APPENDIX F.2

BUILDING 324 (RC-DD-1, RIVER CORRIDOR) EVALUATION UNIT SUMMARY TEMPLATE

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PART I. EXECUTIVE SUMMARY

EU LOCATION

300 Industrial Area

RELATED EUS

Other D&D Projects

PRIMARY CONTAMINANTS, CONTAMINATED MEDIA AND WASTES

As a result of residues and internal facility spills during the conduct of past activities, the Building 324 facility contained areas with significant fixed and dispersible mixed waste contamination. Decontamination began in 1996 shortly after its closure and continued to 2009-10 when a leak in the B-Cell floor was discovered. In 1996, both the HLV and LLV tanks were emptied and the HLV tanks were flushed to satisfy Tri-Party Agreement Milestone M-89-01. The scope of these cleanout activities was to collect and containerize the dispersible materials and decommission and containerize all excess equipment from the B-Cell, and it was during this period that the floor leak was discovered. The 324 Building currently contains significant quantities of residual holdup inside structures, systems and components (SSCs). The contamination primarily is associated with "hot-cell" activities that involved experiments conducted in a controlled environment with highly radioactive materials. In some cases, the material is in a dispersible form and is susceptible to release in the event of a natural disaster or potential accidents. Systems, equipment, and building structures require routine surveillance and preventive measures to ensure that the safety envelope between the managed contaminants and the public, the workers, and the environment is maintained. In addition, the facility contains limited inventories of chemicals and waste from past and present building operations. A recent accident analysis (WCH-140-07 [OUO Document]) estimated that 23,000 curies of ^{90}Sr and 42,000 curies of ^{137}Cs are primarily located in the building's A and B Cells and the HLV & LLV tanks.

In 2009, a breach in the B-Cell liner was discovered during grout removal in the trench and sump. Research determined that a spill of approximately 510 Liters of a highly radioactive waste stream containing about 883,000 curies of ^{137}Cs and 388,000 curies of ^{90}Sr occurred in the B-Cell of the 324 Building in October 1986. High radiation levels at the failed liner locations led to concerns that contamination had spread to the soil beneath the cell and D4 activities on the building were suspended.

In 2010, eight closed casings (Geoprobes) were installed beneath B-Cell which indicated contamination of up to 8,900 Rad/hour in the soil. Modelling by PNNL[1] estimated that the contamination from the spill had migrated to as much as 4 meters below B-Cell based on assumptions that continuing amounts of water would have seeped through the hole until it was plugged up in 1992, thus driving the contaminates lower into the soil. In October 2014 nine new geoprobes were inserted by WCH below the B-Cell floor that enabled the measurement of exposure rates along the full length of each probe. These exposure rates were then converted to activity rates (Curies) at one foot increments. The

[1] Pacific Northwest National Laboratory 2012, *Numerical Modeling of ^{90}Sr and ^{137}Cs Transport from a Spill in the B-Cell of the 324 Building, Hanford Site 300 Area,* PNNL-21214, under contract to U.S. Department of Energy, March 2012

modeling[2] of this data indicates that a contaminant plume containing an estimated 224,100 curies of ^{137}Cs and ^{90}Sr extends down to the cobble layer 4 feet below the B-Cell footings and spreads out horizontally with increasing depth. A maximum reading of 11,700 Rad/hr was recorded by one of the probes. This more recent analysis indicates that the contamination has migrated down from the building footings and also horizontally to about 4 feet outside the boundaries of the building foundation. The strongest readings are in an approximate one-foot wide column that begins at the expansion joints and reaches the coble layer four feet below the footings. Lower readings are recorded as the plume expands horizontally with depth and there is minimal contamination in a 9 x 12 ft. area under the center of the B-Cell floor. Two hydraulic hammer unit penetrometers that were inserted at an angle into the cobble layer showed that the level of contamination below the cobble layer is negligible compared to the level of contamination immediately below B Cell.

BRIEF NARRATIVE DESCRIPTION

The 324 Chemical and Materials Engineering Laboratory is a Hazard Category 2 nonreactor nuclear facility operated by Washington Closure Hanford (WCH). It was constructed in 1965 as a dual purpose facility that contained both radiochemical and radiometallurgical hot cells and laboratories. Research operations ceased in 1996 and cleanout/stabilization activities began.

Planned demolition activities were suspended in 2010, and current work at the facility has been limited since June 2012 to reestablishing maintenance stopped or minimized when demolition was eminent. The goal is to maintain the facility in a safe condition until the material under B-Cell can be placed in a condition that supports the building's demolition. Corrective maintenance on fire systems and ventilation has been a focus.

Multiple methods for removal, stabilization, treatment, packaging, and disposal of the contaminated material beneath the B-Cell were evaluated by Washington Closure Hanford (WCH-503, Rev 0) in 2011. Two alternatives graded better than the rest, using its pre-established grading criteria. They would stabilize the contamination in place by injecting a grout or polymer into and/or under the waste matrix to prevent its migration to groundwater and leave the contamination in-situ with an engineered cap over the site. The majority of the 324 Building would be demolished and transported to ERDF for disposal; however, the B-Cell foundation would remain and used as part of an engineered cap over the area. However, DOE believes that this method is inconsistent with the remove, treat and dispose (RTD) requirements of the *Interim Action Record of Decision for the 300-FF-2 Operable Unit, Hanford Site* (EPA 2001) and CERCLA documentation for the 300 Area.

A group of similar methods that involve excavation of the contaminated soils through the opening created in the B-Cell floor have been deemed consistent with the Final ROD and are the DOE's choice to address this issue. The soils would be extracted up through the floor, mixed with grout and transferred to the C and D hot cells. This process involved technical uncertainty which DOE is seeking to resolve through a $19 million contract with AREVA to design, construct and operate a pilot project designed as "proof of concept" for the remote retrieval of high activity radioactive soils beneath the building 324. The results of this prototype will not be known before September 2015. After the contaminated soils have been removed, the outer shell of the building would be demolished and the hot cells would be cut into monoliths and transported to ERDF for disposal.

[2] Washington Closure Hanford 2015, *Characterization of the Soil Contamination Under 324 B-Cell*, Calculation Sheet Project 618-10FR, Job No. 14655, Calc. No. 0300X-CA-N0140, Rev. 2, February 18, 2015.

