1757), Volume 1, Section 16.4 (Radiological Status of Facility). Additional supporting information in the “Introduction” and “Facility Operating History” sections of the DP were also reviewed. Based on this review, NRC concludes that DOE has described the types and activity of radioactive material contamination at the facility sufficiently to allow NRC staff to evaluate the potential safety issues associated with remediating the facility. NRC has determined that the remediation activities and radiation control measures proposed by DOE are appropriate for the type of radioactive material present at the facility.

5.0 Dose Analysis

5.1 Unrestricted Release using Site-Specific Information

Overall Conclusions

NRC has reviewed dose modeling analyses for Phase 1 of the Phased Decisionmaking Alternative as part of its review of revision 2 of the DP, using the Consolidated Decommissioning Guidance, Volume 2, Section 5.2 (Unrestricted Use Using Site-Specific Information). Based on this review, NRC concludes that dose modeling performed to calculate derived concentration guideline levels (DCGLs) or clean-up levels for various contaminated media present at the WVDP Site is generally acceptable and provides reasonable assurance that the dose to the average member of the critical group is not likely to exceed the 0.25 mSv (25 mrem) annual dose criterion in 10 CFR 20.1402 for source areas that are the subject of Phase 1 remediation. This conclusion is based on review of dose modeling analyses performed by DOE, as well as independent analysis performed by NRC.

Constraints on Partial Decommissioning

As stated above, DOE's DP as supplemented and revised through responses to RAI (DOE 2008a, 2009a, 2009b, 2009c, 2009d, 2009e) issued by NRC (NRC, 2009), used defensible assumptions and models to calculate the potential dose to the average member of the critical group. Sufficient information was provided to allow an independent evaluation of the potential dose resulting from the residual radioactivity after remediation and reasonable assurance that the decommissioning activities will comply with radiological criteria specified in the LTR found in 10 CFR 20, Subpart E, for unrestricted use. However, because WVDP decommissioning activities will result in partial clean-up of the site only, at the end of the phased decommissioning, DOE must ultimately demonstrate that decommissioning criteria are met for the entire West Valley Site, including previously remediated areas. Because DOE is aware that it must address the cumulative impacts of all source areas on entire West Valley Site to demonstrate compliance with LTR criteria and has considered this in its development of DCGLs for Phase 1 (see discussion in DP Section 5.3 [DOE, 2009e] and DOE response to NRC RAI 5C1 [DOE 2009c]), the risk of having to perform additional cleanup due to the phased decommissioning approach taken is reduced. Nonetheless, if previously cleaned areas become re-contaminated, the collection of additional information during the ongoing assessment period reveals that risks are significantly underestimated, or modeling assumptions otherwise become invalid, NRC expects that the impact of these events on the ability of the site to meet LTR criteria will need to be re-evaluated. As such, NRC will be particularly interested in the types of monitoring activities and studies that will occur during the ongoing assessment to ensure that risks are appropriately managed and studied.

Comment: If previously cleaned areas become re-contaminated, the collection of additional information during the ongoing assessment period reveals that risks are significantly underestimated, or modeling assumptions otherwise become invalid, NRC expects that the impact of these events on the ability of the site to meet LTR criteria will need to be re-evaluated at the time of final decommissioning.

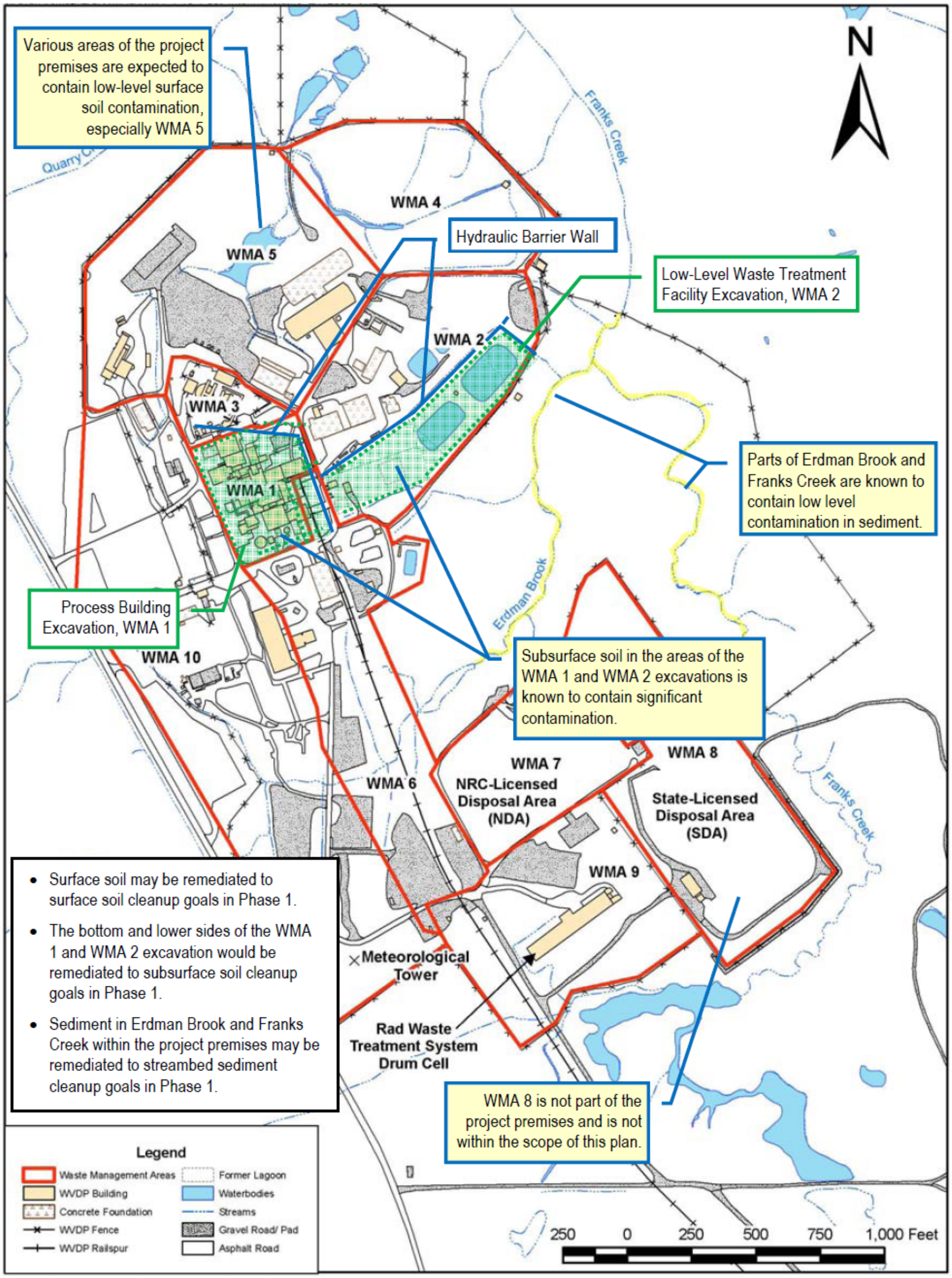

Figure 1 Site Map Showing Areas to Be Remediated in Phase 1

5.1.1 Dose Analysis Overview

DOE developed three sets of DCGLs to guide remediation of the site during Phase 1 of the Phased Decisionmaking Alternative including: (i) subsurface soil DCGLs to guide cleanup of WMA 1 and WMA 2 soils; (ii) surface soil DCGLs to guide cleanup of areas of the Project Premises with surficial contamination less than 1 m (3 ft) in thickness; and (iii) streambed sediment DCGLs to guide cleanup of portions of site streams located on the Project Premises (e.g., portions of Erdmann Brook and Franks Creek). Subsurface soil DCGLs would apply to residual soil contamination located at the bottom of planned soil excavations in WMAs 1 and 2 only. The soil excavations will extend to at least one foot (0.3 m) into a relatively impermeable lavery till located around 10-15 m below grade in WMA 1 and this area will be backfilled with clean soil following remedial (excavation) activities[1]. Figure 1 shows the locations on site where Phase 1 clean-up activities are expected to occur.

Figures 2 through 4 illustrate the basecase conceptual models for DCGL development. These conceptual models are implemented in the RESRAD computer code. Therefore, the site conceptual models are parameterized consistent with the pre-defined conceptual model in the RESRAD computer code. In some cases (e.g., for some alternative conceptual models), additional mathematical tools are needed to evaluate potential transport mechanisms or processes that are not evaluated by the RESRAD computer code (e.g., diffusive transport of residual contamination from the lavery till at the bottom of the WMA 1 and 2 excavations into the overlying initially clean backfilled excavations on the North Plateau where a domestic well could be used)[2].

Figure 2 shows the geometrical configuration of surface soil contamination expected to be less than 1 m (3 foot) thick. The resident farmer scenario is selected as the critical group for surface soil DCGL calculations. The resident farmer engages in various activities that lead to radiological exposures including residing and working in contaminated soils, growing and consuming produce grown in contaminated soils, and consuming contaminated animals/products. The resident farmer is also assumed to use a well for drinking water and irrigation purposes that may lead to secondary (water dependent) sources of soil contamination, as well as exposure to the receptor through the drinking water pathway. General pathways of exposure include external gamma exposure, inhalation, and ingestion (e.g., drinking water, soil [incidental ingestion], produce and animal/products). For a complete list of exposure routes and pathways see Table 5-2 in Revision 2 to the DP (DOE 2009e).

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[1] The depth of the excavation and expected amount of residual radioactivity is more accurate for WMA 1. The lavery till is shallower in WMA 2, such that the excavations may only be around 4-8 m (12-26 ft). Due to the assumed dilution factor of 10 due to mixing of clean backfill material with contaminated material during an intrusion event, residual contamination located at the bottom of the excavation may only be one tenth of the excavation depth or around 0.4-0.8 m (1 to 3 ft) or less in thickness in WMA 2 to be consistent with dose modeling assumptions.

[2] RESRAD includes a leaching code that considers the transport of contamination from the *unsaturated* to the saturated zone rather then the transport of contamination already located within the saturated zone. Diffusional processes that are expected to occur due to the concentration gradient between the residual contamination located in the relatively low permeability lavery till remaining at the bottom of the soil excavations and the initially clean backfill cannot be modeled using the RESRAD code.

The site hydrology is depicted as having an unsaturated zone 2 m (6 ft) thick below the contaminated zone. Because RESRAD treats erosion as a removal mechanism (because the RESRAD code estimates dose for onsite receptors and eroded material is expected to be removed from the source area and deposited in downgradient or offsite locations), DOE conservatively[3] assumed no erosion. Separate analyses were conducted to study the potential impacts of erosion on on-site and off-site receptors (e.g., receptors located in the vicinity of gullies or utilizing surface water impacted by eroded material). Contamination is also assumed to leach out of the contamination zone into the underlying saturated sediments on the North Plateau such that the resident farmer could extract contaminated groundwater for the purposes of drinking water and irrigation.

