DOCUMENT RELEASE AND CHANGE FORM

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☐ Abstract ☐ Journal Article ☐ Summary
☐ Internet ☐ Visual Aid ☐ Software
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Author: McMahon, Bill

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Other: ORP SME	☒	☐	Blackwell, Becky	Approved - IDMS data file att.
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Comments Required for WRPS-Indicate Purpose of Document:

This plan describes the activities to be performed to maintain the performance assessment for Waste Management Area C at the Hanford Site (RPP-ENV-58782, Performance Assessment of Waste Management Area C, Hanford Site, Richland, Washington) in Washington State.

APPROVED
By Sarah Harrison at 6:43 am, Apr 05, 2023

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Waste Management Area C Performance Assessment Maintenance Plan

Prepared by

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Date
March 2023

Prepared for the U.S. Department of Energy
Office of River Protection

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Version History

Version	Date	Author	Change Description
Draft A	March 09, 2017	William J. McMahon	Initial Draft for DOE-ORP Review
Draft B	January 28, 2021	S. Mehta et al.	Updated for DOE-ORP review and comment
Rev. 0	December 15, 2022	S. Mehta et al.	Initial revision for DOE-ORP clearance and public release

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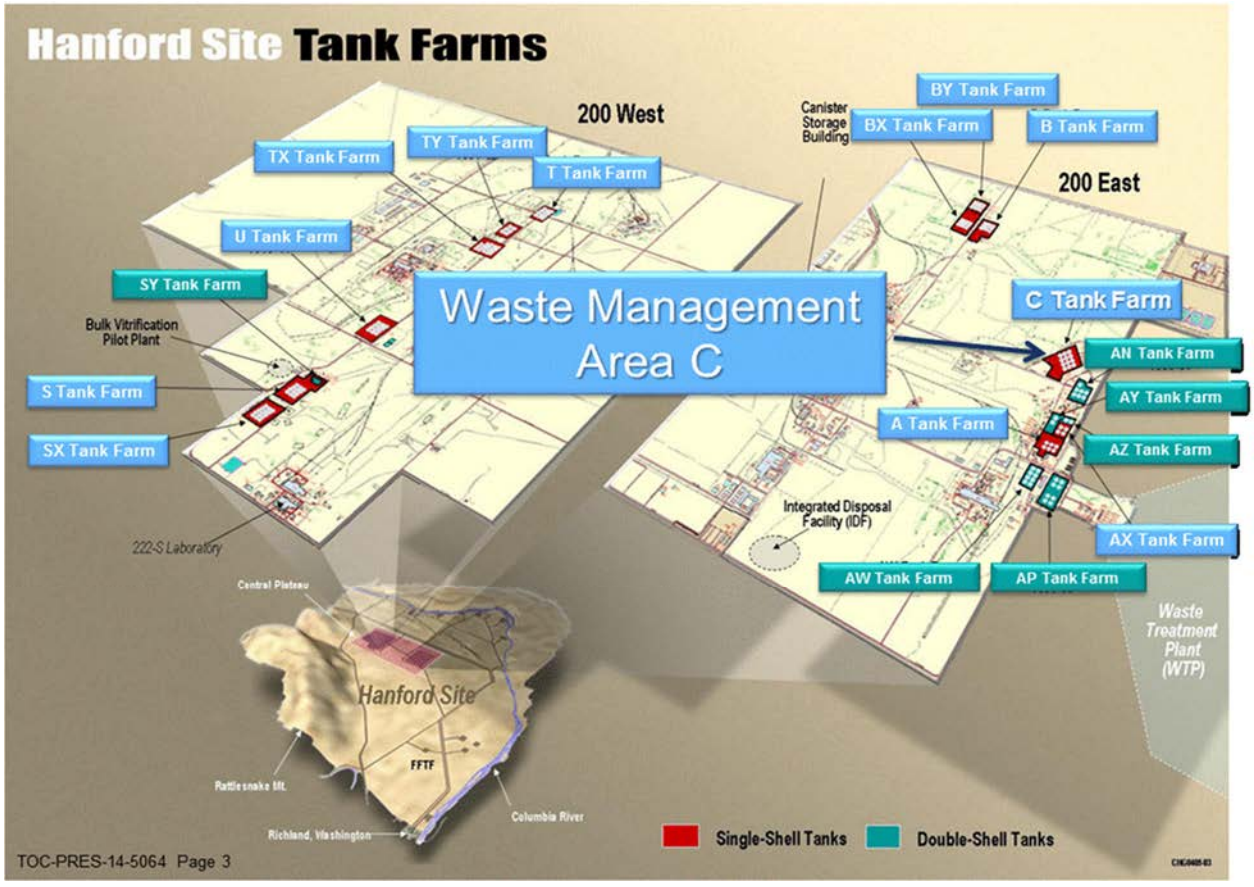
Acronym or Abbreviation	
244-CR vault	244-CR Process Tank Vault
ASTM	American Society for Testing and Materials
CA	composite analysis
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CFR	*Code of Federal Regulations*
DOE	U.S. Department of Energy
DOE-HQ	U.S. Department of Energy, Headquarters
DOE-ORP	U.S. Department of Energy, Office of River Protection
Ecology	State of Washington Department of Ecology
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
FFTF	Fast Flux Test Facility
K_d	distribution coefficient
LFRG	Low-Level Waste Disposal Facility Federal Review Group
NRC	U.S. Nuclear Regulatory Commission
PA	performance assessment
R&D	research and development
RAI	request for additional information
RCRA	*Resource Conservation and Recovery Act of 1976*
SST	single-shell tank
UWMQ	Unreviewed Waste Management Question

WAC	*Washington Administrative Code*
WIR	waste incidental to reprocessing
WMA	Waste Management Area

1.0 INTRODUCTION

DOE O 435.1, *Radioactive Waste Management* and DOE M 435.1-1, *Radioactive Waste Management Manual* require that performance assessments (PAs) for landfill closure of facilities containing low-level waste be prepared and maintained by the U.S. Department of Energy (DOE) field offices. This plan describes the activities to be performed to maintain the PA for Waste Management Area (WMA) C at the Hanford Site (RPP-ENV-58782, *Performance Assessment of Waste Management Area C, Hanford Site, Richland, Washington*) in Washington State (Figure 1-1). The plan is based on DOE O 435.1; DOE M 435.1-1; DOE G 435.1-1 *Implementation Guide for Use with DOE M 435.1-1, Radioactive Waste Management Manual*; and the Guidance for preparation of PA maintenance plans provided in DOE-STD-5002-2017, *DOE Standard Disposal Authorization Statement and Tank Closure Documentation*. This maintenance plan follows the general outline and content guidelines provided in Chapter 7, PA/CA Maintenance Plan Guide of DOE-STD-5002-2017. The plan is intended to satisfy specific criteria in DOE-STD-5002-2017, Table 7-3, Maintenance Plan Review Criteria (reproduced in Appendix A of this plan).

Figure 1-1. Location of Waste Management Area C on the Hanford Site.



FFTF = Fast Flux Test Facility

Reference: TOC-PRES-14-5064-VA, "Waste Management Area C Performance Assessment (PA) Current Status."

The DOE Low-Level Waste Disposal Facility Federal Review Group (LFRG), through issuance of a memorandum dated August 29, 2016 ("Performance Assessment of Waste Management Area C at the Hanford Site, Richland, Washington" [DOE 2016]), authorized the DOE Office of River Protection (DOE-ORP) to formally transmit the PA to the U.S. Nuclear Regulatory Commission (NRC) for consultation, and to the U.S. Environmental Protection Agency (EPA), the State of Washington Department of Ecology (Ecology), and the public for review. The only remaining secondary issue identified in the memorandum involves the inclusion of studies of concrete relevant to tank structure degradation after closure in the WMA C PA maintenance plan.