A new study was conducted by WCH in October 2014 and findings of the data analysis were issued in February 2015. As noted above, this study produced very different results from the 2011-12 analysis of the soil contamination in terms of how deep the ^{137}Cs and ^{90}Sr contaminates may have migrated, and more importantly the new information relating to their having migrated horizontally to as much as 4 feet outside the B-Cell foundation footprint. These results raise large uncertainties that will need to be considered before proceeding with the currently chosen method of excavation through the B-Cell floor. This recent study was undertaken nearly four years after the analysis of remediation alternatives for the contaminated soil (WCH-503) and two years after execution of the Final ROD for the Hanford 300 Area that required the application of remove, treat, dispose (RTD) processes such as the current plan to excavate the contaminated soils through the floor of the B-Cell. This soil remediation method may prove to not be technically feasible and sufficiently safe because of the extensive horizontal migration of the^{137}Cs and ^{90}Sr to outside the B-Cell foundation structure and other alternatives such as in-situ treatment may require further reconsideration.

No public information has been made available to date regarding the status and results of AREVA's prototype development of the proposed remote excavation process. WCH contract is expiring and it is being replaced by CH2M Hill in September 2016. DOE submitted a Class 2 Modification Request to the Hanford Dangerous Waste Permit in June 2016, which is based on a revised 324 Building Closure Plan[3] developed by CH2M Hill. It modifies the proposed process of extracting the contaminated soils through the floor and estimates that it will require seven years to complete the cleanup of the building and 300-296 contaminated soils. It determined that there is insufficient space in the hot cells adjacent to the B-Cell to accept all of the contaminated soils that it believes would need to be removed up through the B-Cell floor. The objective will now be to remove a sufficient amount of contaminated soil to reduce dose rates to those acceptable in order to complete remediation of remaining contaminated soils using conventional excavation means after the building and foundation are removed. Following completion of the revised through-cell retrieval, the excavation beneath B-Cell will be backfilled with stabilizing agents such as grout or controlled density fill (i.e., self-leveling grout).

We have assumed that once a final determination is made on the method to be used for remediation of the contaminated soils, that work to complete the stabilization and deactivation of the 324 Building interior will resume. The hazards and risk ratings for these activities are indicated under "From Cleanup Actions - Building" in Table F.2-1 below.

SUMMARY TABLES OF RISKS AND POTENTIAL IMPACTS TO RECEPTORS

Table F.2-1 provides a summary of nuclear and industrial safety related risks to humans and impacts to important physical Hanford site resources.

Human Health: A Facility Worker is deemed to be an individual located anywhere within the physical boundaries of the 324 Building or immediate areas around the outside of the building; a Co-located Person (CP) is an individual located 100 meters from Building 324; and Public is an individual located at the closest point on the Hanford Site boundary not subject to DOE access control, which in this instance is the west bank of the Columbia River approximately 305 m (1,000 ft) east of the facility. The nuclear related risks to humans are based on unmitigated (unprotected or controlled conditions) dose exposures expressed in a range of from Not Discernible (ND) to High. The estimated mitigated exposure

[3] 324 Building Dangerous Waste Management Units Closure Plan, DOE/RL-96-73, Revision 4, CH2MHill Plateau Remediation Company, June 2016.

that takes engineered and administrative controls and protections into consideration, is shown in parentheses.

Groundwater and Columbia River: Direct impacts to groundwater resources and the Columbia River, have been rated based on available information for the current status and estimates for future time periods. These impacts are also expressed in a range of from Not Discernible (ND) to Very High.

Ecological Resources: The risk ratings are based on the degree of physical disruption (and potential additional exposure to contaminants) in the current status and as a potential result of remediation options.

Cultural Resources: No risk ratings are provided for Cultural Resources. Table F.2-1 identifies the three overlapping Cultural Resource landscapes that have been evaluated: Native American (approximately 10,000 years ago to the present); Pre-Hanford Era (1805 to 1943) and Manhattan/Cold War Era (1943 to 1990); and provides initial information on whether an impact (both direct and indirect) is KNOWN (presence of cultural resources established), UNKNOWN (uncertainty about presence of cultural resources), or NONE (no cultural resources present) based on written or oral documentation gathered on the entire EU and buffer area. Direct impacts include but are not limited to physical destruction (all or part) or alteration such as diminished integrity. Indirect impacts include but are not limited to the introduction of visual, atmospheric, or audible elements that diminish the cultural resource's significant historic features. Impacts to Cultural Resources as a result of proposed future cleanup activities will be evaluated in depth under Section 106 of the National Historic Preservation Act (16 USC 470, et. seq.) during the planning for remedial action.

Table F.2-1. Risk Rating Summary (for Human Health, unmitigated nuclear safety basis indicated, mitigated basis indicated in parentheses (e.g., "Very High" (Low)).

Population or Resource		Evaluation Time Period: Active Cleanup (to 2064)	
		Current Condition: Security & Maintenance	**From Cleanup Actions:** Building and Soils
Human Health	Facility Worker	***S&M***: High (Low) ***Soils***: Not Discernible (ND)	***Building*****:** High (Low) ***Soils***: High[(c)] (Low)
	Co-located Person	***S&M***: Medium (Low) ***Soils*****:** ND	***Building*****:** High (Low) ***Soils***: Unknown[(c)]
	Public	***S&M***: Medium (Low) ***Soils*****:** ND	***Building*****:** High (Low) ***Soils***: Unknown[(c)]
Environmental	Groundwater[(a)]	*Low* (Sr-90)	*Low* (Sr-90)
	Columbia River[(a)]	*ND*	*ND*
	Ecological Resources[(b)]	ND	ND
Social	Cultural Resources[(b)]	**Native American:** Direct: Known Indirect: Unknown **Historic Pre-Hanford:** Direct: Known Indirect: Unknown **Manhattan/Cold War:** Direct: Known Indirect: None	**Native American:** Direct: Known Indirect: Unknown **Historic Pre-Hanford:** Direct: Known Indirect: Unknown **Manhattan/Cold War:** Direct: Known Indirect: None

a. Threat to groundwater or the Columbia River from Group A and B primary contaminants (PCs) (Table 6-1, CRESP 2015a) remaining in the vadose zone. Only Sr-90 has a reported inventory for the Group A and B PCs (and there are no reported inventories for Group C and D PCs). The Sr-90 vadose zone inventory relates to a *Very High* rating; however, there is no driving force for Sr-90 to move in the subsurface over the next 150 years unless the current cover provided by the building structure (concrete floor and foundation) is removed or another source of water was introduced. Typically, a *Not Discernible* (*ND*) would be assigned under the conditions; however, because of the large remaining inventory, proximity of the contamination to the Columbia River, and shallow groundwater in the river area, a rating of *Low* is used for the Active Cleanup and Near-term, Post-Cleanup periods as described in **Part V**.

b. For both Ecological and Cultural Resources see Appendices J and K, respectively, for a complete description of Ecological Field Assessments and literature review for Cultural Resources. Ecological ratings are described in Table 4-11 of the Final Report.

c. Ratings are for the currently approved remediation option.