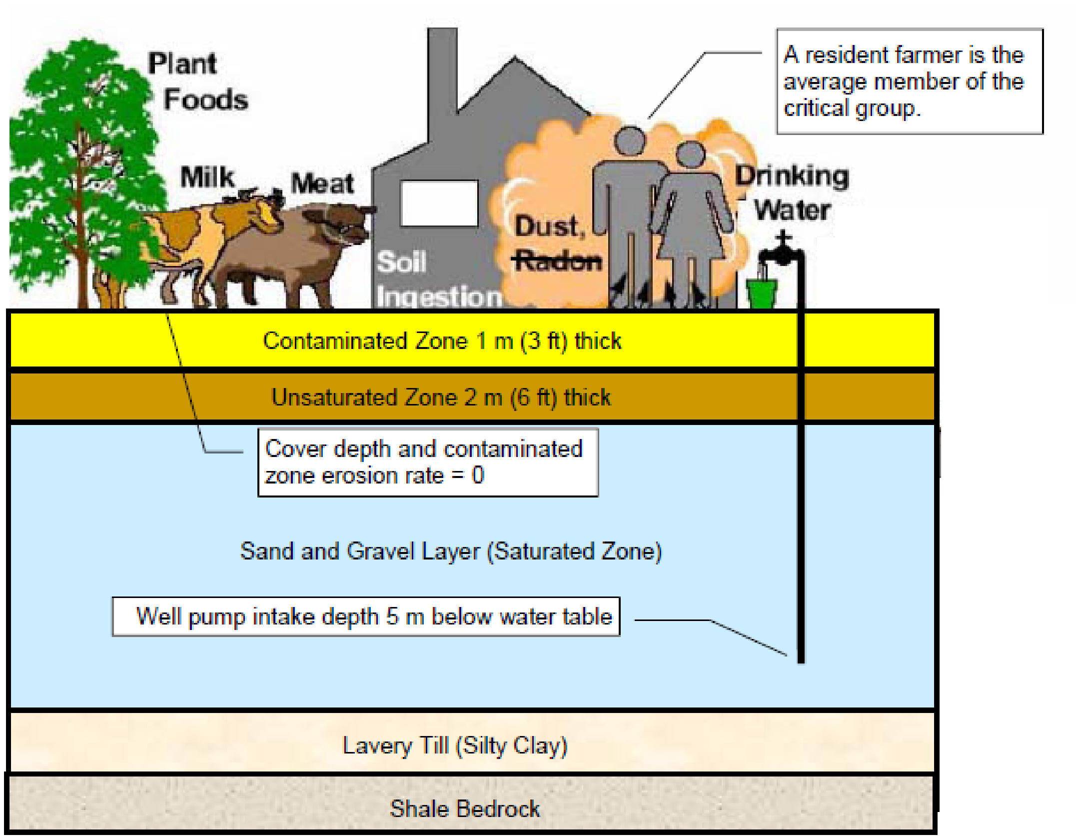

Figure 2 Conceptual Model for Development of Surface Soil DCGLs

[3] The term conservative is used here to imply that the assumption is expected to lead to a higher, rather than lower, estimation of the potential dose with all other factors being equal.

In the case of *subsurface* soil DCGLs, DOE considered the types of initiating events that might occur that could lead to the redistribution of buried subsurface soil contamination[4] to the ground surface such that a resident farmer scenario similar to the scenario evaluated for the surface soil DCGLs would apply. Because excavation of soils for the purpose of building a basement would not be expected to uncover contamination located at least 4 m (12 ft) below grade, this scenario was eliminated from consideration. Instead, construction of a cistern or large well is assumed exposing a receptor to contamination originally at depth then relocated when contaminated drill cuttings are brought to the surface and deposited over some nominal area (e.g., basecase scenario assumes a 100 m^2 area with a contaminated zone thickness of 0.3 m) and subsequently used to construct a residence and garden. Figure 3 depicts the primary conceptual model developed for subsurface soil DCGL development. Exposure pathways for the basecase scenario are listed in Table 5-4 in Revision 2 to the DP (DOE 2009e).

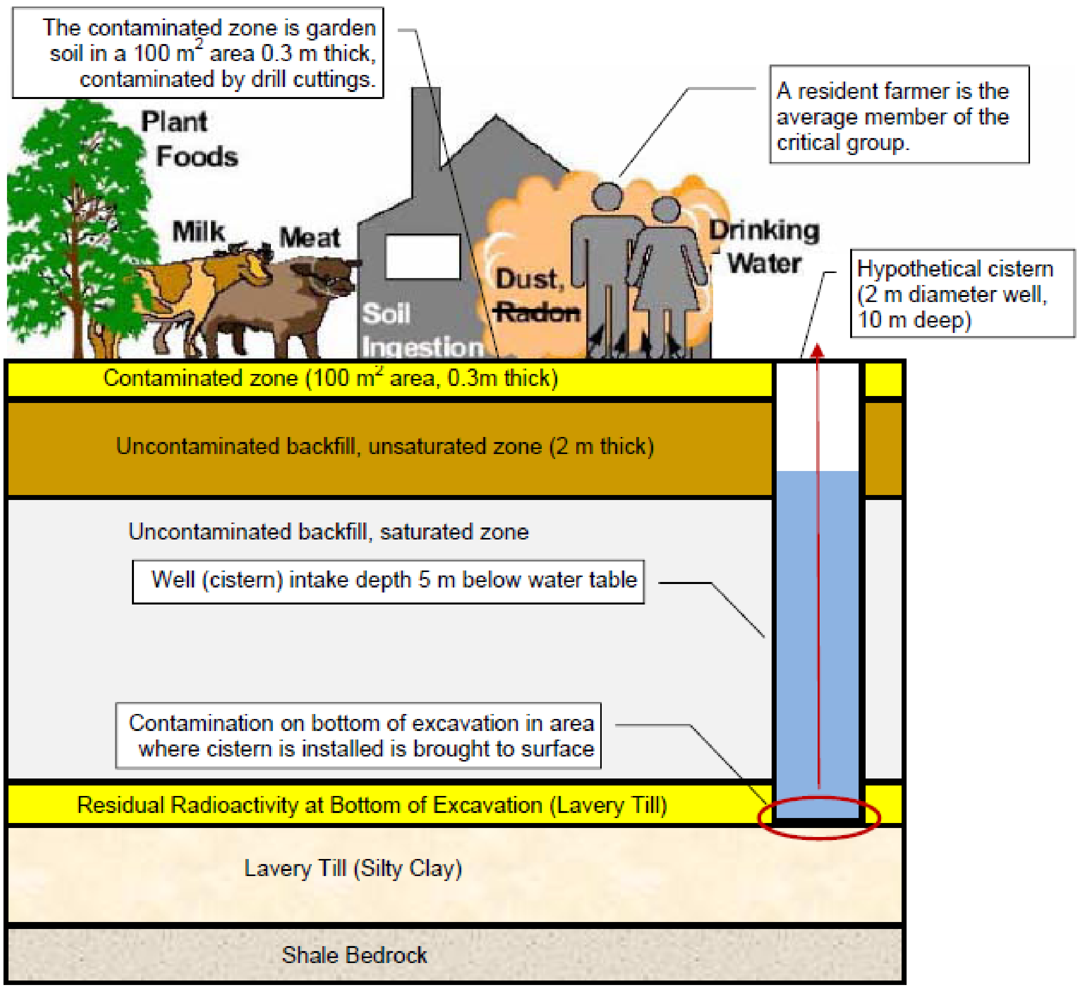

Figure 3 Conceptual Model for Development of Subsurface Soil DCGLs

[4] Subsurface soil DCGLs apply only to WMA 1 and 2, as deep soil excavations are planned for these two source areas. The subsurface soil DCGLs will apply to the bottom and sides of the excavated areas. Clean material will be used to backfill the soil excavations, such that the subsurface contamination will initially be located at significant depths 4-15 m (12-45 ft) below grade following remedial activities.

Finally, DOE developed DCGLs to guide remediation of Project Premises streambed sediments. Because it was not deemed practical to build a residence on streambed sediments given the current topography of steeply sloped stream channels, a residential scenario was not evaluated when developing streambed sediment DCGLs. Instead, the use of site streams for recreational purposes was considered a reasonably foreseeable land use in deriving streambed sediment DCGLs. Recreational activities include hiking over contaminated sediments, fishing from contaminated streams, hunting deer for venison contaminated from foraging (grass consumption) and water consumption near site streams, and incidental ingestion of contaminated sediments and surface water. For a complete list of exposure routes and pathways see Table 5-6 in Revision 2 to the DP (DOE 2009e).

Figure 4 depicts the conceptual model for streambed sediment DCGLs. As shown in Figure 4, the contaminated zone is assumed to be 1 m (3 ft) thick. The contaminated area is assumed to be 1000 m^2 and consistent with the default (circular) geometry in RESRAD. Sediment contamination is assumed to be in equilibrium with surface water using distribution coefficients consistent with lavery till sediments (simulated as leaching with an infinitely small vadose zone in RESRAD).

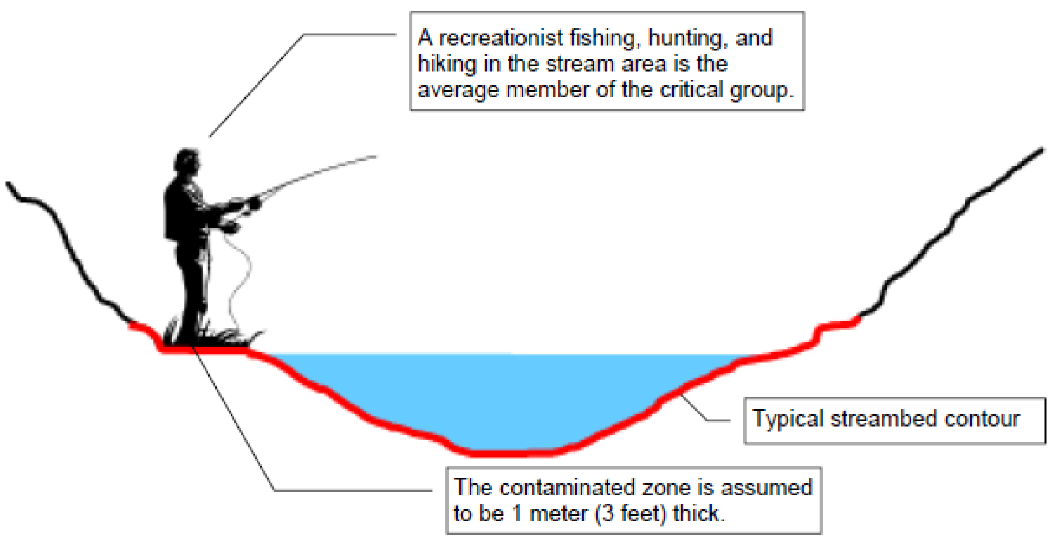

Figure 4 Conceptual Model for Streambed Sediment DCGL Development

5.1.2 Source Term

Source Term—Evaluation

DOE provided information pertinent to developing the source term including nuclides of interest, expected depth of residual contamination in existing source areas, and justification for assumed subsurface soil source configurations (geometry of contaminated zone and garden) following various intrusion events[5]. Based on an NRC RAI (5C2), DOE also provided additional information on the screening approach used to identify 18 key radionuclides targeted for DCGL development. In some cases, radionuclides were eliminated from detailed study due to their relative activity levels compared to other "similar" radionuclides. The basis for elimination of some of these "similar" radionuclides is not clear.

Information on surface soil, subsurface soil, and streambed sediment contamination is limited. Therefore, several NRC RAIs (NRC, 2009) were also directed at DOE's efforts to verify underlying source assumptions used to derive DCGLs (e.g., RAIs 4C1 and 5C9 regarding confirmation of vertical and lateral extent of contamination). DOE agreed to verify dose modeling assumptions in the field and committed to providing a characterization plan for NRC review. DOE noted that the surface soil DCGLs would only apply to areas of the WVDP Site determined to have no subsurface soil contamination (i.e., subsurface contamination extends to depths greater than 1 meter), because DOE does not plan to modify its surface soil DCGLs as it may impact the design of the Phase 1 Final Status Survey (FSS) and considers the 1 m assumption to be conservative. DOE also committed to performing in-process surveys at the bottom of WMA 1 and 2 excavations and along H-piles (that provide support for the Main Plant Process Building) that may serve as a preferential pathway for contaminant transport in the lavery till. While DOE does not intend to remediate streambed sediments at this time (which would require a revision to the DP), DOE also noted its intent to verify dose modeling source assumptions in the field and revise DCGLs as necessary (see response to 5C13 [DOE 2009b]).