The intent of the PA maintenance plan is to provide a means to maintain confidence that the continued use of the results of the WMA C PA analyses remain applicable to the long-term plans for public and environmental protection. Any future changes in the landfill closure operations or onsite policy or strategy and any consequent changes in tank farm facility controls are to be managed by the PA maintenance plan. The maintenance plan should also include activities to resolve any secondary issues identified during the PA review process that are identified in the memorandum authorizing transmittal of the PA to EPA, Ecology, and the public. The ultimate goal of the maintenance plan is to ensure that facility closure is and remains protective of the public.

Maintenance of the WMA C PA is an iterative process that consists of the following four essential activities:

- Compliance and performance monitoring
- Research and development (R&D) activities
- Periodic reviews for evaluating new information
- Revision of the PA to incorporate necessary changes identified through monitoring, R&D, or periodic reviews.

The maintenance process consists of performing annual reviews and submitting annual summary reports to DOE Headquarters (DOE-HQ). The annual reviews for the PAs include consideration of new or updated waste inventory information, facility-specific conditions as they evolve prior to and at closure, results of monitoring, and results of R&D activities. A revision of the PA may be required based on the assessment of any significant changes identified to the input parameters or conceptual model or assumptions (of the original PA) through annual monitoring, R&D, evaluations conducted as part of the Unreviewed Waste Management Question (UWMQ) process, or periodic reviews that may involve evaluating new data or information.

1.1 BACKGROUND

Waste Management Area C (WMA C or the 241-C Tank Farm [C Farm]), part of the single-shell tank (SST) system, is located in the Central Plateau (see Figure 1-1), near the eastern edge of the 200 East Area. One of the first tank farms built, it was constructed in 1944 and 1945.

The WMA C facility contains twelve 100-series tanks and four 200-series tanks (see Figure 1-2). The 100-series tanks are 23 m (75 ft) in diameter, with a maximum 5-m (16-ft) depth and 2,006,000-L (530,000-gal) design capacity. The 200-series tanks are 6 m (20 ft) in diameter with a maximum 7-m (24-ft) depth and 208,000-L (55,000-gal) design capacity. The SSTs were constructed in place with 0.95-cm (0.375-in.)-thick carbon steel (ASTM A283 Grade C) lining the bottom and 0.64-cm (0.25-in.)-thick carbon steel lining the sides of a reinforced-concrete shell. The tanks sit below grade with at least 2 m (7 ft) of soil cover to provide shielding from radiation exposure to operating personnel. Tank pits are located on top of the tanks and provide access to the tanks, pumps, and associated monitoring equipment.

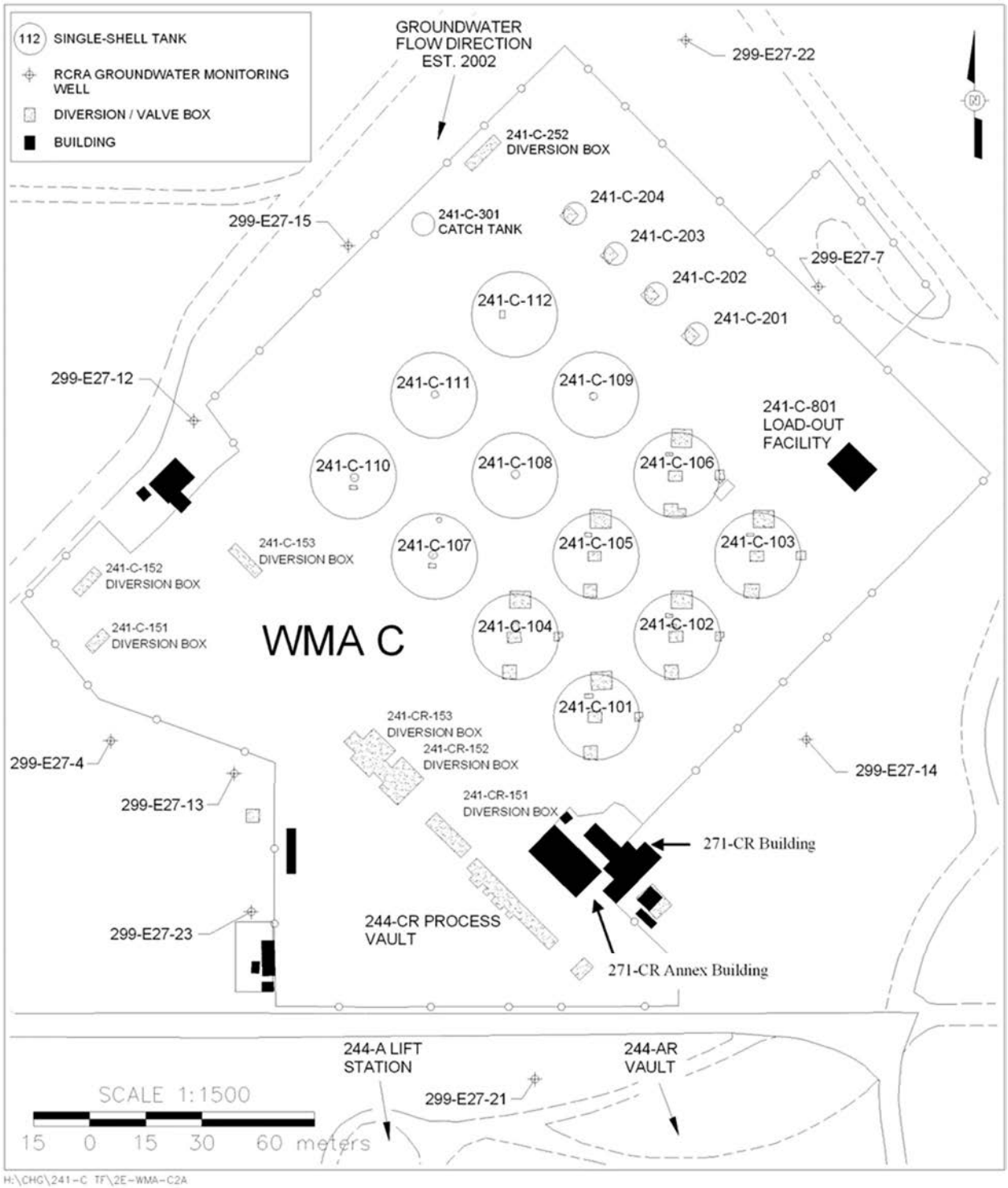
A complex waste transfer system of pipelines (transfer lines), diversion boxes, vaults, valve pits, and other miscellaneous structures was used to support the transfer and storage of waste within WMA C SSTs. These miscellaneous features of the tank farm are referred to in this document by the general term “ancillary equipment and components.”

The 244-CR Process Tank Vault (244-CR vault) is located south of the tanks. The vault is a two-level, multi-cell, reinforced-concrete structure constructed below grade, which contains four underground tanks along with overhead piping and equipment. Two tanks (TK-CR-001 and TK-CR-011) have a capacity of 170,343 L (45,000 gal) each. The other two tanks (TK-CR-002 and TK-CR-003) have capacities of 55,645 L (14,700 gal) each. These sets of ancillary equipment and components are included in the PA.

The WMA C PA calculates the long-term impacts to the environment from residual radionuclide inventory left within the tanks and ancillary equipment following closure. Under the closure configuration, the tanks will be filled with grout and a closure cap (Modified *Resource Conservation and Recovery Act of 1976* [RCRA] Subtitle C Barrier) will be emplaced over the tank farm. For long-term performance, the grout provides several benefits: it provides structural stability to the tank, it chemically conditions the interior of the tanks to a high pH environment, it provides a low-permeability layer to limit contact of water with the residual wastes, and it provides a barrier to potential inadvertent human intrusion. The specific formulation of the grout has not yet been established but is expected to be similar to the cold-cap grout formulation developed by the U.S. Army Corps of Engineers for the Hanford Grout Vault Program. This formulation has low-hydration heat and is free-flowing, self-leveling, and designed to generate little or no free water during curing.

The WMA C PA does not evaluate impact to the environment from existing contamination in the subsurface as a result of past leaks and unplanned releases resulting from tank farm operations prior to the closure date.