SUPPORT FOR RISK AND IMPACT RATINGS FOR EACH POPULATION OR RESOURCE

Human Health

Current

Building and Facility: The only current activities consist primarily of surveillance of the facility and preventative and corrective maintenance of selected equipment. During this period, Building 324 could be impacted by the following natural phenomenon hazard:

Seismic Event: A peak ground acceleration of 0.2 g seismic event would likely lead to a building collapse. The source term from the earthquake consists primarily of the contamination in the hot cells. Portions of surface contaminants in the B-Cell (i.e., some plutonium residue, Sr-90, and Cs-137) are resuspended by the impact and are released to the environment. However, except for the released gases, the fallen debris within the hot cells and the building will impede the flow of contaminants from the cells, reducing the total particulate releases significantly. Impact to the Public is rated similar to that of a Co-located Person because of the relatively short distance (1,000 ft) to the river bank and because of more conservative accepted dose consequences. The Worker has a High Risk rating because of the potential of a building collapse.

Unmitigated Risk: Facility Worker – High; CP – Medium; Public – Medium

Mitigation: The potential for the concurrent loss of all exhaust ventilation and the accident is highly unlikely. Risk to the worker is minimized by the construction of the building to UBC standard, surveillance and maintenance programs, and the emergency preparedness program.

Mitigated Risk: Facility Worker – Low; CP – Low; Public – Low

Contaminated Soils: Workers, CP and the Public are not directly exposed to the contaminated soil because it is located below grade beneath a concrete slab and portions of the building. And because the contamination remains underground, there is not a dispersion pathway for the material to reach the atmosphere that would impact workers, the public or ecological economic resources. Migration of the contaminants through the soil into groundwater requires a driving force such as a large source of water to push the contamination lower. A potential accident scenario that would provide a large amount of water is the rupture of the pressurized water pipe serving the building's fire suppression system. External sections of the water pipe are located in close proximity to the outside B Cell-Building 324 wall, and thus in close proximity to the contaminated soils under B Cell, and could rupture if activated in response to a fire because of their age.

This event has not been analyzed in a DSA, but DOE site management are aware of its possibility. The resulting impact to the Columbia River would depend on the amount of water released and reaching the contaminated soils.

Unmitigated Risk: Columbia River – Low

This risk could be mitigated through immediate replacement of "at risk" sections of water pipe. The risk will also be removed when the contaminated soils are either removed or stabilized through in-situ treatment during cleanup.

Mitigated Risk: Columbia River – ND

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

Building and Facility: Stabilization & Deactivation work on the 324 Building that is expected to resume when a final soil remediation solution is approved and sufficient multi-year funding is committed, could be impacted by the following accident and natural phenomenon hazards (WCH-140-07):

Waste Handling Accident: As part of the S&D activities, radioactive materials are transferred remotely within and between hot cells. In the accident scenario, an open top RGC is filled with B-Cell dispersible material and is in transit to the airlock for dose profiling. A failure of one of the two lifting points on a full RGC or a crane malfunction during transport to the airlock causes a portion of RGC content to spill onto the airlock floor. The spill releases contamination to the airlock atmosphere. The B-Cell door will be open during the transfer and one or more of the other cell doors could be open.

Unmitigated Risk: Facility Worker – High; CP – High; Public – High

Mitigation: Performing operations with the potential for dispersal of significant quantities of contamination are infrequent. The building's design safety factors of HEPA filters, exhaust fans and exhaust of air out through the building's 150-foot high stack will significantly reduce the dose of an airborne release. The potential for the concurrent loss of all exhaust ventilation and an accident is highly unlikely.

Mitigated Risk: Facility Worker – Low; CP – Low; Public – Low

Hydrogen Deflagration: Water used in cleaning the B-Cell leaked into one or more of the LLV or HLV tanks. Hydrogen is generated by radiolysis from radioactivity in the tank, accumulates to flammable concentrations, and ignites causing a hydrogen deflagration.

Unmitigated Risk: Facility Worker – High; CP – Medium; Public – High

Mitigation: The duration of continuing operations following a loss of all exhaust ventilation is brief in the unlikely event of loss of all exhaust ventilation. The potential for the concurrent loss of all exhaust ventilation and an accident is highly unlikely.

Mitigated Risk: Facility Worker – Low; CP – Low; Public – Low

Drop of a Steel-Waste Disposal Box in the Truck Lock: Casks and containers are loaded and unloaded in the 324 Building truck lock. The Steel-Waste Disposal Box is assumed to drop because of a handling accident and release material following the impact. The impact is assumed to induce a fire, which heats all the waste in the SWDB. Impact to the Public is classified higher than Co-located Person because of more conservative accepted dose consequence.

Unmitigated Risk: Facility Worker – High; CP – Low; Public – Medium

Mitigation: The SWDB contains an RODC, which is a welded steel overpack container with a bolted lid, and an RGC, which is an open top box. The radioactive material is located within these three containers. If the fans are not running, the release from the SWDB drop and fire could leak out the truck lock door or through the roof if the fire damages the roof. If the fans are running, the pressure differential will be such that the airflow in the truck lock is into the building and that it exits through the150-ft stack.

Mitigated Risk: Facility Worker – Low; CP – Low; Public – Low

Waste-Handling Accident in the Cask-Handling Area: Activities in the hot cells consist of collecting and removing loose holdup material, and large pieces of equipment, and loading them into steel-waste disposal boxes weighing 22 tons. The postulated scenario is mishandling of an SWDB containing the maximum radioactive content, resulting in a drop from the maximum lift height (approximately 12 ft), and breach of cover blocks and/or the floor and crushing tank 105 and one or more of the other HLV tanks. Impact to the Public is classified higher than Co-located Person because of more conservative accepted dose consequence.

Unmitigated Risk: Facility Worker –High; CP – Low; Public – Medium

Mitigation: The 150-ft stack, filters and the ductwork connecting the building to the stack are credited to reduce the radioactive dose, and the stacks will provide atmospheric diffusion.