NRC also requested additional information regarding the use of surrogate radionuclides as DOE provided insufficient characterization to determine the homogeneity of radionuclide concentrations in the field. Because variable radionuclide ratios are expected over space given the length of time that has passed since releases have occurred (e.g., faster transport rates of more mobile species compared to easy to detect surrogate radionuclides such as Cs-137 would lead to variable ratios along the flow path), additional data collection would be necessary to support use of surrogate radionuclides to demonstrate compliance with LTR criteria for subsurface soils. In response to RAI 5C9 (NRC, 2009), DOE indicated that based on available data it was doubtful that radionuclide ratios would be consistent enough to permit use of an easy-to-measure surrogate radionuclide to identify the concentrations of Sr-90 which available data suggest will be the dominant radionuclide at the bottom of the excavations.

DOE also provided sufficient information regarding the chemical characteristics of the waste including background information on chemical processes that might influence radionuclide transport in the environment. DOE provided a comprehensive summary of available site-specific data on distribution coefficients for key risk drivers at the site that are expected to

[5] Because DOE assumed buried subsurface soils were brought to the surface in its basecase DCGL calculations, certain assumptions regarding the distribution of the subsurface material on the surface were necessarily made to estimate potential dose consequences.

significantly reduce the uncertainty associated with DCGL development. DOE performed a comprehensive sensitivity and uncertainty analysis to ensure that DCGLs adequately accounted for uncertainties in chemical characteristics of the waste, as well as assumptions regarding source geometry (e.g., area and thickness).

Source Term—Conclusions

DOE provided sufficient information regarding the physical and chemical characteristics of residual radioactivity including information regarding chemical processes used in the reprocessing and stabilization of spent nuclear fuel that is the major source of contamination at the site. A fair amount of site-specific information is available regarding the expected attenuation properties of radionuclides in the natural environment. As the uncertainty associated with transport of contaminants in the environment can drive the risk for any given site, the reduction and management of this uncertainty with site-specific information and probabilistic analysis (discussed below) is considered by NRC to be of significant benefit in constraining the dose predictions for key risk drivers at the West Valley Site.

Regarding subsurface soil clean-up in WMA 1 and 2, if in-process survey results reveal significant subsurface contamination not considered in DCGL development, the risk significance of this contamination should be evaluated and appropriately managed. Therefore, NRC has the following comments.

Comment: Dose modeling assumptions regarding the lateral and vertical extent of contamination needs to be verified in the field. If significant deviations exist, DOE needs to: (i) evaluate the risk significance of these deviations; and if necessary; (ii) revise the DCGLs; or (iii) apply the DCGLs to just those areas of the site where the dose modeling assumptions are valid. This comment applies to surface, subsurface, and streambed sediment soils.

Comment: If DOE chooses to use surrogate radionuclides for the FSS, sufficient information (characterization data) needs to be provided to ensure that use of surrogate radionuclides will not lead to a significant underestimation of the potential dose associated with residual contamination at the site.

5.1.3 Critical Groups, Scenarios, Pathways: Identification and Selection

Critical Groups, Scenarios, Pathways: Identification and Selection—Evaluation

In deriving DCGLs, DOE considered reasonably foreseeable land use scenarios including various rural, residential scenarios (i.e., resident farmer and gardener) for development of soil DCGLs. DOE also considered other processes that may lead to exposure to a potential receptor including erosion. In some cases land use was assumed to be limited given certain characteristics of the site (e.g., topography). For example, a recreational receptor was assumed to be located in the vicinity of actively eroding gullies for soil and streambed sediment DCGLs because steep stream banks were assumed to preclude certain activities such as construction of a residence, farming or gardening.

With respect to surface soil DCGLs, DOE considered both the resident farmer and a resident gardener residing on a large (10,000 m^2) area of contamination that was assumed to be 1 m thick. DOE also evaluated two alternative conceptual models involving erosion in response to NRC RAI 5C4. One erosion scenario involved sheet or rill erosion of surface soils to downstream locations. The assumption is that a resident receptor will be exposed to eroded material that is transported downstream via surface water through various water dependent pathways (e.g., drinking water, irrigation, and fish consumption). The second erosion scenario involves contaminated surface soils being deposited in an onsite gully. DOE presented a qualitative evaluation of the impact of this second erosion scenario--due to the reduced number of pathways and lower occupancy factors for a recreationalist, the scenario was not expected to be more limiting then the resident farmer scenario. Results of DOE's analysis show that the residential *farmer* scenario in the absence of erosion is most limiting.

Because residual contamination underlying WMA 1 and 2 following remediation is located at significant depths (around 4 to 15 m below grade), various initiating events or processes that could lead to the redistribution of contamination to the surface thereby making it more accessible to a potential receptor were considered (e.g., drilling of a cistern or natural gas well that could lead to the relocation of well cuttings to the surface or erosional processes that could expose contamination located at depth). DOE presented a range of potential initiating events and alternative conceptual models in response to NRC RAIs (e.g., see RAIs 5C5, 5C6, 5C7, 5C8, 5C9, 5C10, and 5C18 in [NRC, 2009]) which is considered sufficiently comprehensive to provide confidence that the subsurface DCGLs calculated to guide cleanup of WMA 1 and 2 will be protective of human health. The list of scenarios which is also presented in Table 1 below includes the following:

- Intrusion--Cistern Construction
    - Resident farmer
    - Resident gardener[6]
    - Acute dose to worker

- Intrusion--Natural Gas Driller

- Erosional Processes
    - Recreationalist in the vicinity of an actively eroding, onsite gully
    - Offsite resident exposed to eroded sediments transported via surface water to downstream locations

- Groundwater transport from the relatively impermeable lavery till to the more permeable backfill materials where groundwater could be extracted for residential purposes (drinking water and irrigation). An intrusion event is also assumed to occur leading to surface soil contamination from both deposition of contaminants in irrigation water, as well as from deposition of contaminated drill cuttings from cistern or well construction on the surface.

[6] A resident gardener is a modification of the resident farmer scenario. While due to the increased consumption rates, a resident farmer is oftentimes viewed as a more bounding scenario, in some cases the increased water usage requirements for a resident farmer leads to greater well bore dilution and lower potential doses for radionuclides dominated by groundwater dependent pathways.

Similar to the approach taken to develop surface soil DCGLs, DOE considered two erosion scenarios: an on-site and off-site receptor when deriving subsurface soil DCGLs. The on-site receptor is exposed to contamination that will be at significant depths (4-8 m) following remedial activities in WMA 2[7] due to erosional processes (i.e., gully advancement) that is assumed to uncover buried contamination over time. Due to the steep and uneven landscape expected near a gully, the receptor is assumed to participate in recreational activities such as hiking, hunting, and fishing rather then residing in the area of contamination. With respect to the offsite receptor, erosion is expected to lead to transport of contaminated sediments in surface water to a downstream receptor, who is subsequently exposed by using the surface water pathway for drinking and irrigation purposes and through fish consumption. As indicated in the last bullet above, DOE also considered various processes that could lead to the transport of contamination at depth to ground or surface water that could be used by a potential receptor for drinking water or irrigation purposes (e.g., transport of contamination from the lavery till into the more permeable backfill sediments where contamination could be extracted from a domestic well used for drinking water or irrigation).

For streambed sediment DCGLs and given the topography expected near certain streambed channels, DOE selected a recreational scenario to derive DCGLs with similar pathways as described for the onsite gully erosion scenarios discussed above. Based on an NRC RAI (5C12) DOE included an additional inhalation pathway not originally considered in the DCGL calculations. This pathway did not significantly impact the results.

Critical Groups, Scenarios, Pathways: Identification and Selection—Conclusions

With respect to the surface soil DCGLs, DOE evaluated reasonable land use scenarios and appropriately considered potential pathways of exposure. DOE provided a technically sound qualitative argument to support its conclusion that the onsite gully (recreational) scenario would be bounded by the onsite resident farmer scenario due to the limited number of recreational pathways and lower occupancy factors. The onsite gully scenario could only be more limiting if: (i) the land was modified to allow construction of a residence and/or; (ii) upgradient contamination somehow concentrated or accumulated in the downstream gully. Modification of the land in the vicinity of a large gully to support construction of a residence would likely lead to the dilution or burial of eroded (contaminated) material making this scenario less limiting. Higher concentrations of contamination in downgradient locations are not expected, and it is reasonable to assume that material would not accumulate in a gully in a geometrical configuration that would be more limiting than a large, surficial source 10,000 m^3 in volume that is currently assumed in deriving surface soil DCGLs. DOE found the onsite resident farmer scenario to be more limiting than either the onsite resident gardener or the offsite resident farmer (offsite erosion scenario). DOE's analysis and arguments appear reasonable for demonstrating compliance with LTR criteria.

Similar to surface soil DCGLs, DOE evaluated *residential* scenarios that due to the number of pathways considered and high occupancy factors assumed were expected to be most limiting for subsurface soil cleanup levels. In response to RAIs 5C10 and 5C18 (NRC 2009, DOE 2009b, DOE 2009c), DOE revised its DCGLs to account for more conservative source geometry

[7] While erosion was considered for WMA 1, the results of DOE's EIS (2008b and 2010) suggest that a gully would not advance into the area of the Main Plant Process Building within the 1000 year compliance period.

assumptions, as well as assumptions regarding pumping rates necessary to support a smaller garden compared to the larger pumping rates needed to support a 10,000 m^2 garden assumed in the surface soil DCGL calculations. In one case, DOE constrained land use to be consistent with the expected characteristics of the site (steep topography) that precluded certain activities such as construction of a residence, farming or gardening. For this onsite gully scenario, DOE evaluated the potential dose to a recreationalist spending time in the actively eroding onsite gully hiking, fishing, and hunting. Although it is possible that the gullies could be filled with clean material and that home construction could occur leading to potential residential scenarios, it is reasonable to assume that other residential scenarios evaluated by DOE for development of subsurface soil DCGLs would bound the impacts associated with this potential scenario[8].

For streambed sediment DCGLs, DOE also presented a reasonable argument for use of a recreational scenario given the topography expected near certain streambed channels that would make construction of residences difficult (see Figure 5-12 in revision 2 to the DP [DOE 2009e] for map of locations). In other streambed areas where the topography might be more conducive to construction of a residence, DOE will use surface soil DCGLs to guide remediation.

In conclusion, DOE developed reasonable exposure scenarios based on reasonable foreseeable land use. DOE appropriately selected the residential farmer or gardener as the critical group for exposure to site soils and recreational receptor for exposure to streambed sediments. In response to RAIs (NRC, 2009), DOE evaluated a number of alternative conceptual models and scenarios including those that might be deemed less likely but plausible. In all cases[9], DOE selected the most restrictive scenario on a radionuclide-specific basis when deriving DCGLs. DOE adequately evaluated a range of potential exposure scenarios and appropriately selected the critical group or group of people reasonably expected to receive the greater dose from residual contamination at the West Valley Site.

Notwithstanding the conclusion above and although the basis was briefly discussed in a public meeting on DOE's RAI responses, NRC noted that DOE did not provide a robust discussion regarding its lack of consideration of advective flow from the lavery till to the backfill sediments due to the effects of a pumping well that would be expected to cause a head reversal near the well.

Comment: DOE did not demonstrate that diffusive transport is the dominant transport mechanism of contamination from the lavery till into the overlying aquifer. DOE needs to more formally document its conclusion that advective flow from the lavery till to the backfill sediments is not the dominant transport mechanism for the groundwater transport (or multi-source) scenario.

