**REQUESTS FOR ADDITIONAL INFORMATION**
**WVDP PHASE 1 DECOMMISSIONING PLAN**

## Executive Summary

**Comment ESC1 (Section ES, Page ES-14):** Piping is potentially a significant source of residual activity at the site (page ES-14 states one HLW transfer line may contain 0.4 Ci/ft), but the description of the contamination is limited.

**Basis:** The figures (such as Figure 2-3) in the Decommissioning Plan (DP) provide current and previous locations of radionuclides, but do not clearly show the locations, depths, and distributions of piping that will be removed as part of the Phase 1 DP. The description on page ES-8 identifies underground piping generally, but does not provide a complete description of the likely distribution and magnitude of activity, or how the piping inventory estimates were developed.

**Path Forward:** Provide a description of the locations, depths and distributions of piping as well as estimated radiological inventory associated with the piping.

## Chapter 1 Introduction

**Comment 1C1** (**Section 1.2, Page 1-3):** The DP briefly discusses the DEIS preferred alternative (phased decisionmaking). For Phase 2, additional studies and evaluations will be completed to support the selection of Phase 2 activities. The types of studies and evaluations to be completed are not provided in the Phase 1 DP because they are stated as being out of scope.

**Basis:** A cursory description of the studies and evaluations to be conducted during the ongoing assessment period should be provided to ensure the planned actions of Phase 1 are not likely to alter or limit the ability to complete the Phase 2 studies and evaluations.

**Path Forward:** Provide a brief description of the planned studies for Phase 2 in the introductory materials of the Phase 1 DP.

## Chapter 3 Facility Description

**Comment 3C1 (Section 3.7.7, Page 3-72):** Section 3.7.7 discusses numerical analysis techniques used to study groundwater flow and transport at the West Valley site. No additional information is provided regarding the results of this analysis and how the results are used in decommissioning planning.

**Basis:** Groundwater modeling and analysis is needed for the Department of Energy (DOE) to demonstrate its understanding of the evolution of groundwater contamination at the site as well as understand the future pathways of exposure to a potential receptor. Modeling and analysis can also assist DOE with assessing the potential cumulative impacts associated with release of contaminants from various source areas at the site.

**Path Forward:** Clarify the specific purpose and provide results for any numerical modeling conducted to investigate flow and transport at the site as described in Section 3.7.7 of the DP.

**Chapter 4 Radiological Status of Facility/Chapter 5 Dose Modeling/Chapter 9 Facility Radiation Surveys**

**Comment 4C1 (Sections 4.2.3, Page 4-28; 5.1.2, Page 5-4; and 5.2.1, Page 5-22; and Chapter 9):** Additional information should be provided regarding the process DOE plans to use to average soil concentrations obtained during the final status survey for comparison against Derived Concentration Guideline Levels (DCGLs). Surficial soil contamination is defined as the top 0.15 to 0.3 m of soil in NUREG 1757, "Consolidated Decommissioning Guidance," Vols. 1 and 2 (NRC, 2006). However, in determining the radiological status of the surface soil it was noted on Page 4-28 of the DP that the top 0.6 m of the soil column was used consistent with the depth of borings from a 1993 sampling program, while for the purposes of surface soil DCGLs calculations, a depth of contamination of 1 m was assumed.

Similarly, additional information is also needed if DOE plans to use surface soil DCGLs calculated assuming a thickness of 1 m to guide remediation of areas of the site where surface contamination may be significantly greater than 1 m or where existing groundwater contamination may be present.

**Basis:** Surface soil DCGLs were derived assuming a thickness of contamination of 1 m. While derivation of DCGLs assuming a 1 m thickness of contamination for those areas of the site where surface soils are contaminated less than 1 m is conservative, averaging concentrations from the final status survey over 1 m when the thickness of contamination is significantly less than 1 m may underestimate the risk. For example, for those radionuclides where the dose is dominated by the external pathway, the very top of the soil column contributes most significantly to dose. Therefore, the concentration in the upper soil column is most important to dose and should not be diluted over a larger thickness of partially clean soil.

Likewise, use of DCGLs for an assumed thickness of 1 m of contamination in those areas of the site where soils are contaminated over a larger thickness may underestimate the risk for other pathways. For example, for those radionuclides where the plant ingestion pathway or groundwater dependent pathways dominate the dose, the thickness of contamination may be an important parameter value. Comparison of surface soil DCGLs to contamination significantly thicker than 1 m could underestimate the potential risk. In general, DCGLs should be derived consistent with the depth of contamination to avoid significant over- or under-estimates of risk.

**Path Forward:** Sufficient information should be provided by DOE to determine the distribution (i.e., lateral and vertical extent) of contamination across the site and in saturated sediments to ensure that surface soil DCGLs are appropriately derived and used to demonstrate compliance with License Termination Rule (LTR) criteria. DOE should clarify how soil concentrations will be estimated and compared to surface soil DCGLs in the final status surveys to ensure that doses are not significantly underestimated. DOE should also indicate what criteria will be used to determine the applicability of surface soil DCGLs in Phase 1 should the DP be revised as indicated on Page 5-4 to support remediation of surface soil.

**Comment 4C2 (Section 4.0):** It is not clear that the extent of contamination potentially associated with previous releases in the area of the process building has been adequately characterized.

**Basis:** The process building rests on approximately 480 H-piles that were driven into the Lavery Till. The H-piles and other discrete features such as piping, utility conduits, and wells may have acted as discrete pathways for contamination of deep groundwater.

**Path Forward:** Provide a description of the areal and vertical extent of sampling for contamination that has been completed associated with the H-piles and other discrete engineered features relative to past major spills, leaks, or known large sources of activity.

**Chapter 5 Dose Modeling**

**Comment 5C1 (Section 5.3, Page 5-43):** DOE should indicate how its Phase 1 activities preserve all decommissioning options when a final decision is made on decommissioning the site.

**Basis:** DOE relies on a limited site-wide dose assessment to show that the cumulative dose from multiple sources will meet unrestricted release criteria. The limited site-wide dose assessment considers the situation where a receptor is able to get exposed from multiple media (e.g., surface, subsurface, and streambed contamination) due to the receptor's ability to move from a farm on the North Plateau to contaminated stream beds where one might be exposed from recreational activities. However, the limited site-wide dose assessment does not address the possibility that a receptor may be exposed from multiple sources at a single location. For example, a receptor may potentially be exposed at a receptor location outside the immediate footprint of Waste Management Area (WMA) 1 and 2, where the exposure to a resident farmer from WMA 1 and 2 sources is currently being evaluated in deriving subsurface soil DCGLs. At other downgradient locations on the North Plateau, the receptor will likely be exposed to multiple sources. The most obvious point of exposure from multiple sources would be in groundwater and surface water locations downgradient from North and South Plateau source areas where contaminants will ultimately seep or discharge. The combined dose assessment would then consider both the cumulative impacts of multiple receptor locations and the cumulative impacts of multiple source areas at a single receptor location in deriving DCGLs for a single source area.

**Path Forward:** DOE should provide information to demonstrate its understanding of how contaminants are released from source areas and are transported in the environment to downgradient exposure locations over the 1000 year compliance period. Using its current approach, DOE could calculate DCGLs for individual source areas that consider the cumulative impacts of multiple sources at downgradient receptor locations (e.g., attribute a portion of the dose standard at the downgradient receptor location to individual source areas) or demonstrate how DCGLs calculated at the source would bound the DCGLs calculated considering potential impacts at downgradient receptor locations using the aforementioned approach.