Figure 1-2. Location Map of Waste Management Area C and Surrounding Area.



RCRA = Resource *Conservation and Recovery Act of 1976* WMA = Waste Management Area

2.0 KEY ASSUMPTIONS

The discussion of key assumptions must be undertaken with the results of the PA clearly in mind. The WMA C PA has been structured to evaluate the behavior of the closed tank farm under a variety of potential future conditions. An analysis case has been defined in which the safety functions evolve in a nominal manner without unusual behavior or unanticipated disruption: this is termed the "base case." The nominal assumptions are a blend of assumptions representing the expected behavior of the safety functions, and several that have a conservative bias. The base case is the main analysis used to compare against the performance objectives but is not the sole analysis for such comparisons. In addition, a set of deterministic sensitivity analyses have been conducted that show the effects when the safety functions are degraded compared to their expected behavior as defined in the base case. In addition to these deterministic analyses of the effect of the safety functions, a probabilistic analysis of the base case was conducted in the PA to show the effects of parameter uncertainty on the performance of the system. For all of the sensitivity analyses and uncertainty analyses evaluated, the disposal system met the performance objectives.

Given these results, "key assumptions" in this report refer to those that make large relative changes to the PA results. It does not imply that they are key assumptions to meeting performance objectives. In this context, the characteristics of WMA C that strongly affect radionuclide release and transport through the vadose zone and into the unconfined aquifer are its location, the engineered features of the facility and its closure status, and the nature of the residual waste left in tanks and ancillary equipment at closure.

- In the original version of the WMA C PA (RPP-ENV-58782, *Performance Assessment of Waste Management Area C, Hanford Site, Washington*, Rev. 0), the evaluation of radiological impacts from residual wastes left in tanks and ancillary equipment left in WMA C after closure was based on an assumption of a facility closure date of 2020, consistent with planning assumptions in DOE/EIS-0391, *Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington* and the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1989) at the time. This assumption is no longer appropriate, and consequently, revised assumptions concerning the treatment of assumed institutional control for the intrusion assessment, reflective of guidance provided in DOE-0431, *Recommendations for Institutional Control Time Period for Conducting DOE Order 435.1 Performance Assessments at the Hanford Site,* was developed and implemented in Revision 1 of RPP-ENV-58782.

In general, results of the PA for the groundwater pathway[1] and the air pathway[2] are not significantly affected by these kinds of assumptions about site closure timing. However, results of inadvertent intrusion analyses can be significantly affected if alternative timing of closure and site access are assumed. In particular, delays in site closure and facility access can significantly reduce the potential impacts from inadvertent intrusion into residual wastes remaining in shallow ancillary equipment, including waste left in waste transfer pipelines. Since the key dose contributors from intrusion into waste transfer pipelines are short-lived ^{137}Cs and ^{90}Sr, estimated doses for selected acute and chronic intrusion exposure scenarios are strongly dependent on the assumed closure date.

For an isolated low-level waste disposal site, use of facility closure date provides a reasonable basis for the start of the 100-year period of institutional control used in the analysis. However, for a site such as Hanford with hundreds of waste facilities in close proximity to WMA C in the 200 East Area of the Central Plateau, the use of a Hanford Site closure date provides a more reasonable basis for an assumed end of institutional control.

DOE-0431 provides guidance on using a consistent year along with sensitivity analyses for the end of the institutional control period for inadvertent intrusion analyses across all PAs at Hanford based on existing *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) and RCRA decision documents requiring institutional controls as part of the selected remedy.

DOE-0431 recommends that identified end of institutional controls in DOE/RL-2001-41, *Sitewide Institutional Controls Plan for Hanford CERCLA Response Actions and RCRA Corrective Actions*; *Record of Decision Hanford 100 Area Superfund Site for 100-FR-1, 100-FR-2, 100-FR-3, 100-IU-2, and 100-IU-6 Operable Units* (EPA 2014); *Record of Decision Hanford 200 Area 200-ZP-1 Superfund Site Benton County Washington* (EPA 2008); and *Record of Decision Hanford 100 Area Superfund Site 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units* (EPA 2018) provide the basis for the removal of institutional controls for the low-level waste disposal facilities PAs at Hanford. Year 2278, which is indicated in EPA (2014), represents the longest period of institutional controls in DOE/RL-2001-41. Therefore, DOE-0431 recommends

[1] Groundwater and all-pathways dose results from the original PA developed based on an assumed WMA C closure date of 2020 yielded a peak dose of ~0.1 mrem/yr about 1,500 years after closure. This peak dose was largely the result of the diffusive release of estimated technetium-99 inventory from grouted tanks at WMA C. Delays in the actual closure date of WMA C by 10 to 50 years (compared to the assumed closure date of 2020 in the original PA) are unlikely to impact the groundwater and all-pathways dose results in any meaningful way.

[1] Air pathway dose results from the original PA developed based on an assumed WMA C closure date of 2020 yielded a very low peak dose of $\sim 4 \times 10^{-3}$ mrem/yr during the assumed 100-year period of institutional control after this closure date. The dose was pessimistically calculated to a member of the public located 100 m from the boundary of the waste, which cannot occur during the institutional control period. Doses to the public at the nearest Hanford boundary during the institutional control period are negligible. The calculated dose was largely the result of the release of the estimated tritium inventory of ~6.8 Ci (decay corrected to January 1, 2020). Delays in the actual closure date of WMA C by 10 to 50 years would only be expected to further reduce these already negligible doses attributed to the air pathway.

that the impacts from inadvertent intrusion for the ongoing PAs be evaluated after calendar year 2278.

The Central Plateau has been designated Industrial-Exclusive for the indefinite future, based on several Records of Decision [64 FR 61615, "Record of Decision: Hanford Comprehensive Land-Use Plan Environmental Impact Statement (HCP EIS)"; 73 FR 55824, "Amended Record of Decision for the Hanford Comprehensive Land-Use Plan Environmental Impact Statement"]. This area, which includes the 200 East and 200 West Areas, includes WMA C. There is no stated intention to release the Central Plateau from this designation or from DOE control at any time in the future. Despite this designation, it is assumed in this analysis that institutional control and societal memory of the disposal activities are lost at the end of the institutional control time period. This assumption is necessary to allow future hypothetical individuals to come onto the Central Plateau and engage in activities that might result in exposure.

- In the base case, the land use and land cover, including the barrier, remain shrub steppe indefinitely after closure. Alternative infiltration rates in the future are included in alternative analysis cases, which are intended to address a variety of potential future conditions, including progression to different land uses and land covers.

- The engineered cover for WMA C is not yet designed but is assumed to be similar to the Modified RCRA Subtitle C Barrier that limits infiltration through the waste primarily by evapotranspiration processes (i.e., surface barrier) based on the work done for the Hanford Prototype barrier (DOE/ORP-2008-01, *RCRA Facility Investigation Report for Hanford Single-Shell Tank Waste Management Areas*, Appendix C). These processes are not modeled directly for this report, but those processes have been studied through field measurements, tracer studies, and numerical models to estimate net infiltration (PNNL-14744, *Recharge Data Package for the 2005 Integrated Disposal Facility Performance Assessment*; PNNL-14960, *200-BP-1 Prototype Hanford Barrier Annual Monitoring Report for Fiscal Year 2004*; "Multiple-Year Water Balance of Soil Covers in a Semiarid Setting" [Fayer and Gee 2006]). Instead, the recommended net infiltration rates from those reports are applied to the area under the engineered cover and are varied spatially and temporally as appropriate according to the estimated or assumed time-dependent performance of a surface barrier.

- The design life of the cover is assumed to be 500 years in the base case, following which the infiltration through the cover is assumed to return to the site-wide average infiltration rate for undisturbed soil. Alternative infiltration rates in the future are included in alternative analysis cases, which are intended to address a variety of potential future conditions, including progression to different land uses and land covers.