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[8] Gully erosion would be expected to deplete the subsurface soil sources, such that the residential farmer scenario in the absence of gully formation would be expected to bound the risks associated with a potential gully re-fill scenario.
[9] In one case (surface soil DCGLs) and for one radionuclide (Np-237), DOE selected the probabilistic peak of the mean to calculate a DCGL when the deterministic DCGL was slightly lower (factor of 3). However, the critical group was the same—the residential farmer scenario.

Initiating Event or Process	Receptor Location	Mode	Landuse Scenario	Mathematical Model	Notes
Surface Soil DCGLs					
Residence Construction	Various[10]	Deterministic Probabilistic	Resident Farmer Resident Gardener	RESRAD	Basecase scenario (resident farmer) Resident gardener not limiting
Erosion	Cattaraugus Creek	Deterministic	Resident Farmer	WEPP[11] Custom	Not limiting
Erosion	Onsite gully	Deterministic	Recreational	Qualitative	Not limiting
Subsurface Soil DCGLs					
Gully Erosion	Gully near Erdmann Brook/WMA 2	Deterministic	Recreational	DEIS erosion modeling[12] RESRAD	Not limiting
Gully Erosion	Cattaraugus Creek	Deterministic	Resident Farmer Recreational (fishing)	CHILD[13] Custom	Not limiting
Cistern and Residence Construction	WMA 1 and WMA 2	Deterministic Probabilistic[14]	Resident Farmer Resident Gardener[15] Worker (acute)	RESRAD	Basecase scenario (resident farmer) Resident gardener more limiting in many cases.
Natural Gas Drilling	WMA 1 and WMA 2	Deterministic	Worker (acute)	RESRAD	Not limiting
Groundwater Transport[16]	WMA 1 and WMA 2	Deterministic	Resident Farmer Resident Gardener[17]	STOMP Custom[18]	Diffusion-limited contaminant transport from lavery till to overlying unit. Limiting.
Streambed Sediment DCGLs					
Recreational Activity	Onsite Creeks[19]	Deterministic Probabilistic	Recreational	RESRAD	Basecase Scenario

Table 1 List of Basecase and Alternative Exposure Scenarios

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[10] Receptors are located in contaminated areas outside of WMA 1 and 2, or within the first 1 m (3 ft) of WMA 1 and 2.
[11] The Water Erosion Prediction Project (WEPP) model results presented in the FEIS (DOE, 2010) were used to estimate erosion rates.
[12] Information provided in Appendix F to the DEIS (DOE, 2008b) forms the basis for many of the assumptions regarding the erosion scenario.
[13] Assumptions regarding gully erosion rates were drawn from CHILD landscape evolution modeling presented in the FEIS (DOE, 2010). Custom programs were used to calibrate the CHILD modeling results to a simple gully model and calculate the resulting dose associated with exposure to eroded material.
[14] Only the resident scenarios were run in probabilistic mode. The acute worker was run in deterministic mode.
[15] Different contaminated zone (CZ) geometry assumptions (RAI 5C10) were also simulated with larger area, smaller thickness CZs limiting in some cases.
[16] Also called the multi-source model, the combined risk from residual groundwater contamination and the basecase intrusion event were considered.
[17] Various contaminated zone geometry configurations were considered.
[18] Information from the 3D STOMP model was used to set parameters for custom models including FEIS finite difference groundwater transport and dose models.
[19] See Figure 5-12 in revision 2 to the DP (DOE, 2009e) for exact locations on the Project Premises. The locations do not include certain upstream stretches and tributaries to Erdmann Brook and Franks Creek.

5.1.4 Conceptual and Mathematical Models

Conceptual and Mathematical Models—Evaluation

DOE provided information regarding its conceptual models for exposure including information on the initiating events, transport of contaminants in the environment, and potential pathways of exposure. For most scenarios, DOE selected the RESRAD computer code to calculate surface, subsurface and streambed sediment DCGLs. While the conceptual and mathematical models implemented in the RESRAD computer code are well known and documented, not all contaminant fate and transport processes that may be operable at the West Valley Site are evaluated in the RESRAD models and code (e.g., erosion and diffusion). In these cases, DOE relied on the EIS analysis and models, as well as other custom programs to estimate the risks associated with residual contamination at the site.

For example, DOE used custom models to estimate the dose from eroded surficial soil contamination transported to downgradient locations. Results from the EIS (DOE, 2008b) Watershed Erosion Prediction Project (WEPP) erosion analysis were used to estimate sheet and rill erosion rates. Custom models were used to estimate the dose to potential offsite receptors from use of contaminated surface water for drinking, irrigation, and fish consumption.

As another example, the conceptual model implemented in the RESRAD computer code does not consider the risk associated with residual contamination located within saturated sediments, nor does it consider transport processes that might occur in relatively less permeable sediments such as lavery till materials located at the West Valley Site. Figure 5 illustrates the alternative conceptual model DOE evaluated in response to NRC RAI 5C9 (2009) to assess the impact of diffusion-limited transport from the lavery till vertically upwards into the more permeable backfill sediments where a domestic well could be installed and used to provide groundwater for drinking water and irrigation. This scenario was found to be most limiting for many radionuclides in deriving subsurface soil DCGLs. DOE used flow information from near-field Subsurface Transport Over Multiple Phases (STOMP) modeling to set parameters for a Final Environmental Impact Statement (FEIS) (DOE, 2010) model (e.g., finite difference rectangular source) along with dose to source ratios from RESRAD to evaluate the potential risk associated with this scenario. Verification packages for this custom modeling were provided by DOE for NRC review.

DOE also used custom models to estimate the dose from an actively eroding erosion front, an alternative conceptual model for subsurface soil exposure in response to NRC RAI 5C6 (2009). DOE used information from the FEIS (DOE, 2010) to calculate potential dose to an offsite receptor. The Channel Hillside Integrated Landscape Development model (CHILD) was used to estimate the potential erosion rates associated with gully intrusion into WMA 2. The highest erosion rates from sensitivity runs (e.g., runs with higher precipitation rates) were used to estimate the characteristics of gully propagation over time. A single gully model conceptualized in Figure 6 was used to estimate the volumes of eroded material assumed to be transported in surface water to downstream locations to a potential receptor. Using a stable slope angle of 21 degrees and time variant downcutting and advance rates, the simple analytical model presented in Figure 6 was fit to the most pessimistic CHILD landscape evolution simulation result discussed above (see FEIS [DOE, 2010]). The erosion rate estimates from the analytical model were then used to calculate surface water concentrations used to estimate the potential offsite impacts to a resident farmer from drinking water, irrigation, and fish consumption.

Additionally, potential risk to an onsite recreationalist/hiker in contact with the exposed contaminated zone was implemented in RESRAD as conceptualized in Figure 7. A one meter thick contaminated zone is exposed with an area of 200 m^2 (2 m wide by 100 m long). A recreationalist/hiker is assumed to be exposed from external gamma exposure, incidental soil ingestion and inhalation for 28 hours/yr while traversing the contaminated area.

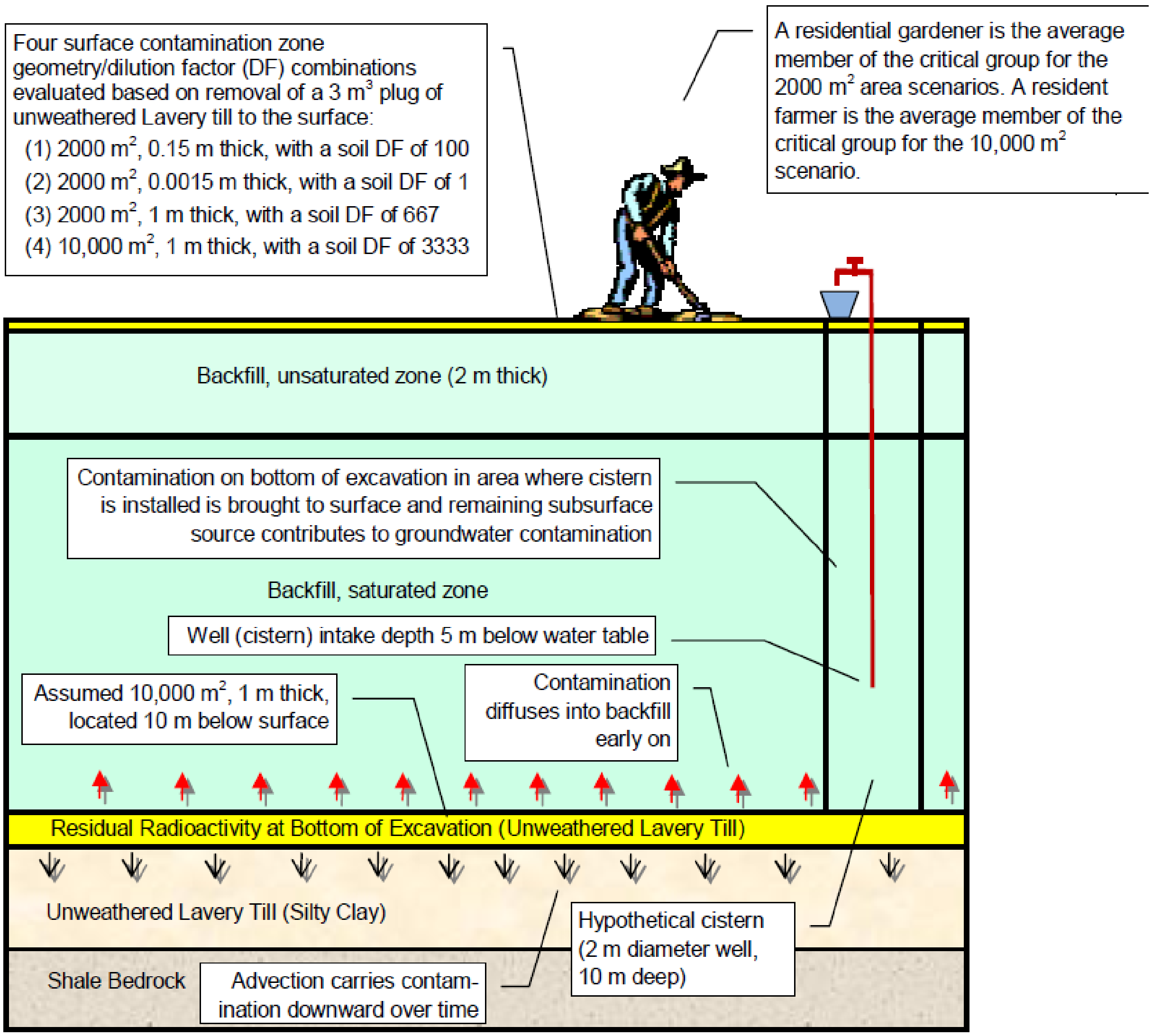

Figure 5 Alternative Conceptual Model for Development of Subsurface Soil DCGLs Groundwater Transport (Diffusion) From Lavery Till to Backfill Sediments with Subsequent Well Withdrawal