DOE could show how the current approach is adequate or bounding by providing quantitative evidence that: (i) Phase 1 source areas do not overlap in space and time with other sources of contamination; or (ii) their dose contributions are expected to be so small relative to the unrestricted dose standard, that it would not be practical to pursue additional clean-up of Phase 1 sources to ensure that unrestricted release is preserved as a decommissioning option at the end of Phase 2.

**Comment 5C2 (Section 5.2, Page 5-19):** DOE should provide additional information on the screening approach used to identify radionuclides to be considered in the DCGL calculations.

**Basis:** The list of eighteen radionuclides for which DCGLs were derived is based on a screening process. Additional risks from radionuclides that were "screened out" were not considered in the dose analysis. Sufficient information on the screening approach should be provided to allow a reviewer to evaluate the merits of the screening process to ensure that a sufficient portion of the site risk is not overlooked.

It is not clear that risk-significant activities of daughter products are not currently present in the environs at the West Valley site. These daughter products may have the most limiting DCGLs and their initial activity may need to be considered in the analysis.

**Path Forward:** Provide additional information on the screening process and calculations used to show that the residual risk from radionuclides not included in the list of eighteen is less than 1% (page 5-19). Provide a supporting basis for the assumption regarding the initial activity of daughter products that may dominate the DCGL calculations.

**Comment 5C3 (Section 5.2.1, Page 5-23 and 5-27):** The impact on the flow field of construction of permanent hydraulic barriers as part of Phase 1 activities should be considered in deriving DCGLs.

**Basis:** The results of the flow and transport modeling in Appendix D indicate that the hydraulic barriers will have a significant impact on the flow field (i.e., reduced natural flow downgradient of the barriers and diverted flow upgradient of the barriers); however, consideration of the presence of these hydraulic barriers was neglected when calculating the surface and subsurface DCGLs (see page 5-23 and 5-27).

Because the impact of the hydraulic barriers on the flow field was not considered, it is not clear that RESRAD calculations are consistent with the amount of clean water that may actually be pumped from the aquifer. Additionally, DOE did not consider how contaminated water from other source areas might be drawn to a well at the given pumping rates and assuming the presence of the hydraulic barriers (e.g., extraction of contaminated groundwater from other source areas or contamination from the bottom of the excavation in the Lavery Till). Application of the RESRAD conceptual model for surficially deposited materials without consideration of actual site conditions (e.g., flow field and multiple sources of contamination) could lead to a significant under-prediction of the risk from groundwater dependent pathways if greater dilution in clean water is assumed then what could actually be supported in the real system.

**Path Forward:** As indicated on page 5-41 of the DP, DOE should evaluate the impact of changes to the flow field (e.g., flow directions and productivity) during Phase 1 due to remedial activities. DOE should demonstrate that well bore dilution is not significantly overestimated with the parameter set selected in RESRAD in the surface and subsurface DCGL calculations in comparison to expected dilution in the real system given the presence of hydraulic barriers and other sources of contamination. DOE could use the three-dimensional STOMP model constructed for Appendix D analysis, to evaluate the impact of hydraulic barriers and other sources of contamination on the assumed dilution factors.

**Comment 5C4 (Section 5.2.1, Page 5-22):** A technical basis is needed to support the conclusion that the assumption of no erosion of the contaminated zone is conservative for the development of surface DCGLs.

**Basis:** Surface DCGLs are developed using RESRAD and setting the contaminated zone erosion rate to 0 m/yr. It is stated that this approach is conservative because it results in no depletion of the source through erosion. A technical basis for this conclusion, such as a quantitative analysis of exposure pathways and rates of exposure to different receptors, should be provided. Release from erosion processes and deposition and exposure to appropriate receptors should be compared against the current concentrations, exposure pathways, and uptake rates for the resident farmer — zero erosion calculation to demonstrate that the current approach is more limiting.

**Path Forward:** Provide a technical basis that the use of a resident farmer with no depletion of the source area results in more limiting surface DCGLs than those developed for erosion of the source. The basis should consider the impact of dilution during release and transport that would occur as a result of release from erosion. For example, Figure 2-7 shows the impact of dilution on operational surface water discharges further downstream on Buttermilk Creek. A full erosion analysis is not necessary, but a relative comparison of concentrations, exposure pathways, uptake rates, and exposure times should be provided.

**Comment 5C5 (Section 5.2.1, Page 5-28):** Acute dose to a well driller should be evaluated to demonstrate that DCGLs derived for the resident farmer are bounding.

**Basis:** A statement is made on page 5-28 of the DP that, based on the results of the acute worker scenario in the Draft Environmental Impact Statement (DEIS), the dose after 100 years would be insignificant (less than 1E-08 mrem/yr). The text goes on to state that the resident farmer dose would be much higher than the acute worker, but no specific details are provided. The DEIS evaluation includes an acute worker and chronic resident scenario. However, for both cases, the dose is assumed to be negligible (less than 1E-08 mrem/yr). Therefore, the statement that the resident farmer dose is significantly higher than the acute worker dose is not supported by the DEIS analysis, as the predicted doses for both cases are negligible and not reported. In fact, in the case of subsurface contamination at the bottom of the excavations, DOE expects the dose from an intrusion event to be much higher than predicted for a similar scenario evaluated for the North Plateau in the DEIS analysis (i.e., in the range 1 mrem/yr according to page 5-51), but it is not clear how this dose would compare to an acute worker for the DP analysis.

An important assumption in the DEIS analysis is that a cuttings pond would be used when drilling a cistern and that the depth of water in the pond would be 0.6 m (2 feet). As the pond would reduce the external exposure to an acute worker by a factor of approximately 75, this assumption should be fully supported, if relied on for the DP analysis.

**Path Forward:** A quantitative evaluation of acute worker dose should be performed with a representative parameter set to support the assumption that the worker dose is bounded by the chronic resident farmer dose. Parameter assumptions should be consistent with regional practices (e.g., use of a cuttings pond) and shielding factors reflective of the expected shielding for the radionuclides and gamma energies expected to be present at the site.

**Comment 5C6 (Section 5.1.4, Page 5-14):** DOE did not provide enough information to show that the subsurface DCGL calculations considering a cistern drilling scenario are bounding.

**Basis:** Subsurface DCGLs are calculated assuming a cistern is drilled throughout the thickness of the sand and gravel unit to the top of the Lavery Till.

DOE acknowledges that gully erosion could intrude upon the lagoon areas (see page 5-14). However, DOE did not provide quantitative support for its assumption that erosion from gully formation/advancement, or stream widening could intercept the WMA 2 source areas and produce greater exposures to an offsite or onsite receptor.

**Path Forward:** DOE should provide the results of a quantitative analysis that supports its assumption that the subsurface DCGLs calculated assuming a cistern driller scenario bound the potential impacts from erosion.

**Comment 5C7 (Section 5.2.1, Page 5-26):** The approach to developing subsurface DCGLs may not be limiting for all types of contamination sources found and scenarios expected at the WVDP. Two aspects should be more fully assessed: 1) the potential for groundwater contamination by buried sources; and 2) erosion of cover material thereby converting a subsurface source into a surface source and making an excavation scenario applicable.