Mitigated Risk: Facility Worker – Low; CP – Low; Public – Low

Building and Contaminated Soils

As noted above, there is the potential for several high risk radiological and industrial related accidents during remediation and deactivation inside Building 324. There are additional risks and potential impacts associated with the extraction of the contaminated soil up through the B-Cell floor, mixing it with grout and transferring it to the C and D hot cells. Upon completion, the outer shell of the building would be demolished, and the hot cells would be cut into monoliths and transported to ERDF for disposal.

This soil remediation method was scored by Washington Closure Hanford (WCH-503) as having a greater potential for workers to be exposed to radiological contamination and dose rates than two in-situ alternatives described below, because of the possible need to enter B-Cell for maintenance and/or repair of equipment. In addition, the sealing of C and D cells may expose workers to radioactive material in the form of dust and debris. The risk associated with the Waste Handling Accidents identified above would also appear to be directly relevant and applicable to this method. In addition, the potential of a peak ground acceleration of 0.2 g seismic event would still exist and thus likely lead to a building collapse during a period when highly contaminated soils are being brought into the building through an open floor in B-Cell.

Two other alternatives which involve injecting a grout or polymer into and/or under the waste matrix scored higher in WCH's analysis. With these methods, the majority of the building would be demolished and transported to ERDF for disposal; however, the B-Cell foundation would remain and used as part of an engineered cap over the area. This alternative method leaves the contaminated soils in-situ and capped, thus preventing exposure to workers, ground water and the atmosphere. Although this method is not consistent with the remove, treat and dispose (RTD) requirements of the *Interim Action Record of Decision for the 300-FF-2 Operable Unit, Hanford Site* (EPA 2001) and CERCLA documentation for the 300 Area, it may prove to be a viable option if the currently chosen method proves to be not technically feasible or sufficiently safe to carry out.

Based on available information and analysis of risks in WCH-503, we estimated the following ratings on the currently preferred remediation plan to the Facility Worker. The information available does not provide a sound basis for determining potential unmitigated risks to the Co-located Person or Public:

Unmitigated Risk Removal of Soils: Facility Worker – High

Mitigation: With regard to accidents while remotely excavating the soils and bringing them into B Cell, the building's design safety factors of HEPA filters, exhaust fans and exhaust of air out through the building's 150-foot high stack will significantly reduce the dose of an airborne release within the cells and building. The potential for the concurrent loss of all exhaust ventilation and an accident is highly unlikely.

Mitigated Risk Removal of Soils: Facility Worker – Low

Final Building Demolition

The authors were unable to locate a DSA or similar risk analysis associated with the demolition or dismantlement of a DOE building with large hot-cells having shared common walls constructed of 1.2-

meter-thick, high-density concrete or 1.4-meter-thick, concrete walls, such as those making up Building 324. However, the Final Hazard Categorization of Building 327 (WCH-232, Rev. 0) provides a description and risk analysis of the planned D4 of a building having multiple hot cells. The major difference though is that Building 327's hot cells were smaller stand-alone units, often shop-fabricated from cast iron and thus could be removed individually. The final D4 tasks included structurally reinforcing the exterior of each cell so that they could be filled with grout or foam and then preparing them for lifting and transfer out of the building. The cells were separated from the building foundation using cutting techniques such as diamond wire cutting, and the cell monoliths were lifted with a crane through the building roof or moved through the roll-up door, and transported to ERDF for final disposition.

The Building 324 hot cells are much larger in size and interconnected by common thick concrete walls. But the common cell walls presumably could be cut by a similar diamond wire process and the cells separated for removal and the monoliths transported to ERDF for final disposition. Unfortunately, the Building 327 Final Hazard Categorization does not provide a basis for adequately evaluating Worker, CP and public risks to other radiation exposures or industrial accidents involved in the final demolition or dismantlement of Building 324 beyond those already identified in the review of cleanup risks above.

Groundwater

Migration of the contaminants through the soil into groundwater requires a driving force (i.e., source of water) to mobilize the contamination. This driver is not present at this time. The Sr-90 is not expected to move in the subsurface over the next 150 years that would typically lead to a rating of *Not Discernible* (*ND*). The rupture of the pressurized water pipe serving the building's fire suppression system is a potential accident scenario that could provide necessary water infiltration for movement. A *Low* rating is applied for the Active Cleanup period to account for the large vadose zone inventory, proximity of the contamination to the Columbia River, shallow groundwater in the area, and uncertainties in the evaluation.

Columbia River

Migration of the contaminants through the soil into groundwater requires a driving force (i.e., source of water) to mobilize the contamination. The contamination would first have to reach groundwater before then entering the river. There is no such driving source at this time as described above leading to a rating of ND.

Ecological Resources

Current

There are currently no ecological resources on EU or buffer area.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

Any ecological risk depends upon the quality and quantity of re-vegetation following remediation; there could be a risk from invasion of exotic species.

Cultural Resources

Current

Ratings for cultural resources are not being made because cultural resources will be evaluated under Section 106 of the National Historic Preservation Act (16 USC 470, et. seq.) during the planning for remedial action. The resulting Section 106 process will engage all stakeholders, including Native American Tribes, concerning the Native American, Historic Pre-Hanford, and Manhattan Project/Cold War landscapes. This process will identify all cultural resources and evaluate their eligibility for the National Register of Historic Places, any direct and indirect effects from remediation, as well as the need

for any mitigation actions. CRESP has consulted with the Native American Tribes having historical ties to Hanford and they consider the entire Hanford Site to be culturally and historically important.

There are very disturbed, but close to important cultural resources (close proximity to river); Manhattan era significant facility has already been mitigated. There are no known recorded archaeological sites or TCPs located within the 324 Building EU; there are five archaeological sites located within 500 meters of the 324 Building EU. There are no ecological resources at Building 324 or the buffer area

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

There are no expectations for impacts to known cultural resources.

Considerations for timing of the cleanup actions

There is no risk to the Facility Worker, CP or Public if cleanup of the soils or building is delayed up to a few years. There is no known physical deterioration occurring in Building 324 or its several hot cells, and recent measures were taken to improve the condition of its exterior and to prevent rain from reaching soils covering the recent excavation. Studies indicate that the contaminants are not moving from their current location in the soils and thus not threatening groundwater, although additional groundwater monitoring is recommended to ensure that contaminants have not migrated toward the River. There are potential benefits to near-term measures that prevent infiltration to the soils (e.g., covers or in-situ grouting) and allow time for an order of magnitude decrease in radiation levels due to natural decay (ca. 90 years) or allowing natural attenuation to achieve long-term environmental safety. The building, however contains a considerable amount of radiological contaminants and long-term delays would likely require improvements to the roof and other parts of the exterior structure.