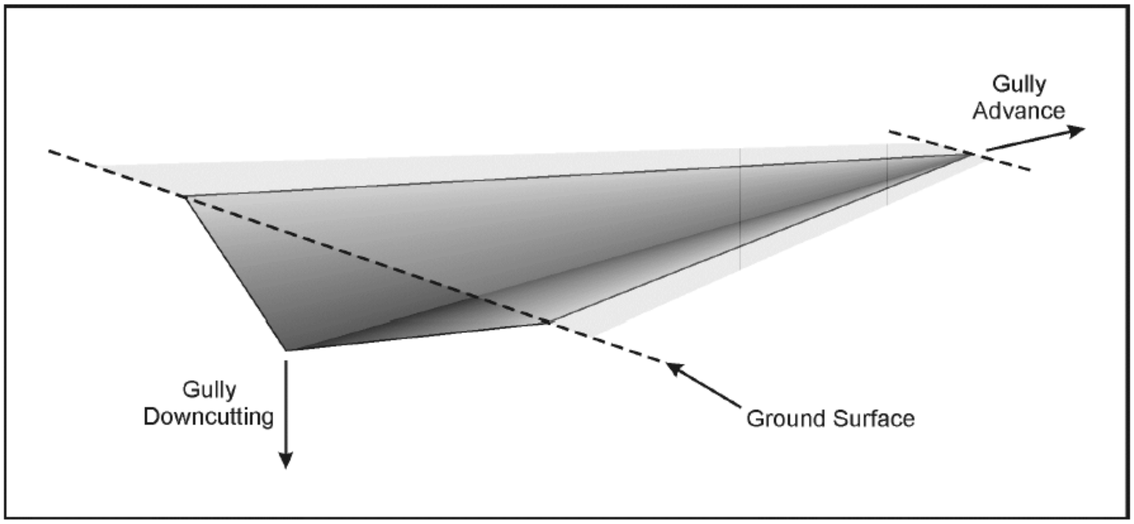

Figure 6 Schematic Representation of Single Gully for the Purposes of Estimating Doses to an Offsite Receptor Due to Erosion

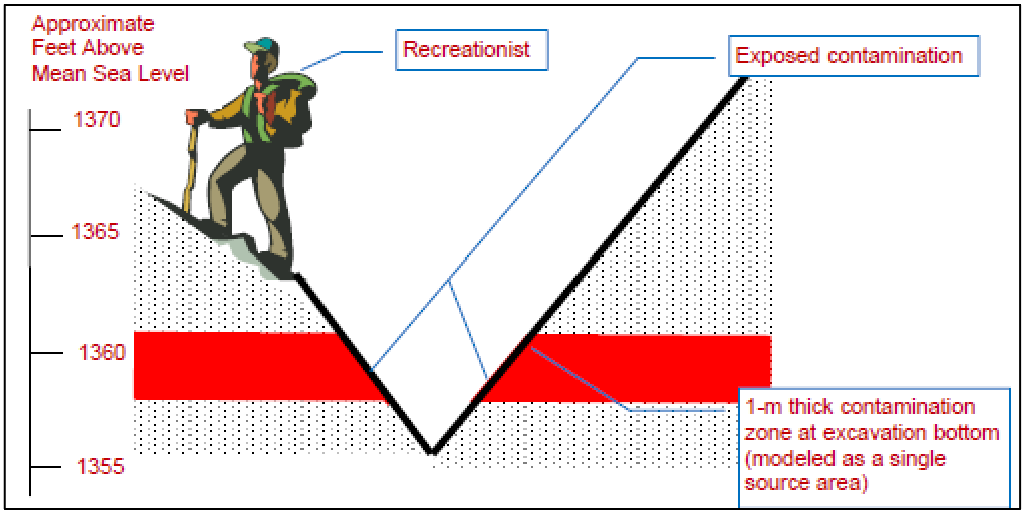

Figure 7 Alternative Conceptual Model for Development of Subsurface Soil DCGLs—Exposure to Onsite Receptor Due to Gully Formation

Although the underlying conceptual model implemented in RESRAD differs fundamentally from the conceptual model developed specifically for streambed contamination, DOE provided additional information and clarification on the adaptation of the streambed sediment DCGL conceptual model to RESRAD in response to NRC RAI 5C11, DOE expects the risks from streambed sediments to be overestimated by the RESRAD modeling due to several dose modeling assumptions (e.g., inclusion of the fish pathway on site streams that are not expected to support this pathway). However, because there is a potential for recontamination of streambed sediments that may be remediated during Phase 1, DOE elected to defer cleanup of streambed sediments at this time. A revision to the decommissioning plan would be necessary to remediate streambed sediments. Nonetheless, NRC has offered a few comments below that should be considered if the DP is revised to support remediation of streambed sediments.

In response to NRC RAIs (5C3, 5C9 and 5C20), DOE also evaluated the impact of engineered barriers on the flow field and the potential impact of flow field changes on dilution factors calculated in the RESRAD code. This evaluation was performed using the three-dimensional STOMP code. DOE interpreted the results of these analyses and showed that the engineered barriers will have little impact on the dilution factors. Additionally, DOE provided comparisons of the dilution factors calculated by RESRAD and STOMP and hard-wired the RESRAD non-dispersion sub-model used in the surface soil DCGL calculations to produce results similar to what would be expected using the more sophisticated code. DOE showed that dilution using the mass balance model in RESRAD for the subsurface soil DCGLs was underestimated compared to the STOMP modeling.

It is important to note that DOE plans to remove the Phase 1 hydraulic barriers in the event sitewide removal is sought at the end of phased decision-making, making the technical issue moot. However, because a final decision on Phase 2 has yet to be made, it would be difficult for DOE to evaluate the impact of final engineered barrier designs on site performance for all potential engineered barrier configurations that might be employed if the site-wide close-in-place (or similar) alternative is considered as the final decommissioning decision for the site. While engineered barriers are typically used to limit radionuclide releases and resultant doses, in some cases due to underperformance, degradation, or indirect impacts (e.g., changes in flow paths or decreased dilution in the saturated zone due to the presence of a cap) adverse impacts may occur and would need to be considered to ensure that when evaluating potential cumulative impacts of all remaining source areas, including remediated Phase 1 sources, that the dose remains below LTR criteria for the 1000 year compliance period. Because the dose standard would be four to twenty times higher[20] then the unrestricted use standard being used to guide Phase 1 remediation, engineered barriers that may be constructed to support restricted use in Phase 2 are not expected to have a significant detrimental impact on DOE's ability to comply with LTR criteria due to the level of clean-up of Phase 1 source areas.

DOE provided elevated measurement concentration DCGLs (or $DCGL_{emc}$) to guide clean-up of smaller, elevated areas of contamination. However, insufficient information was provided to allow independent assessment of these calculations. Namely, revision of the values to account for more limiting exposure scenarios such as the resident gardener or multi-source model were referenced in the report; however, details of these calculations were incomplete. Evaluation of the actual application of these DCGLs during the FSS is the subject of Section 9 (radiological survey) evaluations.

[20] In the case of restricted use and loss of institutional controls, 10 CFR 20.1403 provides a restricted use limit of 1 mSv/yr (100 mrem/yr) or in certain cases 5 mSv/yr (500 mrem/yr) compared to the unrestricted use limit of 0.25 mSv/yr (25 mrem/yr) found in 10 CFR 20.1402.

Conceptual and Mathematical Models—Conclusions

Most of the DCGL scenarios were modeled with the RESRAD code. RESRAD developers have subjected the code to extensive benchmarking, verification, and some limited validation. No independent verification of this NRC approved code is necessary (NRC, 2006). RESRAD input and output files were provided, as were spreadsheets presenting results of the analysis.

Given its expected risk significance, DOE provided sufficient information for NRC to perform a high-level review of the landscape evolution and custom programs used to calculate erosion rates and dose consequences as a result of gully propagation. Additionally, the mathematical representation is adequate for the purposes of DCGL development. While limited information is available on CHILD verification and validation (CNWRA, 2008), independent calculations conducted by NRC using site-specific information on gully downcutting and advance rates generally supports the adequacy of the final DCGLs developed for subsurface soils. Any potential issues NRC identified with the erosion analysis (e.g., use of a Cattaraugus versus Buttermilk Creek receptor with a factor of eight greater dilution factor and assumptions regarding the timing or magnitude of peak erosion rates) were either offset by: (i) the safety margin between the basecase and erosion scenarios; and/or (ii) due to the use of a more limiting scenario such as the multi-source model (e.g., NRC results showed that the erosion scenario might be more limiting than the cistern scenario for C-14 but the multi-source model was even more limiting). With a few exceptions, which will be resolved separately and at a later time, DOE provided adequate descriptions and documentation (e.g., calculation packages) of alternative conceptual models evaluated with custom models and programs. These models generally appear to be adequate for the purposes of DCGL development.

NRC has confidence that the mathematical models employed by DOE are sufficient to implement the conceptual models for exposure from surface and subsurface soils and that DCGLs were appropriately derived.

Although the underlying conceptual model implemented in RESRAD differs fundamentally from the conceptual model developed specifically for streambed contamination, implementing the conceptual model associated with risks from streambed sediments in RESRAD should be adequate for the purposes of guiding clean-up of contaminated streambed sediments. DOE responded adequately to NRC comments (RAIs 5C1 and 5C11) regarding potential cumulative impacts to surface water to ensure that DCGLs for specific source areas are sufficiently bounding, as future surface water impacts were not specifically considered in developing streambed sediment DCGLs. For example, NRC cautioned DOE that if the risk associated with seepage, discharge, or erosion of multiple sources in downgradient receptor locations is potentially greater than the onsite risk for individual sources, then the DCGLs for individual source areas may need to be adjusted to ensure that LTR criteria are met at these downgradient locations. DOE thinks that this risk is low and has provided compelling arguments to support its assumption that the “onsite” or on-source receptor DCGLs derived will bound the impacts associated with any “offsite” or down-source receptors. In any event, DOE has elected to postpone remediation of contaminated streambed sediments in Phase 1. A revision to the DP would be needed to support remediation of streambed sediments.

Notwithstanding the conclusions above, NRC offers the following comments:

Comment: Potential adverse impacts of final engineered barrier designs have not been evaluated at this time. DOE needs to evaluate any potential adverse impacts of final engineered barrier designs that may affect risk calculations to support Phase 2 decision-making.

Comment: It is not clear that alternative conceptual models (e.g., multi-source and gardener) were appropriately considered when deriving area factors provided in Chapter 9. NRC expects DOE to provide a basis for the number and size of the areas evaluated and the model selected to derive a particular set of area factors prior to remediation.

5.1.5 Parameter Support and Analysis

Parameter Support and Analysis—Evaluation

DOE provided information for NRC to evaluate the parameters used in RESRAD and custom models to estimate the potential risk from the site including information on its deterministic parameter selection and probabilistic parameter selection. DOE initially performed a deterministic analysis with a comprehensive sensitivity analysis to identify significant risk factors and to indicate the level of uncertainty due to incomplete information regarding parameter values. In response to several NRC RAIs regarding justification for parameter selection (see for example RAIs 5C15 through 5C19 in [NRC, 2009]) and other stakeholder comments regarding use of a probabilistic analysis to evaluate uncertainty, DOE revised its DCGL calculations to consider results of a probabilistic assessment. Additionally, based on the results of the updated (DOE 2009e) parameter sensitivity and uncertainty analysis and in response to NRC comments, DOE revised its deterministic model parameters to help ensure that the modeling did not underestimate the potential risk. With one exception, the most limiting DCGL from either the deterministic or the probabilistic modeling was selected[21] (DCGLs derived using the peak of the mean from the probabilistic analysis were more limiting for surface soil and streambed sediments). DOE also evaluated scenario uncertainty and managed this uncertainty by using the most limiting DCGL considering a range of alternative conceptual models and scenarios evaluated, as discussed above.

NRC noted that DOE did not consistently consider uncertainty in the distribution coefficients for subsurface media. The response to RAI 5C15 indicated that DOE would consider the uncertainty in distribution coefficients for all zones (contaminated, unsaturated, and saturated) in the probabilistic DCGL calculations for all media (see Table 5C15-1). However, it is not clear from Appendix E, or the RESRAD input files that uncertainty in distribution coefficients for all subsurface media were considered and appropriately correlated. For example, the surface soil DCGLs included distribution coefficients for all radionuclides and zones; however, correlation coefficients for progeny were not considered. Subsurface soil DCGLs only considered uncertainty in the distribution coefficients for the contaminated zone. It is not clear why uncertainty in distribution coefficients for the unsaturated and saturated zones were not considered.