**Basis:** The approach of using a scenario where a cistern well is installed and a resident is exposed to the contaminated cuttings may be limiting for some types and distributions of contamination, but may not be limiting for certain sources. For example, the old sewage plant drainage was significantly contaminated and covered with three feet of soil. While the old sewage plant drainage is not considered part of the scope of Phase 1 (see Figure 1-5), if contamination is located in a thin lens but in a hydrologically active or previously hydrologically active area to be remediated as part of Phase 1, the dilution and partitioning with soil afforded in the cistern disruption scenario may be larger and result in higher DCGLs than would be developed from exposure to contaminated groundwater or an excavation scenario that would become applicable if the cover was eroded.

**Path Forward:** Provide the technical basis that the approach to developing subsurface DCGLs is limiting when groundwater transport and erosion processes are considered. Part of the technical basis could be assurance that the subsurface DCGLs will exclusively be used to guide remediation of excavated areas in WMA 1 and 2, adequate characterization will be conducted to ensure any unremediated areas are not impacted, and that erosion is not expected to uncover residual WMA 1 and 2 contamination following remediation over the 1000 year compliance period. If erosion could lead to applicability of an excavation scenario within the 1000 year compliance period (i.e., if erosion could lead to depletion of the cover materials to a thickness of 3 m or less), then an excavation scenario should also be evaluated. Erosion processes may be limited to those that result in landform evolution consistent with the expected future land use scenario.

**Comment 5C8 (Section 5.2.1, Page 5-26):** A cistern development for water usage scenario is used to develop DCGLs for subsurface contamination. A scenario of drilling for natural gas should be more thoroughly considered or shown to not be as limiting as the cistern development scenario.

**Basis:** Natural gas development in areas that were previously not economical to exploit has increased dramatically in many areas of the United States, particularly in those areas with large shale deposits. Section 3.8.1 of the DP indicates that oil and gas development has occurred in Cattaraugus County in 2001, but does not provide multiple years of data to assess the rate of change for energy exploitation. Because the technology for installation of a natural gas well may differ materially from the cistern scenario, technical basis should be provided that the cistern scenario would be generally more limiting than disruption of the contamination from the recovery of natural gas or oil.

**Path Forward:** Provide the technical basis that the cistern scenario is more limiting for developing subsurface DCGLs than installation of oil or natural gas wells.

**Comment 5C9 (Section 5.2.1, Page 5-23):** DOE has not provided sufficient information to justify lack of consideration of subsurface contamination at the bottom of WMA 1 and 2 excavations when deriving subsurface soil DCGLs. Additional data collected on the extent of Lavery Till contamination as remediation proceeds may show greater extent of contamination than originally assumed, additional transport pathways not considered in the subsurface DCGL calculations (e.g., contamination of Lavery Till Sand or along H-piles in the Lavery Till), or greater accessibility of contamination at depth than what is expected.

**Basis:** DOE presented several qualitative arguments (page 5-41) to justify lack of consideration of subsurface contamination at depth after contaminated subsurface soils are excavated from WMA 1 and 2. While some of the qualitative arguments regarding the relative inaccessibility of contamination in the Lavery Till to a potential receptor are compelling, additional data and calculations are needed to fully support the arguments presented. Because only one scenario is evaluated in deriving subsurface DCGLs (i.e., construction of a cistern), this scenario must be demonstrably conservative when considering other scenarios that may be just as, or more, likely. The amount of contamination assumed to be brought to the surface from construction of a cistern is relatively small and dilute[1] and may not be limiting for those radionuclides where water-dependent pathways may dominate the dose (e.g., existing contamination present in the saturated zone may be drawn from a well leading to water-dependent exposure pathways).

Additional information may be needed to support the hydrogeological conceptual model for contamination assumed to be present underneath WMA 1 and 2 used to derive subsurface DCGLs. Previous geologic interpretations showed contamination of a significant portion of the Lavery Till and Lavery Till Sand underneath the Main Plant Process building that could lead to pathways of exposure not considered in the current analysis. DOE should indicate how it plans to manage the risk associated with significantly greater contamination levels at depth along H-piles or within the Lavery Till then were assumed in the DCGL calculations.

Additional calculations or modeling should be performed to support the assumption regarding the expected lower relative risk of residual contamination at depth versus the risk associated with contamination assumed to be brought to the surface due to a cistern drilling scenario. This would include a quantitative evaluation of the potential for Lavery Till contamination to be transported to the Kent Recessional Sequence (KRS). DOE should present information on the

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[1] Only one tenth of the soil column is assumed to be contaminated resulting from assumptions regarding the thickness of contamination in the Lavery Till at the bottom of the excavation and the amount of clean soil used to back-fill the excavation.

relative risk of the cistern versus a ground/surface water transport scenario. DOE should also quantitatively evaluate the impact of pumping and the presence of hydraulic barriers on the potential migration of contamination from the top of the Lavery Till to a well located in the sand and gravel unit and present the relative risks associated with a cistern versus groundwater well scenario.

DOE should clarify how the residual risk from contaminated soil located just below 1 m (e.g., on the sides of the excavations) is appropriately accounted for when comparing residual concentrations to subsurface DCGLs which assume the contamination is mixed with clean soil at a ratio of one to ten (i.e., dilution factor of ten). DOE indicates in a footnote on page 5-4 that contamination on the sides of the excavation up- and cross-gradient from the source area is not expected to be contaminated. This expectation should be confirmed in the field or enough data collected to evaluate the impact of contamination at intermediate depths on the dose calculations.

**Path Forward:** DOE could provide additional information such as borehole logs for those locations where the top of the Lavery Till was significantly lowered and the Lavery Till Sand eliminated underneath the process building in the vicinity of the source of the North Plateau groundwater plume. Additional cross-sections overlaying recent concentration data over reinterpreted geology underneath the process building would also provide additional confidence in the revised hydrogeological conceptual model.

DOE should provide additional details on how in-process or final status survey data will be collected at the bottom of excavations. A procedure should be in place to provide adequate assurance that the thickness of contamination at depth is less than assumed in the DCGL calculations and is present within the impermeable Lavery Till as assumed in the DCGL calculations. If the thickness of contamination is significantly greater than assumed and/or is present in more permeable sediments (e.g., Lavery Till Sand), then sufficient data should be collected to perform additional dose modeling to adequately assess risk. If DOE amends the DP to allow use of surrogate DCGLs to demonstrate compliance with LTR criteria at the bottom of the WMA 1 and 2 excavations, DOE should provide supporting information such as radioisotopic ratios within the Lavery Till used to derive the surrogate DCGLs. DOE should also indicate how it intends to update surrogate DCGLs based on collection of additional data obtained during in-process or final status surveys, if necessary.

As discussed in a preceding comment, it is recommended that DOE provide results of calculations or perform additional modeling (e.g., multi-dimensional groundwater modeling using STOMP) to show the impacts of (i) a pumping well, and (ii) hydraulic barriers on the flow field in the immediate vicinity of WMA 1 and 2 excavations and potential transport of contaminants from the Lavery Till to a the drinking water well located in the sand and gravel. DOE should also evaluate the potential risk associated with transport of contamination from the Lavery Till to the KRS or to surface water. This information could be used to provide additional support that the potential contributions from subsurface contamination to the overall risk from the site from other pathways of exposure (i.e., drilling scenario) are insignificant.

DOE should explain how contamination present on excavation sides will be remediated to ensure that unrestricted use criteria will be met.

**Comment 5C10 (Section 5.2.1, Page 5-27):** For certain pathways and radionuclides, the assumption that contamination is distributed over a larger area (e.g., 1000 $m^2$) rather than 100 $m^2$ would lead to more restrictive DCGLs. Sensitivity analyses currently do not evaluate the impact of area on the DCGL calculations.