Near-Term, Post-Cleanup Risks and Potential Impacts

Both soil remediation alternatives will remove or fully stabilize the contaminated soils, and Building 324 will either entirely or mostly be demolished, and then transported to ERDF. The second alternative would leave a soil monolith and engineered cap in the Industrial 300 Area to allow the ^{90}Sr and ^{137}Cs to reach safer radiation exposure levels before removal and final building demolition, and thus represents a potential impact on ecological resources during its removal. Long-term surveillance and maintenance of the 300-296 site would be required until the contaminated soils and engineered cap are removed.

Any ecological risk depends upon the quality and quantity of re-vegetation following remediation. There could be a risk from invasion of exotic species.

There are no expectations for impacts to known cultural resources.

PART II. ADMINISTRATIVE INFORMATION

OU AND/OR TSDF DESIGNATION(S)

300-FF-2

COMMON NAME(S) FOR EU

300-296 and Building 324

KEY WORDS

D&D, Hot Cells, Soils

REGULATORY STATUS

Regulatory basis: Removal of the 324 Building, and the hot cells would be performed under the CERCLA Action Memorandum #2 for the 300 Area Facilities. In addition, closure of the TSD units in the 324 Building would be performed under the RCRA Closure Plan.

Removal of contaminated soils under the B-Cell are subject to the remedy specified in the Final ROD[4]:

> "Principal threat wastes exist in three waste sites in 300-FF-2. Soil in waste site 300-296 below the 324 building, vertical pipe units at the 618-10 and 618-11 burial ground waste sites and caissons at 618-11 contain principal threat waste. Under the selected remedy for 300-FF-2, all principal threat waste will be treated where practicable to reduce the toxicity, mobility, contamination or radiation exposure, including some that will be treated in-situ prior to removing the waste for disposal. Treatment will be with grout or an alternative method approved by EPA during remedial design. The selected remedy for 300-FF-2 requires all waste that is removed for disposal to be treated as necessary to meet the waste acceptance criteria of the disposal facility. Such treatment also reduces the toxicity and mobility of radionuclides and chemical hazardous substances."
>
> "Because the selected and amended remedies will result in hazardous substances, pollutants or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedies are, or will be, protective of human health and the environment. Five-year reviews will be conducted after the initiation of remedial action and continue until hazardous substances no longer remain present above levels that allow for unlimited use and unrestricted exposure."

Applicable regulatory documentation

Remedial Investigation/Feasibility Study for the 300-FF-1, 300-FF-2, and 300-FF-5 Operable Units, February 2013.

Record of Decision for 300-FF-2 and 300-FF-5, and Record of Decision Amendment for 300-FF-1 Area 300 Final ROD and RI/FS; U.S. Environmental Protection Agency, Region 10; U.S. Department of Energy, Richland Operations Office; November 2013.

Applicable Consent Decree or TPA milestones:[5]

TPA Milestone M-016-00B was changed to remove the 300-296 contaminated soil area site from its requirements and Milestone M-094-00 was changed to exclude the 324 Building and its ancillary buildings and structures, and two new Milestones were created.

M-016-85A: Complete remote excavation of the 300-296 waste site in accordance with an approved RD/RA Work Plan. Due date September 30, 2019

M-016-85: Complete remedial actions for the 300-296 waste site in accordance with RD/RA Work Plan for 300-FE-2 Soils (DOE/RL-2014-13-ADD1) and disposition for the 324 Building and Ancillary Buildings in

[4] U.S. Environmental Protection Agency, Region 10, U.S. Department of Energy, Richland Operations Office 2013, *Hanford Site 300 Area, Record of Decision for 300-FF-2 and 300-FF-5, and Record of Decision Amendment for 300-FF-1*, November 2013, p. iii and iv.

[5] *Final Approval Package for the Tentative Agreement on Hanford Federal Facility Agreement and Consent Order Revisions for Central Plateau Cleanup,* U.S. Department of Energy, U.S. Environmental Protection Agency, and the Washington State Department of Ecology, May 2016

accordance with the Removal Action Work Plan (DOE/RL-2004-77). Completion of facility disposition is defined as the completion of deactivation, decontamination, decommissioning, and demolition in accordance with the removal action work plan. Due date September 30, 2021

Although these changes extend the cleanup completion dates of the 300-296 contaminated soils and D4 of the 324 Building, they appear to be in conflict with the new Closure Plan developed by CH2M Hill which would require out to 2023 for completion of these tasks.

RISK REVIEW EVALUATION INFORMATION

Completed: Revised August 26, 2016 by Henry Mayer

Evaluated by: H. Mayer

Ratings/Impacts Reviewed by: D. Kosson, M. Gochfeld, J. Salisbury, A. Bunn

PART III. SUMMARY DESCRIPTION

CURRENT LAND USE

DOE Hanford industrial site area

DESIGNATED FUTURE LAND USE

Industrial (300 Area Final ROD)

PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

There is one trench and one unplanned release (UPR) with reported inventories.

High-Level Waste Tanks and Ancillary Equipment

Not Applicable

Groundwater Plumes

Not Applicable

Operating Facilities

Not Applicable

D&D of Inactive Facilities

Significant amounts of ^{90}Sr and ^{137}Cs are in B-Cell and in the soils directly beneath B-Cell of Building 324. Migration of the material through the soil into groundwater requires a driving force (source of water to push the contamination).

LOCATION AND LAYOUT MAPS

Building 324 is located approximately 300 meters from the Columbia River.