- It is assumed that the tanks will be filled with grout according to the basic assumptions outlined for landfill closure in DOE/EIS-0391. The specific formulation of the grout has not yet been established, but it is assumed that the fill material for the tanks will be similar to the cold-cap grout formulation developed by the U.S. Army Corps of Engineers for the Hanford Grout Vault Program. This type of grout is assumed to behave

chemically like ordinary cementitious material. It has been assumed that the grout formulation does not provide any specific or unusual chemical conditions, such as reducing conditions.

- Transport of contamination from the tanks is assumed to be primarily controlled by diffusion from the grouted tanks through the base mat below the tank, while releases from ancillary equipment (including pipelines) are primary dominated by advection. Alternative assumptions are included as sensitivity cases that evaluate the consequences of hydraulic failure (i.e., fracturing) of the grouted tanks and base mat.

- The specific formulation of the grout has not yet been established, and site-specific measurements of the chemical influence of the grout have not been performed. The chemical effect of the grout is represented by contaminant-specific distributions of distribution coefficients (K_d), which have been developed from international literature on sorption of radionuclides on cementitious materials. These values are generally consistent with or more conservative than comparable values used for the facility-specific grout at the Savannah River F and H tank farm PAs [WSRC-STI-2007-00369, *Hydraulic and Physical Properties of Tank Grouts and Base Mat Surrogate Concrete for FTF Closure* and WSRC-STI-2007-00607, *Chemical Degradation Assessment of Cementitious Materials for the HLW Tank Closure Project (U)*].

- Release from one WMA C solute source and migration are independent of other solute transport and source terms in the model.

- The post-retrieval inventory of contaminants in WMA C is assumed to be uniformly distributed throughout the waste residual volume. The residual volume in the tanks is assumed to be a uniform layer distributed at the bottom of the tanks. In pipelines and ancillary equipment, the residual waste is assumed to be distributed in a homogeneous layer across WMA C at the depth and area of the pipelines.

- Inventories of contaminants in retrieved tanks are based on post-retrieval sampling and measurements. It is assumed that the sampling results are representative of the entire waste residual. Inventories for tanks that have not yet completed retrieval use the best estimates of post-retrieval conditions available at this time.

- Each geologic unit within the vadose zone and saturated zone is assigned upscaled, effective hydraulic properties by assuming equivalent homogeneous media.

- Post-closure groundwater flow beneath WMA C is assumed to be northwest to southeast and parallel to the four tank arrays of 100-series tanks in WMA C. The justification for this assumption is found in RPP-RPT-46088, *Flow and Transport in the Natural System at Waste Management Area C*. Groundwater flow parameters have been derived from the Central Plateau groundwater model (CP-47631, *Model Package Report: Central Plateau Groundwater Model Version 6.3.3*).

- Distribution coefficients (K_ds) are used to represent sediment-contaminant chemical interaction that best represent plausible levels of reactivity. The K_d values are chosen assuming low-salt, near-neutral waste chemistry in the vadose and saturated zone. Justification for the selected parameter values is found in RPP-RPT-46088; PNNL-16663, *Geochemical Processes Data Package for the Vadose Zone in the Single-Shell Tank Waste Management Areas at the Hanford Site*; and PNNL-17154, *Geochemical Characterization Data Package for the Vadose Zone in the Single-Shell Tank Waste Management Areas at the Hanford Site*. In addition, uncertainties in K_d values have been assessed as part of the uncertainty analysis.

- The point of calculation used in the calculation of the groundwater concentrations corresponds to the location 100 m (328 ft) downgradient from the facility per DOE O 435.1. For the purpose of calculating groundwater concentrations for comparison with groundwater protection requirements, it is necessary to identify the peak location in space at which the concentration occurs. The approach for identifying the location of peak groundwater concentrations is described in Section 6.3.9.

- Age- and gender-weighted intake rates are generally developed for a Representative Person in accordance with the recommendations described in DOE-STD-1196-2011, *Derived Concentration Technical Standard*. The 95th percentile intake rates were obtained from EPA/600/R-090/052F, *Exposure Factors Handbook: 2011 Edition*, National Center for Environmental Assessment, based on available information. Even though mean intake rates were available, the 95th percentile values from the underlying distribution were chosen conservatively to maximize the likely exposure. Typically, the 95th percentile intake rates weighted by age and gender are calculated (Appendix P of RPP-ENV-58813, *Exposure Scenarios for Risk and Performance Assessments in Tank Farms at the Hanford Site, Washington*). The exceptions to this approach were the indoor inhalation rate (taken directly from a reference source) and the soil ingestion rates (where simple age weighting is performed for children and adults).

- The following assumptions are specific to inadvertent human intrusion.

  - The only credible intrusion event is a drilling event. Both depth of disposal and the existence of concrete and grout intrusion barriers limit credible intrusion scenarios.

  - Although results are provided for intrusion into individual SSTs, the most credible intrusion event is assumed to be into the ancillary equipment rather than a tank. This type of event is more credible than a tank intrusion, since the tank dome and grout form a substantial intruder protection barrier.

  - For the analysis of intrusion into the pipelines, the driller is assumed to penetrate a transfer line at the assumed end of institutional control of year 2278. The basis of this assumed end of institutional control is consistent with information provided in DOE/RL-2001-41 as described in Section 2.2 “Point of Assessment and Timing Assumptions” of the WMA C PA (RPP-ENV-58782). Sensitivity analyses have

investigated intrusion into a cascade line, which would release a larger inventory relative to other pipeline locations in WMA C.

- For the intrusion analysis for the 100- and 200-series tanks, the C-301 catch tank, and the 244-CR vault, the intruder is assumed to penetrate the tank dome, tank shell, grout, and residual waste at 500 years after a facility closure date of year 2070.

3.0 MONITORING

DOE M 435.1-1 requires the ongoing maintenance of the PA to evaluate changes that could affect the performance, design, and operating bases for the facility. The maintenance includes a series of activities that are performed on an annual basis. A determination of continued adequacy of the PA is required on an annual basis and includes consideration of the results of data collection and analysis from any research, field studies, and monitoring. The results of the annual review will be reported in the annual summary report. This section describes the activities required in support of the PA regardless of the status of future PA revisions.

3.1 MONITORING

The primary pathway of interest on the basis of the dose calculations in the PA is the groundwater for post-closure conditions at the WMA C. The planned PA monitoring prioritizes data collection associated with these pathways.

3.1.1 Requirements

Section IV.R (3) of the manual for DOE O 435.1 requires that a monitoring plan for the PA be prepared. The DOE-ORP field office shall use the results from WMA C monitoring activities to determine the adequacy of the PA results for continued use.

3.1.2 Status

Groundwater and air monitoring programs already exist to meet the Record of Decision (78 FR 75913, "Record of Decision: Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington") requirements pertinent to WMA C. RPP-PLAN-61305, *Performance Assessment Monitoring Plan for Waste Management Area C* will be used to verify that PA modeling assumptions and analyses conducted in the PA continue to comply with the performance objectives of DOE O 435.1. Results of the PA will also be used towards the design of a performance monitoring plan to verify that the facility is performing as projected in the PA. RPP-RPT-49701, *Waste Management Area C Closure – Conceptual Design Report* identifies air monitoring, groundwater monitoring, surface barrier monitoring, and vadose zone monitoring as requirements included in DOE/ORP-2003-05, *Environmental Impact Statement for Retrieval, Treatment, and Disposal of Tank Waste and Closure of Single-Shell Tanks at the Hanford Site, Richland, WA Tank System Closure and Facility D&D Data Package.* The plans most pertinent to PA monitoring consist of the following:

- RPP-PLAN-61305, *Performance Assessment Monitoring Plan for Waste Management Area C*

- DOE/RL-2009-77, *Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area C*

- RPP-ENV-56271-VOL1, *Technical Basis Document for Air Emissions, Compliance Summary for Air Emissions from TOC Facilities and Activities Volume 1: Radioactive Air Emissions*

- RPP-ENV-56271-VOL2, *Technical Basis Document for Air Emissions, Volume II: Non-Radioactive Air Emissions from TOC Facilities and Activities*.