**Basis:** For those radionuclides dominated by certain pathways (e.g., plant and water ingestion), the assumption regarding the area (and thickness) of contamination significantly impacts the DCGL calculations. On a footnote on page 5-26 of the DP, there is some discussion regarding use of a 1000 $m^2$ area of contamination rather than a 100 $m^2$ area of contamination; however, sensitivity analysis results do not address larger assumed areas of contamination. Assumptions regarding the distribution of contamination brought up from drilling a cistern should be further evaluated as the DCGL for many radionuclides would be more restrictive if a change in assumption regarding the area of contamination is made.

**Path Forward:** Suggest calculating DCGLs considering a 100 $m^2$ and larger areas (e.g., 1000 $m^2$) of contamination and use the more limiting DCGL for the list of 18 radionuclides evaluated or provide additional justification for why an assumed 100 $m^2$ area of contamination is reasonable.

**Comment 5C11 (Section 5.2.1, Page 5-28):** DOE has not provided adequate information on the conceptual model related to exposure of a potential receptor from stream bed contamination and the adequacy of the mathematical model, RESRAD, to represent this conceptual model.

**Basis:** Complex subsurface and surface water interactions are operable at the West Valley site (e.g., stream widening, gully formation, seasonal fluctuations in water-levels, flooding, groundwater seepage/discharge, and surface water runoff). However, the approach used to derive stream bed DCGLs through use of the RESRAD code, which is first and foremost a code that models leaching processes from surface soils to groundwater, considerably simplifies the more complex processes occurring in the real system. DOE has not addressed the limitations of the RESRAD code in modeling ground and surface water interactions or the more complex processes occurring in the real system. Key processes significantly impacting the dose calculations for stream beds should be identified and evaluated to ensure that the DCGLs appropriately bound the exposures to a potential receptor.

**Path Forward:** For the purposes of Phase 1 DCGL calculations, DOE should evaluate the adequacy of the adaptation of the conceptual model in RESRAD for calculation of stream bed DCGLs. DOE should clarify that the streambed DCGLs only consider *existing* contamination and that future release and transport to streambeds from upgradient sources is considered separately in a combined dose assessment, if DOE performs such a combined dose assessment to address NRC comments (see comment 5C1 above).

To guide final decisions on decontamination and decommissioning of the site, DOE should consider interactions between contaminated groundwater and surface water in estimating future risks including seepage/discharge concentrations from upgradient sources, and potential accumulation of residual contamination on stream beds from erosion, flooding, seasonal water fluctuations, and other processes.

**Comment 5C12 (Section 5.2.1, Page 5-29):** The streambed sediment DCGL development does not include the inhalation of airborne radioactivity from resuspended contaminated sediment because of the assumed moisture content and limited resuspension. However, this argument may not consider the dynamic aspects of sediment deposition, stream water levels, and soil moisture content.

**Basis:** In general, streambed sediments will have relatively high moisture content and would experience limited resuspension. However, mobilization of contaminants from source areas may increase during storm events and result in deposition of the contaminants in areas that are above the normal water levels, such as a flood plain. Moisture content of these environments will be very dynamic, ranging from saturated to quite dry depending on the frequency the location experiences high water.

**Path Forward:** Provide an evaluation of the importance of the inhalation pathway relative to the other pathways that have been included in the streambed sediment DCGL development. The evaluation should consider the natural inherent variability in deposition processes and sediment moisture contents.

**Comment 5C13 (Section 5.2.1, Page 5-31):** The assumed distribution of contamination for development of the streambed sediment DCGLs should be compared to observed contamination.

**Basis:** The contaminated zone of interest is located on the stream bed and is assumed to be three meters (10 feet) wide and 333 meters (1093 feet) long, with a total area of 1000 square meters (approximately ¼ acre). Figure 2-7 on page 2-38 shows how natural redistribution processes can result in contamination over a much broader area than would be expected based solely on the geometry of the stream channels. For remediation of onsite streams, a technical basis should be provided to support the assumption that the assumed extent of contamination is consistent with or more limiting than expected to result from observed redistribution processes.

**Path Forward:** Provide a comparison of the assumed size of the contaminated zone to the observed contamination of streambed sediment.

**Comment 5C14 (Section 5.2.1, Page 5-29; Appendix C, Section 1.0, Table C-1):** The data sources for transfer factors used for the game ingestion pathway were not provided.

**Basis:** It is not clear what values were used or the data source for transfer factors for uptake of radionuclides to venison in the streambed sediment DCGL development.

**Path Forward:** Provide the transfer factors for venison and the associated data sources in Table C-1.

**Comment 5C15 (Section 5.2.4):** DOE did not provide sufficient support that the selection of parameter values in the deterministic analysis is sufficiently conservative to demonstrate compliance with LTR criteria.

**Basis:** When performing deterministic analysis to demonstrate compliance with radiological criteria for license termination it is important to demonstrate that the selection of parameter values does not lead to a significant under-prediction of the potential risk to the average member of the critical group for a 1000 year compliance period. Due to the large number of radionuclides and limited characterization, it is difficult to select a global parameter set that is demonstrably conservative for the actual mix of radionuclides expected to remain at the site following remediation. For example, if water-dependent pathways dominate the dose, then distribution coefficients ($K_d$s) on the low end of the distribution (lower quartile) may be conservative. But, if water-independent pathways dominate the dose, then $K_d$s on the high end of the distribution (upper quartile) may be conservative. Several important parameter values were identified in the sensitivity analysis (e.g., distribution coefficients, various parameters/model affecting groundwater dilution, bioaccumulation factors); however, DOE did not evaluate the sensitivity of the results to all parameter values and it is not clear how DOE made changes to its selection of parameter values to ensure that the deterministic analysis is sufficiently conservative.

**Path Forward:** DOE should provide support that the selection of parameter values in the deterministic analysis does not significantly under-predict the potential risk associated with residual material remaining at the site following remediation. Using what limited characterization data is available, DOE should identify the key risk drivers and indicate how the parameter selection is conservative for these radionuclides. In the absence of sufficient information on radionuclide distributions, DOE should consider use of pathway- or radionuclide-dependent parameter sets that would tend to over-estimate rather than under-estimate the potential dose when considering the potential uncertainty associated with the dose calculations.

**Comment 5C16 (Section 5.2.4; Appendix C, Table C-2):** DOE did not provide sufficient support that the selection of parameter values in the deterministic analysis is sufficiently conservative to demonstrate compliance with LTR criteria. This specific comment is related to DOE's selection of $K_d$s.

**Basis:** On page C-2 of the DP, a statement is made that $K_d$ values were selected to represent the central tendency of the site-specific data or were based on specific soil strata characteristics, where available. When site-specific information is available, this information should be used to provide more realistic estimates of the potential risk. However, when site-specific information is not available or is uncertain, Appendix I of NRC decommissioning guidance, NUREG 1757, Vol. 2 (NRC, 2006), recommends conducting a sensitivity analysis to identify parameter values that have the most impact on dose and selecting conservative values for these parameter values to estimate dose (e.g., upper quartile of the distribution for those parameters positively correlated to dose).

With regard to the $K_d$s selected for the RESRAD analysis, it is not clear why Lavery Till $K_d$s are used for the contaminated zone in the subsurface DCGLs and for the sediment DCGLs (see Table C-2). While the contaminant is assumed to be bound to Lavery Till in the subsurface DCGL calculations, this material is assumed to be uniformly mixed with uncontaminated sand and gravel that is ten times the volume of the contaminated Lavery Till brought to the surface. Leaching would therefore occur primarily through the thickness of the sand gravel in the contaminated zone. Likewise, no basis is provided for the assumption that sediment sorptive properties are similar to the Lavery Till and depending on the radionuclide in question, this assumption may lead to a significant under-prediction in dose.