Figure F.2-1. Building 324

Figure F.2-2. Building 324 Evaluation Unit

PART IV. UNIT DESCRIPTION AND HISTORY

EU FORMER/CURRENT USE(S)

The 324 Chemical and Materials Engineering Laboratory was constructed in 1965 as a dual purpose facility that contained both radiochemical and radiometallurgical hot cells and laboratories in the 300 Area of the Hanford Site. It was operated by Pacific Northwest National Laboratory (PNNL) until 1996, when the facility was transferred to B&W Hanford Company (BWHC) for interim operation and eventual stabilization and deactivation (S&D) in preparation for building demolition. PNNL continued limited operations in the 324 Building until October 1998. Responsibility for the building S&D was assumed by Fluor Hanford (FH) in September 1999 and continued until August 2005. Responsibility was assumed by Washington Closure Hanford (WCH) in August 2005. In 2009, a breach in the B-Cell liner was discovered during grout removal in the trench and sump. This changed condition lead to suspension of planned demolition activities until safety basis documentation could be revised and options for soil remediation and building use/demolition could be developed. Current work at the facility has been limited since June 2012 to reestablishing maintenance stopped or minimized when demolition was eminent, pending resolution of the soil remediation issues and eventual demolition of the 324 Building.

LEGACY SOURCE SITES

There is one trench and one UPR with reported inventories (Table F.2-3 through Table F.2-5) that represent the vadose zone inventory. The other sites are buildings that are considered isolated from the environment.

HIGH-LEVEL WASTE TANKS

Not Applicable

GROUNDWATER PLUMES

The general verbally expressed consensus of WCH and EPA is that currently there is no short-term threat of the Cs-137 and Sr-90 contaminants migrating to groundwater levels.

D&D OF INACTIVE FACILITIES

The 324 Chemical and Materials Engineering Laboratory was constructed in 1965 as a dual purpose facility that contained both radiochemical and radiometallurgical hot cells and laboratories. It conducted diverse studies on the chemical and physical processing of high-activity radioactive materials, characterization of physical and chemical properties of irradiated materials, and non-radioactive process development. It is a substantial concrete and steel structure, and has a partial basement and first, second, and partial third floors. The foundation structure is poured-in-place reinforced concrete. The superstructure is insulated fluted steel industrial panel supported on a structural steel frame. The parapeted roof (original sections constructed in 1963) has a slightly sloped steel deck covered with concrete with gravel-finished built-up roofing. The structure and systems for the building were designed to the UBC and the Hanford Plant SDC in existence at the time of their design (SDC-4.1) and therefore were designed to resist the extreme weather and earthquakes specified in these documents.

The building contains two groups of heavily shielded cells with operating and service galleries and two vaults equipped with tanks for retaining radioactive liquid. In addition, the building houses two engineering development laboratories; used for non-radioactive activities. The cells were equipped with cranes, remote manipulators, viewing windows, various types of test equipment, POG systems, and various services including air, water, steam, and electrical power. The cells and vaults are designed to

shield the workers from direct radiation and, with the ventilation system and its HEPA filters, to confine any radioactive particulate materials.

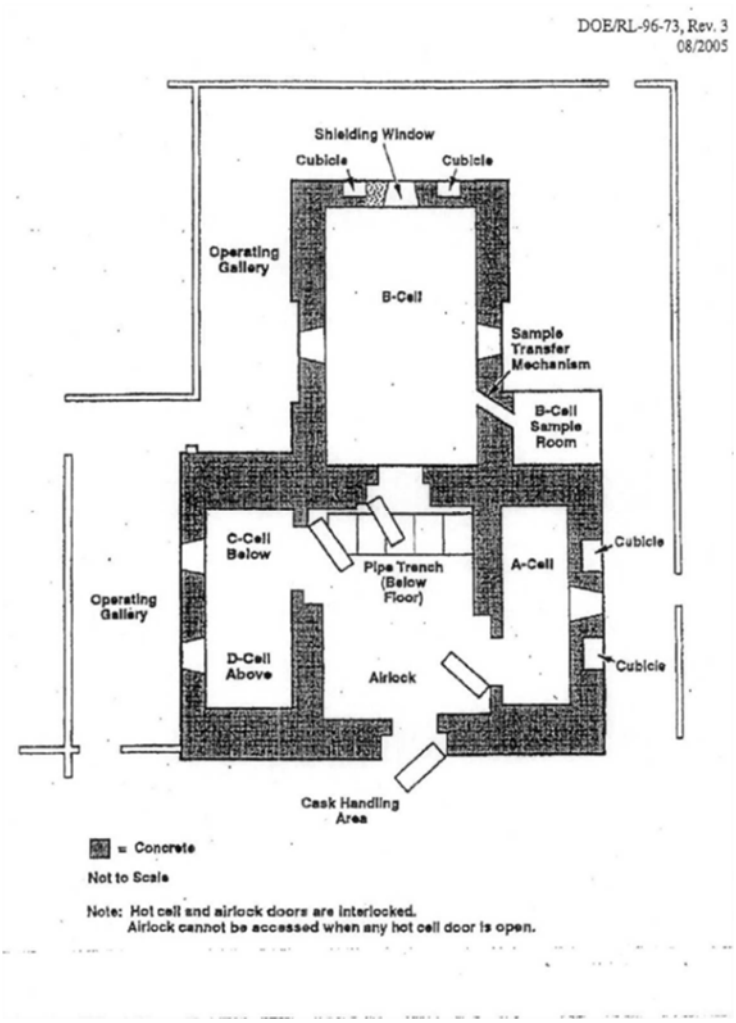

Figure F.2-3. Building 324 Schematic

The radiometallurgical portion of the laboratory, known as the Radiometallurgy and Materials Testing Laboratories, included three large hot cells known as the Shielded Materials Facility and were located in the southeast section of the building. The radiochemical portion, located on the north side, had four large hot cells (A, B, C, and D-Cells) and an Air Lock Cell. The cells and airlock are joined to form a T-shaped structure. D-Cell is located above the C-Cell on the south side. C-CeII/D-Cell, the airlock, and the A-Cell form the top of the T-shape. B-Cell connects to the airlock to form the bottom of the T-shape. The walls are constructed of 1.2-meter-thick, high-density concrete or 1.4-meter-thick, normal-density concrete.

The radiometallurgical portion of the laboratory, known as the Radiometallurgy and Materials Testing Laboratories, included three large hot cells known as the Shielded Materials Facility and were located in the southeast section of the building. The radiochemical portion, located on the north side, had four large hot cells (A, B, C, and D-Cells) and an Air Lock Cell. The cells and airlock are joined to form a T-shaped structure. D-Cell is located above the C-Cell on the south side. C-CeII/D-Cell, the airlock, and the A-Cell form the top of the T-shape. B-Cell connects to the airlock to form the bottom of the T-shape. The walls are constructed of 1.2-meter-thick, high-density concrete or 1.4-meter-thick, normal-density concrete.