The existing WMA C groundwater quality assurance plan (DOE/RL-2009-77) is a component within DOE/RL-89-12, *Hanford Site Ground Water Protection Management Plan*; DOE/RL-2002-59, *Hanford Site Groundwater Strategy Protection, Monitoring, and Remediation*; and PNNL-15176, *Fiscal Year 2005 Integrated Monitoring Plan for the Hanford Groundwater Performance Assessment Project*, which describes the overall monitoring of groundwater at the Hanford Site. The existing groundwater quality assurance plan establishes a groundwater monitoring program that (1) meets applicable or relevant and appropriate requirements associated with groundwater monitoring, (2) documents baseline groundwater conditions, (3) monitors those conditions for change, and (4) allows for modifications to groundwater sampling, if required.

RPP-ENV-56271-VOL1 and RPP-ENV-56271-VOL2 require air monitoring to detect potential migration of contaminants. Quantification of emissions, implementing control technology, and air monitoring have been identified as relevant and appropriate requirements for the conduct of operations at WMA C. The pertinent requirements are contained in Title 40, *Code of Federal Regulations*, Part 61, "National Emission Standards for Hazardous Air Pollutants" and *Washington Administrative Code* (WAC) 246-247, "Radiation Protection—Air Emissions." Continuous air monitoring for diffuse/fugitive radionuclide air emissions from WMA C occurs at two locations along the perimeter of WMA C.

Surface barrier monitoring includes surveillance of the cap for structural integrity, animal burrowing, soil erosion and deposition, and vegetation status (RPP-RPT-49701, Appendix G "Regulatory Framework"). Vadose zone monitoring includes measures to confirm that the surface barrier is performing as designed (RPP-RPT-49701, Appendix G). Specific monitoring plans for these activities have yet to be developed and the details of such a plan will depend on the final design of the surface barrier, which is still in development.

4.0 RESEARCH AND DEVELOPMENT

4.1 REQUIREMENTS

DOE M 435.1-1 requires that the PA maintenance include conduct of research and field studies to address uncertainties or data gaps in existing knowledge. The review will determine if data collected during monitoring or R&D activities support the closed facility performance postulated in the PA and will determine if the conceptual models are still reasonable representations of the closed tank farm facility.

4.2 STATUS

No changes in the currently-expected closure or environmental conditions, PA assumptions, or test data are expected. However, during reviews by LFRG and NRC, considerable attention was focused on several features of the PA. These comments indicate areas in which data support for the WMA C PA could be improved, and which may provide improved support for future PAs, but which are not key issues for WMA C. These areas of interest for data collection are as follows.

- Improved characterization of inventories in ancillary equipment. Currently in the PA, this inventory has been established by process knowledge, and treated in the PA in a bounding, conservative manner.

- Data on degradation of surface barrier and changes in infiltration rates both spatially and temporally. The rate of infiltration through the Modified RCRA Subtitle C Barrier as it degrades over time has not been studied at the scale of WMA C. Instead, conservative (and bounding) infiltration estimates are used as recharge boundary conditions in the fate and transport models.

- Data on degradation of cementitious systems in Hanford conditions. Currently, data and modeling have been used to support analyses of the rate of degradation of cementitious barriers, but these can be improved.

- Data on corrosion of the steel tank shells. Currently, the steel is assumed to provide no barrier to releases, which is likely a substantial conservatism for most of the tanks.

- Data on vadose zone flow parameters. Currently, site-specific information on hydraulic properties is lacking, leading to predictive uncertainty in terms of water velocity distribution, moisture content, and moisture-dependent anisotropy.

- Data on the unconfined aquifer system. The unconfined aquifer provides a significant safety function in the dilution of releases; however, site-specific long-duration pumping tests are lacking to estimate the saturated zone hydraulic conductivity.

It is emphasized that these data are not needed for closure authorization decisions for WMA C but are intended to address areas of interest to reviewers, and to improve the technical basis for future Hanford PAs.

4.3 PLAN

The PA results indicate that early dose contribution occurs from diffusive release of tritium through the air pathway; however, the most likely long-term environmental contamination process is through the groundwater pathway from leaching of radionuclides from the facility by water that infiltrated past the surface barrier. For these pathways, the radionuclide inventory, waste form release characteristics, and near-field transport behavior are the most important factors for which estimates could be enhanced by additional data collection. The hydrogeologic properties of the vadose zone and saturated zone are also of interest, but these parameters already have a reasonably substantive basis from a number of studies performed at Hanford and the parameter uncertainties are reasonably quantified.

4.3.1 Research and Development Activities

The following is a list of R&D activities that will be considered to address uncertainties or data gaps in existing knowledge.

- The engineered surface barrier for WMA C is not yet designed but is assumed to be similar to the Modified RCRA Subtitle C Barrier that limits infiltration through the waste primarily by evapotranspiration processes and perform approximately the same as the Hanford Prototype barrier (DOE/ORP-2008-01, Appendix C). R&D activities are proposed to compile information about surface barrier effectiveness, both measured and modeled, and model and evaluate alternatives of specific engineered surface cover systems that could be used at WMA C or other SST WMAs. This may include building a prototype over WMA C and monitoring the near-term and longer-term performance of the alternative prototype.

  Schedule: Prepare a technical report that compiles information relevant to surface barrier performance (e.g., DOE/RL-2016-37, *Prototype Hanford Barrier 1994 to 2015*) and evaluates existing models of surface barrier performance, with the intent to provide recommendations for additional evaluations specific to WMA C. Model and evaluate alternatives of specific engineered surface cover systems that could be used at WMA C or other SST WMAs in fiscal years 2021 through 2023, contingent upon receiving funding.

- The engineered interim surface barriers in place at the 241-T, 241-TX, 241-TY, 241-S and 241-SX Tank Farms divert precipitation from the tank farm surfaces and limit infiltration through the waste. WMA C may also receive an interim barrier because the final barrier may involve extension across to the A Complex group of single- and double-shell tank farms. R&D activities are proposed to continue monitoring and evaluating the effectiveness of the 241-T and 241-TY Tank Farms interim barriers at

reducing soil moisture beneath the barriers compared to the outside of the barrier footprint.

Schedule: Continue monitoring and data collection of the instrument nests measuring long-term changes to moisture content in the vadose zone that was initiated in fiscal years 2017 and 2018 beneath the interim covers constructed at the 241-T and 241-TY Tank Farms, contingent upon receiving funding. Continue monitoring and data collection of the instrument nests measuring long-term changes to moisture content in the vadose zone beneath the interim covers constructed at the 241-S, 241-SX and 241-TX Tank Farms, also contingent upon receiving funding.

- After closure, the reinforced concrete associated with the tank domes, walls, and base mat and the grout emplaced in the tank at closure will be exposed to a combination of physical and chemical processes. Some processes may be beneficial (for example, continuing hydration and self-sealing of cracks), while others may create deleterious changes, such as shrinkage and thermal cracking. Although the geochemical conditions at the Hanford Site are favorable to preventing grout and concrete degradation, there are potential chemical degradation mechanisms that under certain conditions could lead to degradation of concrete forming the tank wall and the tank infill grout material. The grout formulation intended for use at WMA C has not yet been developed, although certain general studies of grout properties and placement have been conducted (e.g., WSRC-TR-2005-00195, *Summary of Grout Development and Testing for Single Shell Tank Closure at Hanford* and WSRC-TR-2003-00556, *Grout Placement and Property Evaluation for Closing Hanford High-Level Waste Tanks – Scale-Up Testing*). A grout development and testing plan to address WMA C tank structural integrity and longevity (e.g., carbonation, volume expansion and cracking) will be developed with the intent to establish an experimentation plan for grout formulation and testing during later years.

  Schedule: Prepare a grout testing plan specific to WMA C in fiscal year 2022 that outlines the studies and experimentation planned for the out years, contingent upon receiving funding.