DOE's selection of Uranium $K_d$s is presented in Table C-2. The value used for the Lavery Till is 10 L/kg based on site-specific information, while the value assumed for sand and gravel is assumed to be 35 L/kg based on literature values. As the $K_d$s in the Lavery Till are generally higher than the $K_d$s assumed for the sand and gravel, it would appear that the sand gravel $K_d$s might be overestimated based on the site-specific values for the Lavery Till, if the values for the Lavery Till are fairly certain.

A footnote to Table C-2 indicates that the uncertainty in $K_d$s for progeny was not evaluated in the sensitivity analysis and RESRAD default values were used in all cases. As the risk from in-growth of daughter products in many cases dominates the risk from the parent radionuclides, the sensitivity of results to daughter product $K_d$s should be evaluated and uncertainty appropriately managed with parameter values that tend to over-estimate rather than under-estimate the potential dose in the deterministic analysis.

**Path Forward:** As $K_d$s for risk-significant radionuclides can have a large impact on dose, $K_d$s values should be selected that are expected to err on the side of over-predicting rather than under-predicting the potential dose in the deterministic analysis when site-specific information is not available, or is uncertain. Commensurate with the risk significance of the parameter values, DOE should provide a more comprehensive discussion on how the $K_d$s were conservatively selected from the expected uncertainty range and address the issues listed above. DCGL calculations are also expected to be complicated by the in-growth of progeny in decay chains. Impacts due to the selection of $K_d$s for daughter products were not studied but may also have a large impact on the DCGL calculations. Therefore, the uncertainty introduced by the selection of $K_d$s for daughter products should also be evaluated in the sensitivity analysis and managed with conservative assumptions.

**Comment 5C17 (Section 5.2.4; Appendix C, Table C-1):** DOE did not provide sufficient support that the selection of parameter values in the deterministic analysis is sufficiently conservative to demonstrate compliance with LTR criteria. This specific comment is related to DOE's selection of external gamma shielding factor.

**Basis:** On page 5-32 of the DP, a statement is made that in the absence of site-specific, semi site-specific, and scenario-specific data, the most likely values among default RESRAD parameters defined by a distribution would be used or, in their absence, mean values from NUREG/CR-6697. Appendix I of NRC decommissioning guidance, NUREG 1757, Vol. 2 (NRC, 2006), recommends conducting a sensitivity analysis to identify parameter values that have the most impact on dose and the selection of conservative parameter values to estimate dose.

A single deterministic value of 0.27 for the external gamma shielding factor was used for all radionuclides. It is not clear that this parameter value is sufficiently conservative for all gamma energies and for important radionuclides such as Cs-137 and U-238 daughters where the external dose pathway dominates the dose. For example, NUREG/CR-5512, "Residual Radioactive Contamination from Decommissioning," Vol. 3 - Draft Report for Comment (Beyeler, et al., 1999), reports shielding factors for various gamma energies and materials. All of the tabulated values for the external gamma shielding factor are greater than 0.27 at the gamma energy of 0.662 MeV representative of Ba-137m (daughter of Cs-137).

**Path Forward:** DOE should demonstrate that its selection of parameters does not significantly underestimate the potential risk from residual radioactivity remaining at the site. When appropriate, DOE should consider using radionuclide-specific parameter sets that consider the most important parameter values for individual radionuclides (e.g., external shielding factor for Cs-137) and select parameter values that are expected to over — rather than under — estimate the potential dose.

**Comment 5C18 (Section 5.2.4; Appendix C, Table C-1):** DOE did not provide sufficient support that the selection of parameter values in the deterministic analysis is sufficiently conservative to demonstrate compliance with LTR criteria. This specific comment is related to DOE's selection of pumping and irrigation rates.

**Basis:** Irrigation and pumping rates can have a significant impact on the expected risk associated with residual contamination remaining at the site following remediation. While higher pumping and irrigation rates would be more conservative for some radionuclides in certain situations, the assumed pumping and irrigation rates may not be conservative for other radionuclides. Therefore, the conservatism of the set of parameter values selected for the DCGL calculations becomes a function of the scenario and radionuclide being evaluated making it difficult to select a global parameter set that is demonstrably conservative for the entire site.

The pumping and irrigation rates selected by DOE are based on the support of various groundwater-dependent pathways including drinking water ingestion and animal and plant product ingestion (see Table C-1). As the subsurface DCGLs assume a contaminated area of 100 $m^2$ the impact of plant and animal pathways is substantially reduced given the much smaller contaminated area that is not expected to fully support these pathways (e.g., 1000 to 2000 $m^2$ is generally needed to support the large plant ingestion rates and 20,000 $m^2$ to support animal product ingestion rates). The drinking water ingestion rates may be the same for a family of four; however, the amount of irrigation water needed for a 100 $m^2$ garden could be substantially reduced. Thus, the pumping requirements for the subsurface DCGLs are expected to be much lower then those assumed for the surface DCGLs. Additionally, a resident scenario may be more limiting then a resident farmer scenario due to decreased water usage in the surface soil DCGL calculations. Lower pumping rates can lead to an increase in dose due to lower dilution factors (all other factors being equal) and in certain circumstances where water-dependent pathways dominate the dose, the DCGLs may be significantly reduced. DOE should also attempt to use site-specific irrigation rates or provide support for the value selected.

Evapotranspiration and runoff coefficients were selected to achieve an infiltration rate of 0.42 m/yr or 25% of the applied water according to Table C-1. No basis is provided for the targeted infiltration rate. Infiltration rates can significantly affect DCGL calculations.

**Path Forward:** DOE should demonstrate that its selection of parameters does not significantly underestimate the potential risk from residual radioactivity remaining at the site considering the potential uncertainty in the dose predictions. In the absence of sufficient characterization data to demonstrate that the DCGLs calculated err on the side of conservatism considering the actual mix of radionuclides expected to remain at the site following remediation, DOE should consider using a radionuclide-specific parameter set that considers the most important parameter values for individual radionuclides (e.g., pumping and irrigation rates for I-129) and select parameter values that tend to overestimate— rather than under — estimate the potential dose. DOE should justify its selection of pumping and irrigation rates for the surface and subsurface soil DCGL calculations and evaluate whether a resident scenario would be more limiting then a resident farmer scenario. DOE should justify its selection of parameter values to achieve the targeted infiltration rate of 0.42 m/yr and provide support that this infiltration rate does not lead to a significant under-estimate of risk for key radionuclides.

**Comment 5C19 (Section 5.2.1; Appendix C, Table C-1):** DOE should justify use of a contaminated plant fraction of -1 in RESRAD.

**Basis:** Use of a contaminated plant fraction of -1 effectively reduces the ingestion rates by one-half. Coupled with use of a contaminated area of 100 $m^2$, the ingestion rates are effectively reduced to 1/20th of their reported values. For many radionuclides dominated by the plant pathway, the DCGLs would be significantly reduced if a contaminated plant fraction of 1 and larger area of contamination is assumed.

**Path Forward:** DOE should use a contaminated plant fraction of 1 and adjust the plant ingestion rates, if necessary, to reflect the expected yield from a smaller area of contamination to ensure that the plant ingestion rates are not arbitrarily reduced by one-half[2] or provide support for the reduced plant ingestion rates. DOE is encouraged to use regional-specific plant ingestion rates, which may be significantly lower then the default values in RESRAD.