Cell operations normally were conducted from the operating gallery using through-the-wall, master-slave manipulators; remotely operated in-cell bridge cranes; a periscope; and electromechanical manipulators. Operations were aided by direct viewing through lead-glass windows that previously contained oil between the glass panes for transparency. The facility handled a large variety of irradiated materials, test assemblies and samples, and segregated radioisotopes. Radioactive/fissionable materials in varying forms and geometry also were handled.

The B-Cell is the largest building component at 22 ft wide by 25 ft long by 30.5 ft high. It is 10 ft below grade and extends 20.5 ft above ground level. The floor and the walls (up to 27 ft high) are lined with stainless steel. The cell is surrounded on three sides by operating galleries on the first and second floors

and on two sides by an operating gallery at the basement level. Shielding walls at the three operating faces are 4-5 ft thick concrete with oil-filled lead glass viewing windows.

To protect against releases of radioactive material from the hot cells to the environment, integral metal liners with sumps (i.e., without drains) were installed in the cells and tank vaults. Confinement of radioactive particulate matter within the shielded cells is provided by a directed airflow through a high-efficiency particulate air (HEPA) filtered ventilation system.

Other support facilities within the 324 Building included the high-level and low-level vault areas, each containing four stainless tanks. These tanks were used as temporary holding tanks for feed solutions, feedstock tanks for process solutions, or collection tanks for effluents from project activities. In 1996, both the High Level Vault and Low Level Vault tanks were emptied and the HLV tanks were flushed to satisfy Tri-Party Agreement Milestone M-89-01.

Research operations ceased in 1996 and cleanout/stabilization activities began. In 2009, a breach in the B-Cell liner was discovered during grout removal in the trench and sump. High radiation levels at the failed liner location led to concerns that contamination may have spread to the soil beneath the cell. It was determined that in October 1986, a spill of approximately 510 Liters of a highly radioactive waste stream containing cesium (^{137}Cs) and strontium (^{90}Sr) occurred in the B-Cell. Unknown quantities of water were used immediately after the spill, and at various other times following the spill, to wash items contained in the B-Cell (MW Perrott, WCH, private communication, January 2011). Wastes being removed from B-Cell were also grouted and in the course of the grouting activities, sufficient grout was spilled on the floor of the B-Cell to completely fill the sump with solidified grout. Although unintentional, this spilling of grout is thought to have effectively stopped any further release of waste through the B-Cell sump, at some undetermined time prior to 1992.

Deactivation and decontamination work on the building was slowed and then suspended in 2012 while the spill and resulting soil contamination was being researched. A study was completed by WCH in December 2011 that recommended remote excavation of the soils through the floor of B Cell, mixing with grout and transferring to the C and D Cells for permanent storage. In 2012-2013 work was conducted on the interior of Building 324 to restore it to safe operational condition in order to be carry out these proposed activities. Areva was awarded a $19 million contract in January 2014 to design and test a system for remotely removing the soils using a full-scale mockup of B-Cell and associated hot cells by September 2015.

A new study was conducted by WCH in October 2014 and findings of the data analysis were issued in February 2015. As noted earlier, this study produced very different results from the 2011-12 analysis of the soil contamination in terms of how deep the ^{137}Cs and ^{90}Sr contaminates may have migrated, and more importantly that they have migrated horizontally to as much as 4 feet outside the B-Cell foundation footprint (but within the overall building footprint). These results raise large uncertainties that will need to be considered before proceeding with the currently chosen method of excavation through the B-Cell floor. This recent study was undertaken nearly four years after the analysis of remediation alternatives for the contaminated soil (WCH-503) and two years after execution of the Final ROD for the Hanford 300 Area that required the application of remove, treat, dispose (RTD) processes such as the current plan to excavate the contaminated soils through the floor of the B-Cell. This soil remediation method may prove to not be technically feasible and sufficiently safe because of the extensive horizontal migration of the ^{137}Cs and ^{90}Sr to outside the B-Cell foundation structure, and other alternatives such as in-situ treatment may require further consideration.

Pending final determination of these major issues, the current mission of the 324 Building contractor is to maintain the building in a safe condition until the material under B-Cell can be placed in a condition

that supports the building's demolition. Corrective maintenance on fire systems and ventilation has been a focus.

OPERATING FACILITIES

Not Applicable

ECOLOGICAL RESOURCES SETTING

Landscape Evaluation and Resource Classification

The amount of each category of biological resources was evaluated at two scales: 1) within the 324 Building EU and 2) within a circular area radiating 231 m from the geometric center of the unit (equivalent to 41.5 acres). The EU and buffer area north, south, and east of the unit were previously classified as level 3 because it is within 0.25 miles of the Columbia River. These areas were reclassified for this assessment to level 0 to reflect current habitat conditions.

Field Survey

Reconnaissance and visual survey of the 324 Building EU indicated the unit consists entirely of non-vegetated areas, paved, concrete, and compacted gravel areas (i.e., level 0 resources), and no field measurements of vegetation abundance were collected during the July 2014 survey. Some weedy species such as cheatgrass and Russian thistle were sparsely established around the road edges and parking lot boundaries. No wildlife were observed within the EU. Previous ECAP building survey data indicated that the starling (*Sturnus vulgaris*), which is not protected by the Migratory Bird Treaty Act (MBTA), was the only bird species observed nesting on the building as recently as 2009.

CULTURAL RESOURCES SETTING

Most of the 324 Building EU has been inventoried for cultural resources with negative findings. Demolition and remediation activities within the 324 Building EU have been addressed in an NHPA Section 106 cultural resources review. There are no cultural resources (archaeological, buildings or TCPs) known to be located within the 324 Building EU. It is very unlikely that intact archaeological material is present in the areas that have not been inventoried for archaeological resources (both on the surface and in the subsurface) given the extensive disturbance present within the 324 Building EU.

There are several cultural resources associated with all three landscapes located within 500 meters of the 324 building EU. These include the following:

- The following buildings are all contributing properties within the Manhattan Project/Cold War Era Landscape with documentation required and are within 500 meters of the 324 building EU. In accordance with the 1998 *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan (*DOE/RL-97-56), all documentation requirements have been completed for these properties.