- The PA results rely on the long-term effectiveness of the grout and concrete construction at the base of the tanks to inhibit the migration of radionuclides from the tanks. The analysis approximates the release of the radionuclides in terms of leach rates determined from distribution coefficients (K_d values) and diffusion coefficients applicable to the various radionuclides and the combination of grout and concrete associated with tank base mat. Concrete cores of SSTs from the dome and sidewalls have been collected and analyzed for compressive strength and for chemical degradation, but no information is available for concrete in the base mat. A testing plan to address WMA C tank grout degradation as it pertains to radionuclide release, and in particular ^{99}Tc release (e.g., petrographic studies of the core to derive degradation rates, diffusion coefficients, and adsorption characteristics), will be developed with the intent to establish an experimentation plan for later years.

Schedule: Prepare a testing plan for the SST concrete cores in fiscal years 2022 and 2023 that outlines the petrographic studies and experimentation to derive degradation rates, diffusion coefficients, and adsorption characteristics planned for the out years, contingent upon receiving funding.

- Current PA flow and transport calculations for the vadose zone relied on estimates of hydraulic properties from vadose zone sediment samples collected from boreholes in the vicinity of the nearby Integrated Disposal Facility. While the vadose zone hydraulic properties used in the WMA C PA appear reasonable, the representativeness of these estimates from samples collected near the Integrated Disposal Facility to the hydraulic properties of vadose zone sediments collected at WMA C is an important topical area of further research and development in this PA maintenance effort. Hydraulic property evaluations of borehole samples collected in the immediate vicinity of WMA C would provide additional data and information to address this PA maintenance research and development need.

  Schedule: Core samples of hydrostratigraphic units within the vadose zone sediments will be opportunistically acquired during the drilling of new groundwater wells currently planned in fiscal years 2022 and 2023 for the WMA C RCRA monitoring network. These samples will eventually be processed to develop estimates of hydraulic properties of the collected vadose zone sediments at WMA C to help support and validate the estimates of hydraulic properties of vadose zone sediments used in the original PA effort. These estimates of hydraulic properties for vadose zone sediments within the WMA C tank farm area would also help support development of hydraulic properties for similar vadose zone sediments in other tank farm areas in the Central Plateau.

5.0 PLANNED REVIEW AND ANALYSIS

5.1 PLANNED PERIODIC REVIEWS

Periodic reviews are needed to evaluate any information that may become available that was not evaluated during the PA including information gained from retrieval, post-retrieval sampling, and R&D activities that may be relevant to the PA. Periodic reviews can focus on reducing conservatisms and uncertainties in the PA results.

5.1.1 Requirements

Specifically, the objectives of annual reviews can be summarized as the following:

- Confirmation of existing controls being effective in ensuring that PA conclusions are valid
- Consideration of expected future events in terms of their significance to facility closure and the adequacy of the PA
- Review of new information and determination of the significance of this new information to the PA through special analysis, if found necessary
- Identification of R&D needs that have been met during the past year, new needs that have arisen as a result of changes in actual or expected future conditions, and revised R&D priorities.

Any data derived from monitoring, tests, or research activities during the review period must be evaluated relative to the current PA assumptions to determine if such assumptions remain credible. Finally, any other information or changes in the WMA decontamination, decommissioning, and/or closure practices that are relevant to PA assumptions and conclusions must be reviewed to determine if the current PA still adequately describes the closure condition, and PA results still predict compliance with the performance objectives. The assessment of any significant changes identified to the input parameters or conceptual model or assumptions (of the original PA) through annual monitoring, R&D, or new data or information will be conducted as part of the UWMQ process.

5.1.2 Status

Annual reviews of the WMA C PA will be provided to DOE-ORP in July in fiscal year 2022, approximately one year after Revision 1 of RPP-ENV-58782 was approved for public release. The DOE-ORP will evaluate the information provided in the review and make the annual determination to document the continued adequacy of the PA or to identify those areas requiring revision.

In the original PA, inventories for those tanks that had not yet been completely retrieved as of September 30, 2014, were estimated using engineering judgment and have been subject to revision. By January 1, 2019, waste had been retrieved from all 16 SSTs in WMA C and post-retrieval sampling results were available for all tanks. To evaluate the impact of updated residual inventory and volumes on the WMA C PA results, a Special Analysis has been performed (RPP-CALC-64406, *Special Analysis of Updated Tank Residual Waste Volumes and Inventories for Single-Shell Tanks in Waste Management Area C*) as per the UWMQ Evaluation procedure developed per guidance provided in DOE-STD-5002-2017. The updated residual inventory estimates are lower than the estimates used in the original WMA C PA, and the associated calculated doses are also lower.

5.1.3 Plans

The purpose of the PA maintenance program is to confirm the continued adequacy of the current WMA C PA and to increase confidence in the results of the PA. A requirement of the maintenance program is to conduct an annual review of the facility closure-related activities. The annual PA review is conducted in a systematic manner that incorporates the following considerations:

1. Changes in estimates of radionuclide inventories, waste volumes, and waste types

2. Testing and research activities performed during the year and planned for the out years

3. Results of PA monitoring conducted in accordance with the PA Monitoring Plan for WMA C (RPP-PLAN-61305).

Several areas of new information that are anticipated in the next few years are worth noting and include the following.

- The collection of residual waste samples is anticipated for the C-301 catch and individual tanks within the 244-CR vault in fiscal years 2022 and 2023. These samples will be used to develop improved estimates of residual waste inventories in these facilities that will help validate the residual waste inventories used for these facilities in the original PA.

- Core samples of hydrostratigraphic units within the vadose zone sediments will be opportunistically acquired during the drilling of new wells in fiscal years 2022 and 2023 that will replace existing wells that are being removed from the WMA C RCRA monitoring network. These samples will eventually be processed to develop estimates of hydraulic properties of the collected vadose zone sediments to help validate the estimates of hydraulic properties of vadose zone sediments used in the original PA effort.

- A multi-well hydraulic pumping test in the unconfined aquifer at the south end of WMA C is anticipated in fiscal year 2022 as a part of an effort to size and design an interim action to remediate groundwater contaminated by ^{99}Tc and other contaminants of concern in the vicinity and downgradient of WMA C. Hydraulic properties estimated

from the multi-well hydraulic testing will be to validate the estimates of hydraulic properties of sediments in the unconfined aquifer used in the original PA effort.

The above factors are reviewed annually to confirm the adequacy of the current facility PA, and to evaluate the need to conduct special analyses under the UWMQ evaluation process or to prepare a revision to that PA. The results of the review are documented in an annual review report for the current WMA C PA.

5.2 REVISIONS

Any planned or ongoing revisions of the PA, monitoring plans, or closure plans must be described.

5.2.1 Requirements

DOE M 435.1-1 requires that the PA be revised when significant new information alters the conclusions or conceptual models of the PA. The manual specifically mentions changes in waste forms or containers, radionuclide inventories, facility design and operations, closure concepts, or improved understanding.

In addition, any planned or ongoing revisions to the monitoring plan or closure plan must be described.

5.2.2 Status

The need for PA revision will be determined by DOE-ORP based on the results of annual reviews and special analyses. The form of a revision will be an addendum or revised PA document. Report revisions will be submitted to DOE-HQ for review and approval. At tank farm facility closure, a final PA will be prepared and submitted to DOE-HQ for approval together with the final monitoring and closure plans.

5.2.3 Plans

The WMA C PA will be revised whenever new data or information is obtained that would change the conclusions of the PA. Similarly, the PA monitoring plan (RPP-PLAN-61305) and the preliminary DOE Tier 1 Closure Plan for WMA C (ORP-61816 Draft D) will be updated as more information becomes available. The following revision(s) are planned at this stage.

1. Prior to closure, update the DOE Tier 1 Closure Plan for WMA C (ORP-61816 Draft D) to address the closure cover design selected for construction and final grout formulations used in filling tanks and ancillary equipment.