**Comment 5C20 (Section 5.2.1; Appendix C, Table C-1):** The impact of hydraulic barriers should be considered when selecting hydrologic parameters for use in RESRAD when deriving DCGLs.

**Basis:** Table C-1 in the DP indicates that the saturated hydraulic gradient is based on historical information. Appendix D modeling shows a flattening of the water table surface downgradient from the WMA slurry wall, which will lead to a lower hydraulic gradient across most of the North Plateau. Decreased flow could have a significant impact on the results of the DCGL calculations.

**Path Forward:** DOE should consider the impact of hydraulic barriers on the flow field when selecting parameter values for use in RESRAD or show how its selection of parameter values is reasonable or conservative.

**Comment 5 C21 (Section 5.2.4, Page 5-37):** The sensitivity analysis of the surface soil model indicated that decreasing the hydraulic conductivity increased the DCGL for I-129 due to increasing the travel time to the well. It is not clear why this result was obtained (see bullet on page 5-37).

**Basis:** I-129 is very long-lived, and therefore the travel time to the well should have little impact on the estimated DCGL instead of resulting in a 1873% change.

**Path Forward:** Provide additional technical basis that the observed change in I-129 DCGL is a result of travel time to the well, or clarify the underlying reason for the change.

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[2] NRC also commented on the assumption of the area of contamination for the subsurface DCGLs. If DOE changes their assumption regarding the size of the contaminated area, then the ingestion rates would change accordingly.

**Chapter 6 ALARA Analysis**

**Comment 6C1 (Section 6.2, Page 6-3):** Provide additional discussion of planned good-practice efforts for ALARA.

**Basis:** The NRC staff believes that ALARA analyses for decommissioning should involve two aspects. One is that all licensees should use typical good practice or good housekeeping efforts, such as floor and wall washing (for buildings that will remain) and removal of readily removable radioactivity in both buildings and soil areas. The second aspect is that in some cases, cost-benefit (quantitative) ALARA analyses should be performed. DOE has focused its ALARA analyses on the latter, and very little discussion is provided to address good practice efforts. In Section 6.2 of the DP, there is brief mention of broad concepts that somewhat relate to such good practices. But, information on actual practices that might be employed as part of the cleanup work has not been provided.

Both aspects are discussed in the NRC staff's guidance in Section 6 and Appendix N of NUREG-1757, Vol. 2 (NRC, 2006).

**Path Forward:** Provide a discussion of the good practice efforts for ALARA that DOE plans as part of its cleanup activities.

**Comment 6C2 (Section 6.3, Page 6-5):** Calculations of costs and benefits for ALARA analyses: Provide either an evaluation using zero discount rate or a sensitivity analysis of the discount rate for the present worth calculations for the value of future dose averted.

**Basis:** In Section 6.3 of the DP, DOE provides the cost-benefit ALARA analyses. In these analyses, DOE calculates the cost of the future doses averted over 1000 years, and applies a discount rate of three percent to calculate the present worth of the future doses. Based on the length of the compliance period (1000 years), the benefits and costs could span across population generations. Thus, the NRC staff is concerned that use of this discount rate essentially eliminates any value in doses averted in the later years of the compliance period.

The NRC staff guidance on use of discount rates is provided in NUREG-1757, Vol. 2, Section N.5 (NRC, 2006). That guidance refers to NUREG/BR-0058, Rev. 2, "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission." However, the most recent version of NUREG/BR-0058 is Rev. 4, dated September 2004. Section 4.3.5 of NUREG/BR-0058 (NRC, 2004) indicates that for certain regulatory actions, such as those involving decommissioning and waste disposal, special considerations arise when considering benefits and costs across generations. That section indicates that the analysis should be supplemented with an explicit discussion of intergenerational concerns. This could be done by performing the analysis based on costs and impacts at the time they are incurred, with no present worth conversion, or by performing a sensitivity analysis using lower discount rates.

**Path Forward:** If the cost-benefit ALARA analyses are retained, DOE should include some method for analyzing the intergenerational concerns, by including an analysis with no discounting or with a sensitivity analysis of the discount rate.

**Comment 6C3 (Section 6.2, Page 6-4; and Section 6.4, Page 6-10):** Provide reasons for why DOE has presented a simple, preliminary ALARA analysis in the DP and proposes an additional, complete ALARA analysis during Phase 1.

**Basis:** In Section 6 of the DP, DOE has presented a simple, preliminary ALARA analysis and proposes an additional, complete ALARA analysis during Phase 1. The discussion does not indicate that this two-step approach is consistent with NRC's guidance (2006). While the NRC believes that the two-step approach is consistent with NRC's guidance (2006), the text in the DP does not discuss this for the benefit of other readers of the DP.

**Path Forward:** Add a discussion that explains why the two-step approach is consistent with NRC's guidance (2006) and why it is a reasonable approach for the nature of Phase 1 decommissioning at this site. Also explain why a preliminary analysis is reasonable for the DP.

**Chapter 7 Planned Decommissioning Activities**

**Comment 7C1 (Section 7.3.8, Page 7-25; Section 7.4.3, Page 7-32):** Section 7.4.3 states that before soil excavation takes place groundwater extraction wells will be installed and placed in operation to dewater the excavation. Details of the dewatering design were not provided in the DP. It is also not clear in Section 7.4.3 how the planned hydraulic barriers will prevent infiltration of upgradient groundwater into the WMA 2 excavation or how excess water will be managed.

**Basis:** The total depth of the planned excavation for WMA 1 is approximately 13.5 m (45 ft), with more than half of the excavation below the water table. Groundwater will continue entering the excavation from below the sheet pile in the upgradient direction. Information on the amount of water to be pumped will help determine the number of wells and need of potential water treatment equipment/facility.

Additional details are also needed regarding the sequencing (e.g., Figure 7-15) of WMA 1 and 2 hydraulic barrier construction and excavations to ensure that contaminated groundwater does not infiltrate the WMA 2 excavation and that infiltrating groundwater is appropriately managed.

**Path Forward:** Based on the site-specific aquifer hydraulic data, planned excavation, and hydraulic barrier design details; provide an estimate or design of the proposed dewatering system, such as number of wells, and pumping capacity as well as an explanation on how the planned hydraulic barriers will prevent infiltration of upgradient groundwater into the WMA 2 excavation or how excess water will be managed.

**Comment 7C2 (Section 7.3.8, page 7-25 and 7-26):** It is not clear how excavated soil will be managed and if soil with residual radioactivity or clean soil will be returned to the excavation. Section 7.3.8, page 7-27, states that uncontaminated soil from similar offsite geologic deposits will be used as backfill.

**Basis:** This section discusses the use of cleanup goals for determining when sufficient soil has been removed from the excavation and that contaminated soil concentrations below cleanup goals will be removed where practical. It is not clear how soil removed from the excavations will be managed to ensure that fugitive dust emissions and airborne concentrations are maintained ALARA, and how the contaminated soil will be managed to prevent contamination of other land areas. There is also no discussion on the quality radiological survey methods to be employed to segregate clean soil from contaminated soil and ensure ALARA principles are maintained.

**Path Forward:** Provide a detailed plan on the management of excavated soils including the location of interim storage areas and environmental controls, and the radiological and associated quality programs for measuring the radioactivity in the soils for segregating non-contaminated soil and contaminated soil. If soil with residual radioactivity is to be returned to the excavation, assess the impact on the dose modeling and the final status survey design.