[21] In one case (surface soil DCGLs) and for one radionuclide (Np-237), DOE selected the probabilistic peak of the mean to calculate a DCGL when the deterministic DCGL was slightly lower (factor of 3).

DOE did not appear to consider uncertainty in important parameters such as effective diffusion coefficients used to estimate the potential risk of contaminating the overlying aquifer due to residual contamination in the lavery till.

DOE used the Buttermilk Creek watershed area to determine surface water dilution factors that impact potential doses from fish and deer consumption. Because the sediment DCGLs are based on exposure to Franks Creek and Erdmann Brook sediments, this assumption, while potentially justified should be further explained. For example, onsite Creeks may not support fish populations and consumptions rates assumed in the analysis and thus, use of the larger Buttermilk Creek watershed area may be appropriate. These assumptions should be clearly documented if the DP is revised to support clean-up of streambed sediments.

Parameter Support and Analysis—Conclusions

Based on DOE's comprehensive evaluation of parameter and scenario uncertainty, NRC concludes (with the exceptions noted below) that DOE has provided adequate justification for its selection of model parameters and has appropriately considered uncertainty in its dose predictions.

Comment: DOE did not provide adequate justification for its treatment of uncertainty of distribution coefficients for subsurface soil DCGL calculations. NRC recommends that DOE consider or provide justification for lack of consideration of uncertainty in distribution coefficients for subsurface materials in the subsurface soil DCGL calculations. DOE needs to properly consider parameter correlations consistent with the approach laid out in Appendix E, Table E-7 of Revision 2 to the DP.

Comment: DOE did not consider the uncertainty in potentially risk-significant parameters when deriving subsurface soil DCGLs based on the multi-source scenario. NRC recommends that DOE perform a sensitivity analysis to evaluate the risk significance of important parameters (e.g., distribution coefficients) on the results of the multi-source scenario, which drives many of the subsurface soil DCGLs, and adjust parameters as necessary to ensure DCGLs are sufficiently protective at the unrestricted use level.

Comment: DOE did not provide a rationale for using the Buttermilk Creek watershed area when deriving streambed sediment DCGLs. NRC recommends that DOE justify use of the Buttermilk Creek watershed area to calculate surface water concentrations in the streambed sediment DCGLs prior to their use in a future DP revision.

5.1.6 Compliance with Regulatory Criteria

Compliance with Regulatory Criteria—Conclusions

Based on review of DOE's Phase 1 DP as revised by NRC review and comment (DOE 2009e), NRC has reasonable assurance of the following:

- DOE has provided adequate information on surface and subsurface soil source terms for the purposes of DCGL development and has agreed to verify dose modeling assumptions in the field. If in-process or other characterization surveys of subsurface soils at the bottom of excavations or along H-piles reveal significant levels of contamination not previously identified, the risk significance of this contamination should be evaluated and appropriately managed. DOE has agreed to apply surface soil DCGLs in only those areas of the WVDP site where surface contamination exists (defined by DOE to be less than 1 m thick) consistent with dose modeling assumptions. Streambed sediment geometries will be verified in the field and DCGLs modified, if necessary, if DOE elects to remediate streambed sediments in a future DP revision.

- DOE has analyzed a range of reasonably foreseeable land use scenario(s), and has demonstrated that the exposure group(s) adequately represents a critical group(s).

- The mathematical method and parameters used are appropriate for the scenarios evaluated and parameter uncertainty has been adequately addressed (with comments noted above).

- For deterministic analyses, the peak annual dose to the average member of the critical group is expected to be less than (or equal to) 0.25 mSv (25 mrem) or for probabilistic analyses, the “peak of the mean” dose distribution to the average member of the critical group is expected to be less than (or equal to) 0.25 mSv (25 mrem).

- DOE has committed to using radionuclide-specific DCGLs to guide remediation of the WVDP Site to ensure that the total dose from all radionuclides will meet the requirements of Subpart E by using the sum of fractions rule. NRC encourages DOE to follow through on its intent to evaluate the final dose using data collected from the final survey results to provide additional assurance that LTR criteria are met and to provide a more accurate estimate of risk from residual contamination. NRC also encourages DOE to calculate potential dose at downgradient locations to provide an indication of the available safety margin remaining for Phase 2 decommissioning activities (or additional support that the on-source DCGLs will be more limiting when cumulative dose from all sources is considered).

Notwithstanding the conclusions above, due to the relatively large amount of information that has been provided for NRC review since the Revision 1 DP submittal, NRC has performed a comprehensive review all recent submittals (with more risk-significant comments noted in this TER). NRC would like to discuss these and other less risk-significant comments and questions further with DOE.

Comment: Clarity of Phase 1 DP modeling assumptions and parameters could be enhanced. NRC seeks clarification on a few modeling assumptions and parameter values to help improve clarity of the Phase 1 DP and/or ensure all remaining risk-significant technical issues are adequately addressed.

5.2. Engineered Barriers

Engineered Barriers - Evaluation

In the Phase 1 DP, DOE proposed to use a variety of different engineered barriers to facilitate remediation. These barriers include: sheet pilings, hydraulic barrier walls, a Permeable Treatment Wall, and French drains. Many of these barriers have been used previously at the WVDP during site operations. Phase 1 decommissioning activities will involve the excavation of contaminated soil for offsite disposal. The engineered barriers will be used to prevent the intrusion of groundwater into excavations during their excavation, FSSs, and backfilling with clean soil. The engineered barriers are not being relied upon as long-term barriers to meet the unrestricted use decommissioning criteria. The sheet pilings are temporary barriers used during excavation. The hydraulic barrier walls are permanent barriers used to facilitate excavation of contaminated soil and to prevent recontamination of remediated areas prior to completion of Phase 2 activities. Monitoring will be performed to verify recontamination has not occurred, and if necessary additional remediation will be completed. Figure 8 is a plan view of the site showing the location of the permanent barrier walls to facilitate decommissioning and associated monitoring locations.

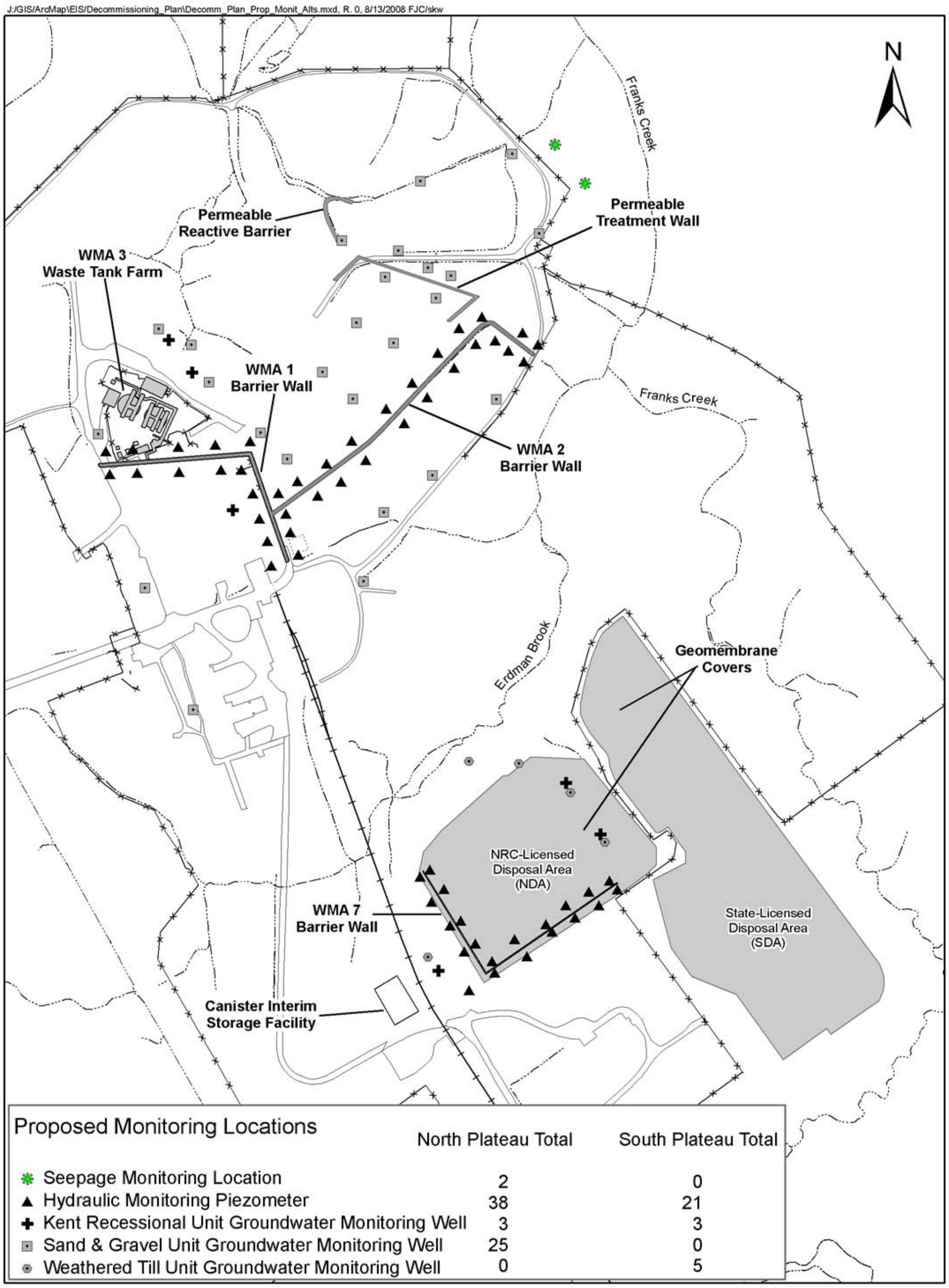

Figure 8 - DOE's Proposed Use of Permanent Engineered Barriers for Phase 1 Decommissioning Activities and Associated Monitoring Locations

DOE described the design information provided in the Phase 1 DP as conceptual in nature, because a ROD for the EIS has not yet been made. DOE stated if the Phased Decisionmaking Alternative for decommissioning is selected, then a final design for the engineered barriers will be provided to NRC for technical review.

Temporary sheet piling will be driven into uncontaminated soils on the upgradient and cross-gradient sides of the excavations. Interlocking sheet piling was used during construction of a variety of facilities at WVDP in the 1960's and during construction of the Permeable Treatment Wall in 1999. The sheet piling was used to support excavations ranging from 9 to 15 meters (30 to 50 feet). In response to an NRC RAI, DOE provided photographs and a discussion of previous experience with sheet piling. The photographs support the reasonable likelihood that DOE will be able to limit water flow into the excavations with sheet piling.

The permanent hydraulic barrier wall constructed on the downgradient side of the excavation would be a soil-cement-bentonite slurry wall installed using slurry wall trenching technology. The wall would be installed under a quality control – quality assurance program. The soil-cement-bentonite mixture would be in the proportion 85-5-10, with an initial maximum design hydraulic conductivity of 6.0E-06 cm/s. The wall would be approximately 230 meters (750 ft) long, up to 15 m (50 ft) deep, and 1 to 4 meters (2 to 13 feet) wide. In RAI DC3, NRC requested additional information with respect to a number of aspects of the permanent barrier wall design and implementation. The Phase 1 DP provided insufficient information that the performance goals of the slurry wall are likely to be achieved. DOE responded that it is premature to present final performance goals prior to a EIS ROD, and that the final design details, performance goals, and supporting technical basis for the hydraulic barriers and French drains will be provided to NRC for technical review prior to their installation. When DOE provides the information to NRC, it needs to address the specific elements stated in RAI DC3.