5.3 STATUS OF LOW-LEVEL WASTE DISPOSAL FACILITY FEDERAL REVIEW GROUP SECONDARY ISSUES

The LFRG Review Team examined the validity of the analyses and associated PA documentation during their review of the Revision B Draft of the WMA C PA (RPP-ENV-58782). Upon completion of the initial review, the review team identified 1 key issue and 27 secondary issues. The key issue identified was that the PA should include an inadvertent intruder scenario considering an intrusion into a pipeline after 100 years and into a tank after 500 years.

The key issue was successfully addressed in Revision 0 of the WMA C PA. All of the secondary issues except one were also addressed successfully in Revision 0 of the PA ("Review Team Report for the *Performance Assessment of Waste Management Area C Tank Farm at the Hanford Site, Washington, RPP-ENV-58782, Revision B Draft, December 30, 2015*" [LFRG 2016]). The one remaining secondary issue that could not be addressed within Revision 0 of the PA is identified in Table 5-1. This issue will be addressed, tracked, and resolved through the PA maintenance plan and program. The last column in the table indicates the proposed resolution path.

Table 5-1. Issues and Conditions Identified in the Low-Level Waste Disposal Facility Federal Review Group Review of Waste Management Area C Performance Assessment in Fiscal Year 2016.

Issue #	Outstanding Issues/Conditions Identified During the Performance Assessment Review	Resolution Path
S-13	Section 6.2.1.2.1 states that due to limited availability of sulfate, the impact from sulfate attack is not expected to be important for grout degradation in Hanford single-shell tanks, and the WMA C PA focuses on carbonate attack. However, Section 6.2.1.2.3 reports that ettringite was observed in the void spaces in concrete core samples taken from Hanford aboveground structures during the last 57 years. It is recommended that these statements be reconciled to address any potential impact on the PA.	It is possible that secondary ettringite mineral may have formed from sulfate-containing impurities in the cement paste. The pore-water in the soil has low sulfate content and is unlikely to be the source. Reference that provides the basis for the observations of secondary ettringite in tank 241-A-106 sidewall core sample, RPP-RPT-58254, *Concrete Core Testing Report for the Single-Shell Tank 241-A-106 Sidewall Coring Project*, will be added to the discussion of this topic in Section 6.2.1.2.3. The details of chemical degradation of concrete in underground tank structures for WMA C will be investigated as part of the PA Maintenance program as additional information becomes available on the chemical composition of the existing tank concrete core samples.

PA = performance assessment WMA C = Waste Management Area C

DOE-ORP received a memorandum from DOE-HQ that indicated that the remaining issue does not affect release of the PA, and authorized submittal of the PA to the NRC to initiate consultation under a process similar to that governed by Section 3116 of the *Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005*, and to the EPA, Ecology, and the public for comment (DOE 2016).

5.4 STATUS OF THE U.S. NUCLEAR REGULATORY COMMISSION WASTE INCIDENTAL TO REPROCESSING REVIEW

In June 2018 DOE issued DOE/ORP-2018-01, *Draft Waste Incidental to Reprocessing Evaluation for Closure of Waste Management Area C at the Hanford Site* (the Draft WIR Evaluation). By means of an interagency agreement between DOE and NRC, NRC conducted a consultative technical review of DOE's Draft WIR Evaluation. Prior to preparation of the Draft WIR Evaluation, DOE interacted with NRC staff in development of the WMA C PA (RPP-ENV-58782). The interactions included extensive discussions and scoping meetings between DOE, NRC, and other parties regarding the fundamental technical bases, approaches, and key parameter values to be used in developing the WMA C PA.

On April 30, 2019, NRC staff submitted comments on the Draft WIR Evaluation and WMA C PA in the form of requests for additional information (RAIs) ("Request for Additional Information on the Draft Waste Incidental to Reprocessing Evaluation for Closure of Waste Management Area C at the Hanford Site" [NRC 2019]). On May 30, 2019, DOE and NRC held a joint public meeting in Richland, Washington to discuss and clarify the intent of the NRC RAIs. DOE issued a response to the RAIs (ORP-63747, *Comment Responses for the Nuclear Regulatory Commission Request for Additional Information on the Draft Waste Incidental to Reprocessing Evaluation for Waste Management Area C*).

In May 2020 NRC issued its Technical Evaluation Report (*Technical Evaluation Report Draft Waste Incidental to Reprocessing Evaluation for Closure of Waste Management Area C, Hanford Site, Washington, Final Report* [NRC 2020]). The WMA C PA (RPP-ENV-58782, Revision 0) was updated to incorporate substantive comments received during the NRC consultation. Revision 1 of the WMA C PA forms the technical basis for the waste incidental to reprocessing (WIR) determination.

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6.0 PLANNED MAINTENANCE ACTIVITIES AND SCHEDULES

This section provides a listing of planned maintenance activities and their proposed schedule (funding estimates/expectations) for each of the four essential maintenance components (compliance and performance monitoring, R&D activities, periodic reviews and analyses, and revision of the PA). This listing of maintenance activities also includes maintenance activities of the WMA C PA effort needed to support the Hanford Site Composite Analysis maintenance activities. A summary of the planned schedules and estimated costs of WMA C PA maintenance activities between fiscal years 2021 and 2030 is provided in Table 6-1.

Table 6-1. Planned Schedules and Estimated Costs (in Thousands of Dollars) of Waste Management Area C Performance Assessment Maintenance Activities between Fiscal Years 2021 and 2030. (2 sheets)

	Fiscal Year										Total
	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
Support to WMA C PA Maintenance Activities (Cost Estimate in Thousands of Dollars)											
Compliance and Performance Monitoring	—	—	—	—	—	—	—	—	—	—	—
Update WMA C PA Monitoring Plans	60	—	—	—	—	60	—	—	—	—	120
Conduct WMA C PA Monitoring Evaluation and Validation	30	30	30	30	30	30	30	30	30	30	300
Research and Development	—	—	—	—	—	—	—	—	—	—	—
Evaluate Components of Tank Shell Concrete and Relevance to Concrete Degradation	25	100	100	50	—	—	—	—	—	—	275
Evaluate Detailed Performance of Interim and Proposed Engineered Surface Barrier to Validate PA Assumptions	375	350	100	50	50	50	50	50	50	50	1,075
Evaluate Geochemical Properties of Final Grout Formulation to Validate PA Assumptions	—	50	100	75	50	—	—	—	—	—	275
Periodic Reviews and Analysis	—	—	—	—	—	—	—	—	—	—	—
Evaluate Impact of Numerical Dispersion on PA Limits	30	—	—	—	—	—	—	—	—	—	30
Evaluate Updated Estimates of Hydraulic Properties of Vadose Zone Sediments to Validate PA Assumptions	20	200	200	150	100	—	—	—	—	—	670
Evaluate Updated Estimates of Hydraulic Properties of Unconfined Aquifer Sediments to Validate PA Assumptions	20	—	50	50	—	—	—	—	—	—	120
Evaluate Updated Estimates of Residual Waste Inventories in Tanks and Ancillary Equipment to Validate PA Assumptions	40	—	40	40	40	—	—	—	—	—	160
Revision of the PA	—	—	—	—	—	—	—	—	—	—	—
Perform Unreviewed Waste Management Question Evaluations and Special Analyses to Maintain WMA C PA Baseline	150	120	100	100	100	100	100	100	100	100	1,070
Maintain WMA C PA Models, Documentation, and Databases	100	50	50	50	50	50	50	50	50	50	550

Table 6-1. Planned Schedules and Estimated Costs (in Thousands of Dollars) of Waste Management Area C Performance Assessment Maintenance Activities between Fiscal Years 2021 and 2030. (2 sheets)

	Fiscal Year										Total
	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
Total PA Maintenance	**850**	**800**	**770**	**595**	**420**	**290**	**230**	**230**	**230**	**230**	**4,645**
Support to Hanford Site CA Maintenance Activities (Cost Estimate in Thousands of Dollars)											
Support CA Annual Review	10	10	10	10	10	10	10	10	10	10	100
Support Performance of Special Analyses to Maintain CA	10	10	10	10	10	10	10	10	10	10	100
Support Maintenance of CA Models, Documentation, and Databases	10	10	10	10	10	10	10	10	10	10	100
Total Support to CA Maintenance	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**300**
Total Support to WMA C PA/CA Maintenance	**880**	**830**	**800**	**625**	**450**	**320**	**260**	**260**	**260**	**260**	**4,945**

CA = composite analysis
PA = performance assessment
WMA = Waste Management Area

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7.0 REVISIONS TO DISPOSAL AUTHORIZATION STATEMENT DOCUMENTS

This section describes planned or ongoing revisions of documents related to the Tank Closure Authorization Statement for closure of WMA C. These include the PA and associated UWMQ Evaluations and Special Analyses, the PA Maintenance and Monitoring Plans, and the Closure Plans. Also included are any planned revisions to the Hanford Site Composite Analysis that support the WMA C PA. A summary of planned revisions and updates to these documents are provided in Table 7-1.