**Chapter 9 Facility Radiation Surveys**

**Comment 9C1 (Section 9.4, Page 9-8):** The plans, methodologies, and Data Quality Objectives (DQOs) to be used for characterization surveys are not completely defined.

**Basis:** A "Characterization Sample and Analysis Plan" is anticipated, but it has not yet been provided for NRC review. Chapter 9.0 of the DP indicates that. "[w]hile this section addresses all applicable requirements for facility radiation surveys, it does so in general terms because two supplemental documents would later be developed to provide additional details: a Characterization Sample and Analysis Plan and a Phase 1 Final Status Survey Plan (or multiple Phase 1 Final Status Survey Plans)." The Characterization Sample and Analysis Plan is referred to numerous times throughout the WVDP Phase 1 DP, and it appears that this plan will become an integral part of the characterization of site radiological conditions including current soil and sediment conditions in preparation for site excavation (Chapters 7.0 and 9.0). Additionally, DP Section 9.4.1 states that, "[a] key objective of [The Characterization Sample and Analysis Plan] would be to produce data for the Phase 1 final status survey of sufficient quality and quantity to serve final status survey purposes when practicable."

**Path Forward:** Considering the emphasis that has been placed on the Characterization Sample Analysis Plan and its usage as a basis for in-process and final status surveys, it is requested that this plan be submitted to the NRC in order to supplement the technical review of the WVDP Phase 1 Decommissioning Plan.

NUREG-1757, Vol. 2, Sections 2.3 and 4.2 (NRC, 2006) states that there is no requirement that the final status survey be performed at the end of the decommissioning process, but in order to use other surveys the data must be of sufficient quality and detail to meet the expectations for final status survey data. It is also important to ensure that non-impacted areas of the site have not been adversely affected by decommissioning activities.

Characterization DQOs are briefly outlined in the DP Section 9.4, but not applied, and it is noted that they will be detailed later in the Characterization and Sample and Analysis Plan. Further elaborate on how the quality control of measurements and samples will be maintained during characterization surveys. Describe the plans to ensure non-impacted and excavated areas will not be adversely affected during the decommissioning process. Provide the details of site characterization DQOs that will be consistent with those for final status surveys. NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)." (NRC, 2000) and NUREG-1757, Vol. 2, Sections 4.2 and 4.4, and Appendix D and E (NRC, 2006) may provide additional guidance on the planning required for characterization and final status surveys.

**Comment 9C2 (Section 9.5, Page 9-15):** It is not clear that the survey methodologies and instrumentation to be used in the in-process and remediation action support surveys are adequate to detect contamination sufficiently below the DCGLs under site specific conditions.

**Basis:** NUREG-1757, Vol. 1, Appendix D, Section XIV.c. (NRC, 2006) on in-process surveys requires, "[a] demonstration that field screening should be capable of detecting residual radioactivity at the DCGL." NUREG-1575 (NRC, 2000) specifies in Chapter 6 that "Scanning and direct measurement techniques should be capable of measuring levels below the established DCGLs – detection limits of 10-50% of the DCGL should be the target." NUREG-1575 (NRC, 2000) guidance also cautions that the sensitivities of detection limits given by service providers and instrument manufacturers are usually based on "ideal or optimistic situations and may not be achievable under site-specific measurement conditions." NUREG-1575 (NRC, 2000) additionally notes that cost, time, best available technology, or other constraints may create situations where the above stated sensitivities are deemed impractical. If it is anticipated that certain site conditions will not allow for detection sensitivities at 10-50% of the DCGL, then justification for the use of higher detection sensitivity should be provided in each situation.

**Path Forward:** Provide a demonstration that methodologies proposed are capable of detecting residual radioactivity sufficiently below the proposed DCGLs in the WVDP DP. This demonstration should be performed for each of the ten (10) major survey areas based on characterization data currently available with the goal of demonstrating the ability to accurately measure DCGLs under site-specific measurement conditions. The focus of the demonstration should be on determining the appropriate field instrumentation and detectors and survey methods. The demonstration and justification for the survey methods chosen should be based on the minimum detectable count and scanning rates, the use of surrogate nuclides for hard-to-detect nuclides, and how backgrounds will be determined and applied in the field. If laboratory soil analysis is required, report Lower Limits of Detection in the same units as the DCGLs. Provide the procedure, discussion, and justification for the survey methodology for determining how it will be demonstrated that sufficient soil has been removed and that there is no residual radioactivity at depth. NUREG-1757, Vol. 2, Section 4.3 and Appendix E (NRC, 2006) provide additional guidance on remediation action support surveys and in-process surveys.

**Comment 9C3 (Section 9.3, Page 9-8):** Provide a description and technical justification for how the soil background data will be applied to characterization, in-process and remediation action support surveys and final status surveys.

**Basis:** 10 CFR 20.1402, "Radiological Criteria for Unrestricted Use" states a site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from background radiation results in a total effective dose equivalent to an average member of the critical group that does not exceed 25 mrem (0.25 mSv) per year. Chapter 4 of the DP provides background concentrations for various environmental media and Chapter 9 discusses NRC guidance that may be followed.

**Path Forward:** Provide a technical justification for the application of the background radiation in the decommissioning survey process. The justification must address application to defining non-impacted and impacted areas and how background activity is used in survey measurements. NUREG-1757, Vol. 2, Appendix A (NRC, 2006), and NUREG-1575 (NRC,

2000) Sections 8.3 and 8.4 provide guidance on determining background, application in radiological surveys, and the statistical tests.

**Comment 9C4 (Section 9.6, Page 9-15):** Provide details for the Final Status Survey Design as required by the NUREG-1757, Vol. 1, Appendix D, Section XIV.d (NRC, 2006) checklist using the data determined in Comment 9C1-9C3 above.

**Basis:** NRC guidance in NUREG-1757, Vols. 1 and 2 (NRC, 2006) requires the development of a Final Status Survey Design.

**Path Forward:** Given the characterization data collected to date and the development of the Characterization Plan, In-process/Remediation Action Support Survey information demonstration, and determination how background concentrations will be applied, provide the details for the Final Status Survey Design for Phase 1 areas. NUREG-1757, Vol.2, Section 4.4 and Appendix E (NRC, 2006) and NUREG-1575 (NRC, 2000) provide additional guidance for Final Status Survey Design.

**Appendix D Engineered Barriers and Post Remediation Activities**

**Comment DC1 (Section 1.1, Page D-2):** Additional explanation is needed for the footnote regarding recontamination potential on page D-2 and to summarize the experience at West Valley with temporary interlocking sheet piling.

**Basis:** The footnote on page D-2 indicates that the recontamination potential for the WMA-1 excavation would be limited since groundwater flows northeast away from WMA-1. However, if the media is removed it will locally alter the water table prior to backfilling. The DP should also describe the experience with temporary interlocking sheet piling to provide confidence that the barriers can be effectively implemented to prevent recontamination.

**Path Forward:** Provide a more detailed discussion of the impact of the excavations on water flow patterns and summarize the experience with interlocking sheet piling.

**Comment DC2 (Appendix D):** One of the stated objectives of the two phase decommissioning process is to not limit potential Phase 2 decisions. The installation of hydraulic barriers for the WMA 1 excavation may impact future decisions.