NRC requested additional information on the Phase 1 engineered barrier corrective action program. Identifying that engineered barriers have been implemented properly and are functioning as designed is essential. NRC expressed concern that without an effective monitoring and maintenance program or robust designs, the engineered barriers may not be able to meet their performance requirements. DOE responded that both a groundwater monitoring network and a French drain would be installed adjacent to the barrier wall to monitor its performance and identify necessary corrective actions. The monitoring could involve the use of nested piezometers at different depth intervals installed at regular intervals upgradient and downgradient. Groundwater samples would be routinely collected and analyzed for radiological indicator parameters. Changes in those parameters may identify defects. However, the monitoring network can not be fully-designed until site-specific hydrological and geotechnical information is collected. Section 2.1.1 of the DP was modified to reflect the types of monitoring that would be performed. NRC staff reviewed the information and found the content to present a reasonable path forward. NRC will review the specific details of the engineered barrier monitoring system design when it becomes available during implementation of Phase 1, as applicable.

NRC requested additional information on the effect of the engineered barriers on groundwater flow (e.g., to WMA 3 [waste release, Tank Farm groundwater dewatering system] or the Permeable Treatment Wall), which could impact Phase 2 activities. In response, DOE outlined a number of actions that will be taken to ensure the use of the permanent hydraulic barrier walls will not have adverse impacts on Phase 2 decision making.

- The WMA 1 barrier wall and French drain will be designed to result in minimal changes to groundwater flow patterns and levels in WMA 3.

- Additional monitoring locations will be added to better identify potential changes to the water flow to WMA 3.

- The contractor responsible for the Permeable Treatment Wall design is modeling the effects of the WMA 1 and 2 barriers on groundwater flow directions and gradients.

- If a Phase 2 close-in-place option were selected for the HLW tanks, the design would likely include engineered barriers such as a circumferential hydraulic barrier wall and upgradient barrier wall to divert groundwater flow away from the tanks and a multi-layer closure cap to reduce infiltration.

- The Phase 2 barrier walls could be tied into the proposed Phase 1 barriers, if necessary.

Collectively, the proposed actions provide adequate basis that the impacts of Phase 1 barriers on Phase 2 activities will be addressed. However, NRC will verify this conclusion upon review of the detailed information as it becomes available.

<u>Engineered Barriers - Conclusions</u>

NRC has reviewed the engineered barriers analyses and information as part of the review of DOE's decommissioning plan, using the Consolidated Decommissioning Guidance, Volume 2, Section 3.5 (Use of Engineered Barriers). Based on this review, NRC concludes that the use of engineered barriers for unrestricted use of areas of the WVDP identified in the Phase 1 DP is reasonable and appropriate for the stated objectives of the barriers. The stated objective of the engineered barrier is to control the spread of contamination from unremediated areas to remediated areas, as well as to limit the flow of groundwater to areas that are being remediated. This conclusion is based on NRC evaluation in the Phase 1 DP and responses to requests for additional information. NRC conclusions for specific issues related to engineered barriers are found in the staff evaluation section above in order to provide the reader with the appropriate context.

In the DP for Phase 2, DOE will need to demonstrate that the entire West Valley Site meets the LTR. If the engineered barriers employed to limit recontamination of areas that have been remediated prove not be effective resulting in recontamination of Phase 1 areas that were previously remediated, further remediation of those areas could be required to meet LTR criteria. Additionally, design of the Waste Tank Farm groundwater dewatering system or other systems may be confounded by increased water flow resulting from the presence of Phase 1 engineered barriers. The basis for selecting a two phase approach to decommissioning is in part that Phase 1 actions will not impact the selection of Phase 2 options. Decisions based on conceptual designs are subject to greater uncertainty than if the designs of the engineered barriers were more robust. However, because the engineered barriers are not being relied upon for long-term performance (i.e. they are designed to eliminate the need to perform additional remediation at some future date), conceptual designs are suitable at this time. Detailed information will be reviewed as it becomes available during Phase 1 activities.

6.0 ALARA

ALARA Evaluation

DOE provided its ALARA evaluation in Section 6.0 of the Phase 1 DP, Rev. 0 (DOE 2008a). NRC reviewed Section 6 of the DP, Rev. 0 and raised concerns about three ALARA issues in the May 15, 2009, RAI (NRC 2009). DOE provided responses to the RAI (DOE 2009b) and a revision 2 of the DP (DOE 2009e). The ALARA evaluation addresses: (i) methods by which DOE plans to achieve a decommissioning goal below the dose limits (Section 6.2 of the DP); (ii) cost-benefit ALARA analyses for surface soil cleanup (and DCGL), subsurface soil cleanup, and streambed sediment cleanup (Section 6.3 of the DP); and (iii) additional ALARA analyses that DOE plans to perform (Section 6.4 of the DP).

NRC guidance provides that ALARA evaluations for unrestricted use decommissioning should address two aspects: (i) typical good practices or good housekeeping efforts and (ii) cost-benefit ALARA analyses. Regarding the good practices, DOE had partially addressed qualitative aspects of ALARA, in Section 6.2 of the DP, Rev. 0 (DOE 2008a). However, NRC staff had a concern, included in the RAI (NRC 2009), that DOE had only provided a brief mention of broad concepts related to good practices and should provide more details on actual practices that might be employed. In its response to the RAI (DOE 2009b) and in Rev. 2 of the DP (DOE 2009e), DOE provides references to DOE documents that include good practice provisions that promote ALARA, and mentions specific good practices that will be used. The staff considers the DOE revision acceptable.

DOE also describes its cost-benefit analyses, in Section 6.3 of the DP. In Rev 0 of the DP (DOE 2008a), DOE used a simplified analysis, which assumed the only benefit would be the collective dose averted by the action and evaluated only the cost of disposal of Low-Level Radioactive Waste (LLW). Based on that comparison, DOE concluded that soil remediation below the proposed DCGL is not warranted. This is consistent with NRC's conclusion that shipping soil to a LLW facility is unlikely to be cost-effective for unrestricted use (NUREG-1757, Vol. 2, Appendix N, Section N.1.5). However, in its analysis, DOE applied a monetary discount rate of 0.03/yr (3%/yr). NRC expressed its concern in the RAI (NRC 2009) that the use of a discount rate is inappropriate when the benefits and costs span across population generations (as may be the case here, with some long-lived radionuclides). In its response to the RAI (DOE 2009b) and in Rev. 2 of the DP (DOE 2009e), DOE provided additional analyses using lower discount rates (to zero), and showed that with zero discount rate, the disposal component of costs exceeds the value of dose averted and further remediation would not be necessary. NRC considers the DOE revision acceptable.

NRC also had a concern (NRC 2009) on Rev. 0 of the DP (DOE 2008a) about why DOE presented a preliminary ALARA evaluation (i.e., in the present DP) and plans an additional, more detailed ALARA evaluation during the Phase 1 remediation work. In its response to the RAI (DOE 2009b) and in Rev. 2 of the DP (DOE 2009e), DOE indicated that this approach is appropriate because information used in the analyses may change by the time remediation takes place. DOE mentioned an example of waste disposal costs potentially changing, which could affect the analyses. NRC also notes that characterization activities are not complete at this time, and additional information obtained through characterization might also change the analyses. Given the overall approach to the Phase 1 decommissioning, the NRC considers it acceptable for DOE to perform the more complete, detailed ALARA analyses during the remediation work.

NRC also notes that DOE commits in Section 6.4 of Rev. 2 of the DP (DOE 2009e) to meeting soil cleanup goals that are concentrations lower than the calculated DCGLs (calculated based on 25 mrem/yr). This is another aspect of the application of ALARA to the Phase 1 decommissioning.

ALARA – Conclusions

NRC has reviewed DOE's ALARA evaluation as part of the review of the Phase 1 DP, using the Consolidated Decommissioning Guidance, Volume 2, Section 6 and Appendix N (ALARA Analyses). Based on the NRC staff's review of DOE's DP as supplemented and revised through responses to the RAI (DOE 2008a, DOE 2009b, DOE 2009e), NRC concludes that DOE's ALARA evaluations completed for the proposed Phase 1 decommissioning provide reasonable assurance that the ALARA criterion in NRC regulations at 10 CFR 20.1402 will be met. As discussed above, DOE plans to perform additional ALARA analyses during implementation of the Phase 1 decommissioning work; and NRC will review the additional ALARA analyses when available during implementation of Phase 1, as applicable.

Based on the Statement of Considerations for the LTR (NRC 1997), the radon pathway does not need to be included in dose assessments for compliance with the dose criteria of the LTR. However, the ALARA evaluation for compliance with §20.1403(a) (restricted use) should consider the practicality of radon mitigation techniques in structures as part of the institutional controls proposed for the site. Thus, if restricted use is proposed for Phase 2 and if radon-generating radionuclides are present (e.g., Th-230 or Ra-226), DOE should address this for Phase 2 and should consider whether any changes to Phase 1 decommissioning are appropriate.

Comment: Although final decommissioning decisions have not been made, DOE needs to be aware that if it selects sitewide close-in-place for Phase 2 decommissioning with institutional controls to meet criteria for restricted use, DOE may need to consider radon impacts as part of the demonstration of compliance with §20.1403(a) even for Phase 1 source areas.

7.0 Planned Decommissioning Activities

Planned Decommissioning Activities - Evaluation

DOE provided a description of the West Valley Site and area conditions anticipated at the beginning of Phase 1 decommissioning and a general overview of proposed Phase 1 decommissioning activities. DOE stated that detailed procedures or "Decommissioning Work Plans" will be completed to ensure work is performed safely prior to the commencement of Phase 1 decommissioning activities.

A summary of remediation and demolition technologies was provided in Section 7 of the Phase 1 DP. DOE provided a general schedule with the basic sequence and order-of-magnitude of the proposed activities. Prior to DOE developing the Phase 1 DP, NRC agreed that certain DOE regulations, orders, and technical standards are adequate to define, control, and establish safe work activities at the site. NRC determined that DOE did not need to provide these details in the Phase 1 DP. In this respect, NRC considered areas such as project management and organization, the health and safety program, the environmental monitoring and control program, and the radioactive waste management program adequate under DOE's responsibility and authority.

Planned Decommissioning Activities - Conclusion

NRC has reviewed the planned decommissioning activities described in the Phase 1 DP for the WVDP according to the Consolidated Decommissioning Guidance (NUREG-1757), Volume 1, Section 17.1 (Planned Decommissioning Activities). Based on this review, NRC concludes that DOE provided sufficient information to allow an evaluation of planned decommissioning activities and to ensure that the decommissioning can be conducted safely and in accordance with NRC decommissioning criteria.

8. Quality Assurance

Quality Assurance - Evaluation

NRC has completed a qualitative assessment of the information in the "Quality Assurance Program" section of the Phased 1 DP for the WVDP which focuses on the Quality Assurance (QA) related to characterization surveys, engineering data, calculations, dose modeling, and FSS supporting the proposed decommissioning activities. In this section, DOE provides an overview of the QA program but states that the information is generic because contractual arrangements for the proposed decommissioning have not yet been made. This overview includes information on QA: (i) organization; (ii) duties and responsibilities of each unit within the organization; (iii) controls for documents, measuring and test equipment, purchased material, contractor services, corrective action, audits and surveillances, and for control of QA records; and (iv) refers to existing quality control assurance programs for the preliminary dose modeling and engineered barrier design that will be completed prior to the initiation of Phase 1 decommissioning activities.

Quality Assurance - Conclusion

NRC has completed a qualitative assessment of the Quality Assurance Program for the WVDP Phase 1 DP according to the Consolidated Decommissioning Guidance, Volume 1, Section 17.6 (QA Program). Based on this assessment, NRC concludes that DOE's QA program is sufficient to provide reasonable assurance that accurate, high-quality information will be developed to support Phase 1 decommissioning activities.