Table 7-1. Planned Updates and Revisions to Waste Management Area C Performance Assessment Disposal Authorization Statement-Related Documents by Fiscal Year.

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
WMA C PA Update	—	—	—	—	—	—	—	—	—	X
WMA C PA-Related Special Analyses	X	X	X	X	X	X	X	X	X	—
WMA C PA Maintenance Plan Update	—	—	—	—	X	—	—	—	—	X
WMA C PA Monitoring Plan Update	—	—	—	—	X	—	—	—	—	X
WMA C Closure Plan Update	—	—	—	—	X	—	—	—	—	X
Supporting Hanford Site Composite Analysis Updates	X	—	—	—	—	—	—	—	—	X

PA = performance assessment WMA = Waste Management Area

X – denotes that the cited document will be updated

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APPENDIX A

PERFORMANCE ASSESSMENT MAINTENANCE PLAN REVIEW CRITERIA

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APPENDIX A

PERFORMANCE ASSESSMENT MAINTENANCE PLAN REVIEW CRITERIA

This appendix provides an assessment of the performance assessment maintenance plan versus the review criteria based on DOE-STD-5002-2017, *DOE Standard Disposal Authorization Statement and Tank Closure Documentation* that indicates whether or not the review criteria are applicable, and if applicable, how and where within the maintenance plan they are addressed. The review criteria are included in Table A-1.

Table A-1. Performance Assessment/Composite Analysis Maintenance Plan Review Criteria. (4 sheets)

ID	Review Criteria	Criteria Met (Yes/No/ Comment)	Comments
MA-1	Describe the purpose and scope of the PA/CA maintenance program and provide an overview of the approach, including the site-established priorities for maintenance activities for the PA/CA, monitoring plan, and CP. Summarize the relationship of the PA/CA maintenance plan with other relevant documents associated with the disposal facility. The PA/CA maintenance plan should be reviewed annually by the site and updated as needed to address priorities based upon new information or proposed changes, the status of any disposal authorization statement (DAS) conditions/limitations and LFRG issues. (7.2.1 Introduction)	Yes. This general information is provided in Section 1.0.	
MA-2	Describe key assumptions regarding major aspects of the disposal facility including design, operations, waste form/inventory, and closure, essential to the performance expectations and maintenance of the PA/CA and CP until the facility is released from DOE control. Should identify major assumptions such as land use(s), point of assessment (POA), and any interacting end-state facility/waste site configurations and inventories [including decontamination and decommissioning (D&D), Resource Conservation and Recovery Act (RCRA), and Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) actions] not directly related to the disposal facility. (7.2.2 Key Assumptions)	Yes. This general information is provided in Section 2.0.	

Table A-1. Performance Assessment/Composite Analysis Maintenance Plan Review Criteria. (4 sheets)

ID	Review Criteria	Criteria Met (Yes/No/ Comment)	Comments
MA-3	Provide an overview of the monitoring program and describe any planned changes to the PA/CA Monitoring plan, special monitoring studies, or monitoring-related oversight activities (e.g., site-wide groundwater model consistency committee reviews). (7.2.3 Monitoring)	Yes. This general information is provided in Section 3.0.	
MA-4	Describe any ongoing or planned research and development (R&D) activities associated with managing and/or reducing the uncertainty associated with the PA/CA/CP. Each activity should be linked to a specific need related to the PA/CA, change control, or resolution of LFRG conditions or review issues. (7.2.4 Research and Development)	Yes. This general information is provided in Section 4.0.	
MA-5	Describe all planned and/or ongoing reviews including the disposal facility annual summary report (ASR) (Chapter 9); review of PA, CA, and other DAS technical basis documents, UDQE/SA as well as reviews of radioactive waste management basis (RWMB), or by DOE and other regulatory authorities [U.S. Environmental Protection Agency (EPA)/ state/ Nuclear Regulatory Commission (NRC)]. (7.2.5 Planned Review and Analysis)	Yes. This general information is provided in Section 5.1.	
MA-6	Identify any conditions/limits identified in the DAS; including a proposed schedule for resolution/compliance for each. A description of other conditions imposed by the PSO that require the PA/CA maintenance plan to track should be included. A schedule should be developed for resolution of DAS Conditions/Limits (e.g., revision of the Monitoring plan within 1 year of issuance of the DAS). (7.2.5.1 Status of DAS Conditions/Limits)	Yes. A tank closure authorization statement (TCAS) with limits for WMA C has not been provided by DOE-HQ to date.	

Table A-1. Performance Assessment/Composite Analysis Maintenance Plan Review Criteria. (4 sheets)

ID	Review Criteria	Criteria Met (Yes/No/ Comment)	Comments
MA-7	Identify the DAS conditions/limits most commonly linked to key or secondary issues identified in the LFRG Review Report for the PA/CA or other DAS technical basis documents. Additionally, this section should specify expectations regarding the actions necessary to resolve any outstanding LFRG review secondary issues. (7.2.5.2 LFRG Key and Secondary Issues)	Yes. A TCAS with limits for WMA C has not been received from DOE-HQ to date. General information key or secondary issues identified in the LFRG Review Report for the WMA C PA are provided in Section 5.0.	
MA-8	Provide a listing of planned maintenance activities and their proposed schedule (funding estimates/expectations) for each of the four essential maintenance components (compliance and performance monitoring, R&D activities, periodic reviews and analyses, and revision of the PA/CA). (7.2.6 Planned Maintenance Activities and Schedules)	Yes. This general information is provided in Section 6.0.	
MA-9	Describe any planned or ongoing revisions of the DAS, PA, CA, PA/CA Monitoring plan, WAC, UDQE, Unreviewed Composite Analysis Question Evaluation (UCAQE), CP, or RWMB. The annual review and assessment of the PA/CA maintenance plan should be scheduled in coordination with the ASR so than any revisions to the DAS technical basis documents and the results of those revisions are reported in the ASR. (7.2.7 Revisions to DAS Documents)	Yes. This general information is provided in Section 7.0.	
MA-10	Identify references cited in the PA/CA maintenance plan. (7.2.8 References)	Yes. References are provided in Section 8.0.	
MA-11	Include appendices as necessary to provide details supporting the PA/CA maintenance plan. (7.2.9 Appendices)	Yes. The only appendix provided is Appendix A - Performance Assessment Maintenance Plan Review Criteria.	

Table A-1. Performance Assessment/Composite Analysis Maintenance Plan Review Criteria. (4 sheets)

ID	Review Criteria	Criteria Met (Yes/No/ Comment)	Comments

CA = composite analysis
CP = closure plan
DOE = U.S. Department of Energy
DOE-HQ = U.S. Department of Energy, Headquarters
LFRG = Low-Level Waste Disposal Facility Federal Review Group
PA = performance assessment
PSO = Program Secretarial Officers (PSO) from DOE-Environmental Management
SA = special analysis
UDQE = Unreviewed Disposal Question Evaluation
WAC = *Washington Administrative Code*
WMA = Waste Management Area

REFERENCE

DOE-STD-5002-2017, 2017, *DOE Standard Disposal Authorization Statement and Tank Closure Documentation*, U.S. Department of Energy, Washington, D.C.