**Basis:** Installation of hydraulic barrier walls will alter groundwater flow in the North Plateau. It appears that groundwater flow would be increased to the HLW tanks and decreased on the downgradient side of the engineered barriers. Increased groundwater flow to the HLW tanks may make it more difficult to close them in place, if that option were evaluated in Phase 2. Decreased flow in the non-source area of the Sr-90 plume may increase potential exposure concentrations as a result of decreased dilution (in future exposure evaluations) or reduce the effectiveness of remedial activities implemented as part of the interim action to reduce the risk from the site (e.g., permeable reactive wall).

**Path Forward:** Provide an assessment of the Phase 1 alteration of the hydrologic system on potential Phase 2 decisions, or provide a description of how those impacts could be mitigated.

**Comment DC3 (Appendix D):** Additional information is needed to support the assumption that the performance goals (e.g., hydraulic conductivity, mechanical strength or durability) of the slurry wall trenching technology and other engineered barriers are likely to be achieved.

**Basis:** The slurry wall technology is stated as having a long history of successful usage, however this usage is not summarized. An initial maximum design hydraulic conductivity of 6E-06 cm/s is provided, which is approximately 200 cm/yr. It is not clear at a moderately high conductivity for a hydraulic engineered barrier that the objectives of the barrier will be achieved. The DP states that the upper three feet of the barrier wall would be clean backfill to allow vehicular traffic over the wall without damaging it, however no basis is provided for this statement. The French drain system will contain perforated pipe and the trench will be backfilled with permeable granular materials. The DP states the French drain trench backfill will be designed to minimize silting, but no technical basis is provided on how it will be designed. In addition, the DP states the French drain will be monitored but includes no description of how the monitoring will be completed and what performance metrics will be used.

The durability of the engineered barriers projected to be used is discussed briefly on page D-8; however, a comparison of the required performance period to the experience base is not provided. The DP states that sodium bentonite would be added at a rate to achieve 1E-8 to 1E-6 cm/s hydraulic conductivity, but no information is provided as to how it will be determined that those hydraulic conductivity values have been achieved.

**Path Forward:** Provide additional technical basis to justify that the performance goals of the engineered barrier systems are likely to be achieved, including but not limited to: a summary of slurry wall technology usage including problems, a demonstration that a hydraulic conductivity of 6E-6 cm/s will achieve the design goals, an evaluation of barrier performance with three feet of backfill subject to vehicle loading, a description of the design and monitoring of the French drain system to minimize silting, a comparison of the required performance period to the experience base for the engineered barriers, and a description of how it will be determined that the design goal hydraulic conductivities and mechanical strength have been achieved in the field.

**Comment DC4 (Section 2.1, Page D-18):** Additional information is needed for the corrective action implementation program to address observed defects or irregularities in the engineered barrier systems.

**Basis:** Page D-11 indicates that corrective action would be implemented to correct observed defects and irregularities, without defining what conditions would constitute a defect or irregularity. Without an effective monitoring and maintenance program or robust designs, the engineered barriers may not be able to meet their performance requirements. Section 2.1.1 states that routine inspections would be performed of the subsurface barrier walls and French drain but does not state how these buried systems will be evaluated.

**Path Forward:** Provide the conditions that lead to corrective actions of the engineered barriers and detail how evaluations of buried systems will be performed.

**Comment DC5 (Section 2.1.4, Page D-19):** There appears to be missing text on page D-19. Also, there are two sections numbered 2.1.4.

**Basis:** Not applicable.

**Path Forward:** Provide the missing text.

**Comment DC6 (Section 2.0, Page D-18 and D-20):** The proposed groundwater monitoring system should include sufficient monitoring points to observe significant changes to hydrologic conditions in the vicinity of WMA 3 and the permanent hydraulic barrier wall. A specific monitoring schedule of water level was not provided for the piezometers located upgradient and downgradient of the permanent hydraulic barrier wall.

**Basis:** The proposed groundwater monitoring system in Figure D-10 on page D-20 does not provide for monitoring points extending from the western most point of the WMA 1 barrier wall. As indicated in a previous comment, changes to the hydrologic system from Phase 1 actions could impact or limit Phase 2 decisions. Groundwater monitoring is needed both pre- and post-installation of the barrier system at the end of the WMA1 barrier wall to ensure that the Phase 1 actions are not significantly impacting the HLW tanks. Increased water flow or a rising water table could also reduce or eliminate the effectiveness of the tank/vault drying, which could impact the ability to maintain it in a stable configuration until Phase 2 decisions and actions are completed. Measurement of water levels with adequate frequency from the upgradient and downgradient piezometers is essential to ensure the integrity of the hydraulic barrier.

**Path Forward:** Provide additional monitoring locations at the western end of the WMA 1 barrier wall both pre- and post-installation of the barrier, and specified monitoring schedules for the monitoring wells and piezometers.

**Comment DC7 (Section 1.3, Page D-8):** The DP does not provide adequate details with respect to the stability of the hydraulic barrier walls.

**Basis:** The DP does not provide adequate details to verify that the permanent hydraulic barrier wall will be sufficiently wide to provide the stability necessary to permit excavation close to the edge of the excavation, as stated in the DP. Stability of the barrier wall is needed to prevent recontamination of the excavation, and to ensure protection of workers during remediation.

**Path Forward:** Provide the design details and analysis to demonstrate that the hydraulic barrier walls will be stable during excavations prior to backfilling under reasonably foreseeable loadings and scenarios.

**Comment DC8 (Section 1.4, Page D-8):** The proposed hydraulic barrier walls in WMA 1 and WMA 2 may potentially impact the effectiveness of the two north plateau plume control measures, Ditch Permeable Reactive Barrier and a full-scale Permeable Treatment Wall (e.g., shown in Figure 5-4 on Page 5-11 and Figure D-10 on Page D-20).

**Basis:** As part of the Phase I DP two hydraulic barrier walls, along with a French drain, will be installed to prevent the remediated sources area from recontamination by the downgradient contaminated groundwater. These reactive barriers are supposed to be installed before Phase I of the proposed decommissioning begins. The diversion of groundwater through the French drain will potentially reduce groundwater flow, and then slow down the migration of Sr-90 plume in the north plateau. The hydraulic barriers also potentially result in slower groundwater flow into the permeable reactive barriers, and the amount of dissolved radionuclides as well.

**Path Forward:** The design of these permeable reactive barriers/walls should balance the overall objective of preventing recontamination with the hydraulic barriers and remediation with the downgradient permeable reactive barriers, by taking into account the potentially lower groundwater flow rate as a result of installation of two upgradient hydraulic barrier walls. Perform a quantitative analysis to optimize the designs.

**Comment DC9 (Section 1.4, Page D-8):** The proposed construction of hydraulic barriers at WMA 1 and WMA 2 may result in an increase of groundwater flow from WMA 1 into the Waste Tank Farm area (WMA 3), which could impact the current dewatering system.

**Basis:** As discussed in Section 1.4, "Engineered Barriers and Groundwater Flow" (page D-8), groundwater modeling indicates a higher flow from the source area toward the waste tank farm even with a French drain. In the Waste Tank Farm a dewatering system is currently operating to minimize in-leakage of groundwater into the tank vaults. Depending on the initial design, the dewatering system may or may not have the capacity to handle an increase in the amount of groundwater infiltrating the tanks/vaults.

**Path Forward:** Conduct an analysis to evaluate the potential implications of increased groundwater flow towards the waste tank farm and ability of the tank and vault drying system to maintain the waste tanks/vaults in a safe configuration during the ongoing assessment period.

**REFERENCES**

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

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).

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