Comment: The Phase 1 DP provides an overview of the QA program noting that the information is generic because contractual arrangements for the proposed decommissioning have not yet been made. Section 1.6 of the Phase 1 DP states that a QA Project Plan will be developed and forwarded in the future. NRC will review the elements of the QA Project Plan applicable to data and information collected in

conjunction with planned characterization and surveys supporting decommissioning activities (e.g., scientific and engineering data, calculations, measurement and test equipment, and dose modeling) when this information becomes available. The QA Project Plan needs to be developed prior to the start of decommissioning activities to ensure the collection of high-quality and defensible information.

9.0 Facility Radiation Surveys

9.1 Decommissioning Criteria

Decommissioning Criteria – Evaluation

DOE's derivation of DCGLs and area factors are described in Chapter 5 and Appendix C of the Phase 1 DP (DOE 2009e). NRC's evaluation of the DCGL modeling and calculations is discussed in Section 5.1. Please refer to Section 5.1 for detailed information and conclusions regarding DCGL and area factor development.

Decommissioning Criteria – Conclusion

NRC has reviewed the information in the Phase 1 DP for the WVDP according to the Consolidated Decommissioning Guidance (NUREG-1757), Volume 2, Section 4.1 (Release Criteria). Based on this review, NRC concludes that DOE has sufficiently summarized the DCGL(s) and area factors used for survey design and for demonstrating compliance with the radiological criteria for unrestricted use.

9.2 Characterization Surveys and Remedial Action Support Surveys

Characterization Surveys and Remedial Action Support Surveys - Evaluation

DOE stated in Section 7 of the West Valley Phase 1 DP that "the WVDP facilities and areas had not been completely characterized for radioactivity as of 2009. Additional characterization will be performed as necessary in accordance with the [CSAP], as explained in Section 9." Additionally, DOE states in Section 9 of the DP that, "while this section addresses all applicable requirements for facility radiation surveys, it does so in general terms because two supplemental documents will provide additional details: a [CSAP] and a Phase 1 Final Status Survey Plan." In Section 9.4.1, DOE also stated that, "[a] key objective of [the CSAP] will be to produce data for the Phase 1 FSS of sufficient quality and quantity to serve FSS purposes when practicable." In response to the above statements and the integral importance to the survey requirements to demonstrate consistency with NRC guidance, NRC requested (RAI 9C1) that the CSAP be provided to NRC to supplement the technical review of the WVDP Phase 1 DP. In response to this request, DOE revised Section 9.4 (Characterization Surveys) incorporating an annotated outline of the content of CSAP summarizing: its scope and content, characterization methodologies, data quality objectives for characterization surveys, quality control of measurements and samples, and use of characterization data for FSSs.

In accordance with NRC review guidance, NRC staff requested detailed information on site-specific facility surveys, “Remedial Action Support Surveys,” also known as in-process surveys. NRC staff requested (RAI 9C2) that DOE provide a Remedial Action Support Survey Plan based upon current site characterization data, and suggested that the Remedial Action Support Survey Plan would also provide DOE with a basis for developing the Final Status Survey Plan (FSSP). NRC specifically requested that the Remedial Action Support Survey Plan include the survey methodologies to be performed to ensure that the detection of residual radioactivity is well below the DCGL, to demonstrate that soil has been sufficiently remediated and that the residual radioactivity at depth meets release requirements. In response to this request, DOE revised Section 9.5 incorporating additional information on survey methodologies and field instrumentation to be used in these surveys to detect contamination below DCGLs. Additionally, DOE has committed to provide further details in the CSAP on how background data will be applied to characterization and remedial action support surveys (as a response to RAI 9C3 on the application of background data).

The CSAP and additional details of Remedial Action Support Surveys were both requested by NRC as part of the RAI process. In DOE’s response to NRC’s request, DOE stated that “the [CSAP] will cover both pre-remediation and remedial support collection needs.” NRC agrees with DOE that the WVDP DP radiological program is highly dependent on the forthcoming CSAP. Accordingly, NRC has determined that a detailed technical evaluation of the Facility Radiation Surveys cannot be completed until the CSAP, a critical technical basis document, is confirmed to adequately address issues identified by NRC.

<u>Characterization Surveys and Remedial Action Support Surveys – Conclusion</u>

In the absence of the CSAP, the information supplied in Revision 2 of the Phase 1 DP was reviewed according to the NUREG 1757 Consolidated Decommissioning Guidance, Volume 2, Section 4.2 (Characterization Surveys) and Section 4.3 (Remedial Action Support Surveys). Since additional information on characterization and remedial action support surveys is anticipated, NRC conclusion is dependent on the CSAP and development of the radiation survey plans.

Comment: NRC will review and comment on the CSAP when it becomes available. The CSAP implementation will enable the development of the radiation survey plans as defined in NRC guidance.

9.3 Final Status Survey Design

<u>Final Status Survey Design - Evaluation</u>

In response to NRC’s request for clarification on the Final Status Survey Design (FSSD) (RAI 9C4), DOE revised the DP by adding Appendix G incorporating Phase 1 Final Status Survey Conceptual Framework to serve as a basis for the development of a FSSP. DOE also provided the WVDP FSSP (DOE 2009f) as a stand alone document to supplement the Phase 1 DP, which includes the FSSD. In the FSSP, DOE states that, “This [FSSP] is consistent with the Multi-Agency Radiation Survey and Site Investigation Manual [MARSSIM NUREG 1575].”

In the DP and FSSP, DOE identifies 18 radionuclides of concern. Many of the 18 radionuclides are hard-to-detect nuclides which have extremely low DCGLs proposed to demonstrate compliance with radiological criteria for unrestricted use. The hard-to-detect radionuclides may require complex radiochemical and measurement protocols in order to validate their existence and to quantify the specific activity in the environment. Consistent with the other radiological facility surveys, the FSSP is highly dependent on the forthcoming CSAP. The CSAP will provide radiological results that DOE will use as the technical basis for demonstrating consistency with MARSSIM and NRC guidance. NRC staff has determined that the FSSP will require clarification and should apply results from the CSAP. In addition, the FSSP proposes the use of composite sampling. However, DOE should clarify its technical justification for using composite sampling to demonstrate compliance and consistency with MARSSIM and NRC guidance. In the DP Section 9.4.1, DOE states that the radiological surveys and samples obtained from the CSAP may be used to satisfy FSSP requirements. The CSAP has not been provided for NRC review; and therefore, the relationship between the CSAP and FSSP can not be determined.

Final Status Survey Design - Conclusion

NRC has reviewed the information in the Phase 1 DP for the WVDP and the Phase 1 FSSD according to NUREG-1757 Consolidated Decommissioning Guidance, Volume 2, Section 4.4 {Final Status Survey Design (FSSD}. Based on this review, NRC concludes that DOE's FSSD may be adequate, but may require clarification upon completion of the site characterization work. In addition, the technical approaches proposed by DOE in the survey plans will require clarification. NRC concurs with DOE that the CSAP results are critical to the finalization of the Facility Radiological Surveys, including the FSSP.

Comment: The CSAP and the survey plans are necessary to clarify the approach to the Facility Radiation Surveys and the technical bases. As stated above, NRC expects DOE to revise the survey plans following implementation of the CSAP. NRC will review these documents when they become available.

10.0 Summary

NRC has completed its review of the Phase 1 DP for the WVDP. The major conclusions based on the staff' evaluations of the Phased 1 DP are summarized below:

- No objections identified.
- Phase 1 DP provides sufficient information and acceptable analyses for NRC to determine if the applicable LTR decommissioning criteria have been met.
- Based on the information provided and independent staff analyses, NRC has determined that there is reasonable assurance that the proposed action will meet the decommissioning criteria.
- Phase 1 DP provides an acceptable approach for guiding decommissioning activities using the DCGLs presented.

- Comments have been identified for DOE to address during Phase 1 activities.
- Some comments request that DOE provide NRC with new information as it is collected or analyzed during phase 1 activities, such as monitoring data for potential re-contamination, or in-process survey data showing significant deviations from modeling assumptions, or changes to DCGLs.

- Other comments relate to information that needs to be developed and provided to NRC for review, such as detailed engineer barrier designs, CSAP, and FSSP.

References

CNWRA, 2008, Final Software Validation and Test Plan Channel-Hillside Integrated Landscape Development (CHILD) Version 2.3.0, Center for Nuclear Waste Regulatory Analysis, San Antonio, Texas, November 2008.

DOE, 20008a, "Phase 1 Decommissioning Plan for the West Valley Demonstration Project, Revision 0," Prepared by Washington Safety Management Solution, URS Washington Division, Science Applications International Corporation, December 3, 2008 (ML083659423).

DOE, 2008b, "Revised Draft Environmental Impact Statement for Decommissioning and/or Long-Term Stewardship at the West Valley Demonstration Project and Western New York Nuclear Service Center," DOE/EIS-0226-D (Revised), November 2008 located at www.westvalleyeis.com.

DOE, 2009a, "Phase 1 Decommissioning Plan for the West Valley Demonstration Project, Revision 1," Prepared by Washington Safety Management Solution, URS Washington Division, Science Applications International Corporation, March 16, 2009 (ML090771108).

DOE, 2009b, "Responses to the US Nuclear Regulatory Commission Request for Additional Information on the West Valley Demonstration Project Phase 1 Decommissioning Plan: Group 1 responses," August 13, 2009 (ML092360234).

DOE, 2009c, "Responses to the US Nuclear Regulatory Commission Request for Additional Information on the West Valley Demonstration Project Phase 1 Decommissioning Plan: Group 2," September 16, 2009 (ML092730062).

DOE, 2009d, "Updated Responses to the US Nuclear Regulatory Commission Request for Additional Information on the West Valley Demonstration Project Phase 1 Decommissioning Plan: 5C6, 5C7, 5C9, 5C10, 5C12, 5C15, 5C21," [Group 3 responses], November 5 2009 (ML093220869).

DOE, 2009e, "Phase 1 Decommissioning Plan for the West Valley Demonstration Project, Revision 2," Prepared by Washington Safety Management Solution, URS Washington Division, Science Applications International Corporation, December 18, 2009 (ML100040393).

DOE, 2009f, "Submission of the Phase 1 Final Status Survey Plan for the West Valley Demonstration Project for NRC Review," December 17, 2009 ML093560393.

DOE, 2010, “Final Environmental Impact Statement for Decommissioning and/or Long-Term Stewardship at the West Valley Demonstration Project and Western New York Nuclear Service Center,” DOE/EIS-0226, January 2010 located at www.westvalleyeis.com.

NRC 1997, “10 CFR Part 20, et al., Radiological Criteria for License Termination; Final Rule,” *Federal Register*, July 21, 1997, 62FR39057.

NRC 2000, Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), NUREG-1575, Revision 1. NRC, Washington, DC, August, 2000. (Also EPA 4-2-R-97-016, Revision 1, U.S. Environmental Protection Agency and DOE-EH-0624, Revision 1, DOE).

NRC, 2002, ”Decommissioning Criteria for the West Valley Demonstration Project (M-32) at the West Valley Site; Final Policy Statement”, February 1, 2002 (67 FR 5003).

NRC 2004, Regulatory Analysis Guidelines of the US Nuclear Regulatory Commission, NUREG/BR-0058, Revision 4, NRC, Washington, DC, September 2004.

NRC 2006, NUREG-1757, Consolidated Decommissioning Guidance, Volume 1, Revision 2. and Volume 2, Revision 1, U.S. Nuclear Regulatory Commission, Washington, D.C., September 2006.

NRC, 2009 “Request for Additional Information on Phase 1 Decommissioning Plan for the West Valley Demonstration Project, May 15, 2009 (ML091200456).

SAND99-2148, “Residual Radioactive Contamination from Decommissioning,” NUREG/CR-5512, Volume 3 - Parameter Analysis @ Draft Report for Comment (Beyeler, et al., 1999) (ML003726967).