340A	WASTE RETENTION BUILDING
382	PUMP HOUSE BUILDING
320	PHYSICAL SCIENCES LABORATORY
309	SP-100 GES TEST FACILITY
308A	FUELS DEVELOMENT LABORATORY
340	WASTE NEUTRALIZATION FACILITY

340B	WASTE LOADOUT BUILDING
326	MATERIALS SCIENCES LABORATORY
329	CHEMICAL SCIENCES LABORATORY
3760	3760 OFFICE BUILDING
3709A	300 AREA FIRE STATION
3790	Badging Office
308	FUELS DEVELOPMENT LABORATORY
325A	CESIUM RECOVERY FACILITY PART OF 325
325	RADIOCHEMICAL PROCESSING LABORATORY (RPL)
318	RADIOLOGICAL CALIBRATIONS LABORATORY
3614A	RIVER MONITORING STATION

- The following buildings are all contributing properties within the Manhattan Project/Cold War Era Landscape with no documentation required and are within 500 meters of the 324 building EU. In accordance with the 1998 *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan (*DOE/RL-97-56), all documentation requirements have been completed for these properties.

331	LIFE SCIENCES LABORATORY
324	CHEMICAL ENGINEERING BUILDING
339A	COMPUTER FACILITY
350	PLANT OPERATIONS AND MAINTENANCE FACILITY
3707F	RADIATION MONITORING BUILDING
3714	SOILS LABORATORY
3730	GAMMA IRRADIATION FACILITY
3766	OFFICE BUILDING

- There are five archaeological sites located within 500 meters of the 324 Building EU. These include one isolated find, three National Register-eligible sites, and a State-Registered archaeological district associated with the Native American Precontact and Ethnographic Landscape and one isolated find associated with the Pre-Hanford Early Settlers and Farming Landscape.

Historic maps indicate that historic land use was occurring within the Pre-Hanford Early Settlers/Farming and the Manhattan Project and Cold War era. Geomorphology indicators suggests potential for the presence of archaeological resources associated with the Native American Precontact and Ethnographic landscape to be present depending on the location of these soils within the 324 Building EU. However, because of the extensive disturbance within the 324 Building EU, it is unlikely any archaeological material remains intact. It is always possible for pockets of undisturbed deposits to exist and archaeological monitoring may be appropriate as well as surface and subsurface archaeological

investigations in these areas prior to initiating a remediation activity. Consultation with Hanford Tribes (Confederated Bands of the Yakama Nation, Wanapum, Confederated Tribes of the Umatilla Indian Reservation, and the Nez Perce) and other groups who may have an interest in the areas (e.g. East Benton Historical Society, Prosser Cemetery Association, Franklin County Historical Society, the Reach, and the B-Reactor Museum Association) may need to occur. Consultation with Hanford Tribes may also be necessary to provide input on indirect effects to both recorded and potential unrecorded TCPs in the area and other cultural resource issues of concern.

PART V. WASTE AND CONTAMINATION INVENTORY

As a result of residues and internal facility spills during the conduct of past activities, the facility contained areas with significant fixed and dispersible mixed waste contamination. Decontamination began in 1996 shortly after its closure and continued to 2009-10 when the B-Cell leak was discovered. In 1996, both the HLV and LLV tanks were emptied and the HLV tanks were flushed to satisfy Tri-Party Agreement Milestone M-89-01. The scope of these cleanout activities was to collect and containerize the dispersible materials and decommission and containerize all excess equipment from the B-Cell, and it was during this period that the floor leak was discovered. A recent analysis indicates that an estimated 23,000 curies of ^{90}Sr and 42,000 curies of ^{137}Cs are primarily located in the building's A and B Cells and the vault HLV & LLV tank area.

A spill of approximately 510 Liters of a highly radioactive waste stream containing about 883,000 curies of ^{137}Cs and 388,000 curies of ^{90}Sr occurred in the B-Cell of the 324 Building in October 1986. It was likely from a glass-waste repository testing program associated with the Federal Republic of Germany (FRG). Unknown quantities of water were used immediately after the leak and at later times to wash the floor of the B-Cell. This added water would have transported ^{137}Cs and ^{90}Sr deeper into the underlying soils. Assuming the benefit of radioactive decay since the 1986 spill to 2014, we estimated that there are 198,000 curies of ^{90}Sr and 464,000 curies of ^{137}Cs[6] remaining in the soils below the B-Cell.

Two studies have been conducted to determine the location and amounts of ^{137}Cs and ^{90}Sr in the soils below the B-Cell. In 2010, eight closed-end horizontal access pipes (Geoprobes) were inserted in a fan-shaped pattern beneath B-Cell. They indicated radiological contamination up to 8,900 Rad/hour was present. One- and three-dimensional flow and transport modeling were performed by PNNL (PNNL-21214[7]) to evaluate the possible extent of migration of ^{137}Cs and ^{90}Sr that leaked from the B-Cell into the subsurface soils. They yielded differing results in terms of the predicted depths to peak concentrations and the maximum depths of penetration of the contaminants. The 1-D model suggests that peak concentrations of ^{90}Sr may be located 1–3 m below the foundation, but ^{90}Sr contamination may extend 4–11 m below the foundation, depending on the assumed water release rate. In contrast, the 3-D Kd-based model results suggest that both ^{137}Cs and ^{90}Sr peak concentrations may be located 1–2 m below the foundation, and nearly all of the contamination may be contained within the upper 3 m of the sediment profile.

In 2014, nine penetrometers geoprobes ranging in length from 60 ft to 100 ft were driven horizontally beneath the B-Cell and exposure rates along the penetrometers were measured using field exposure rate instruments of various ranges. The activity associated with each penetrometer was determined by using the exposure rate measurements along the length of the housing and exposure rate to activity

[6] Decayed values were computed using half-lives of 28.7 yrs for ^{90}SR and 30.17 yrs for ^{137}Cs over 28 years from 1986 to 2014.

[7] *Numerical Modeling of ^{90}Sr and ^{137}Cs Transport from a Spill in the B-Cell of the 324 Building, Hanford Site 300 Area,* PNNL-21214

conversion factors. The highest reading was 11,700 RAD/hr. The results from the individual penetrometers were modeled to generate an approximation of a three dimensional contamination plume that contained three zones of activity (high, medium and low) which follow the path of the expansion joint in the floor of the cell. The strongest readings were in an approximate one-foot wide column that begins at the expansion joints and reaches the coble layer four feet below the footings. Lower readings were recorded as the plume expands horizontally with depth. The plume extends approximately 4 feet outside the entire B-Cell foundation structure and there is minimal to no contamination in a large area under the center of the B-Cell floor (see Figure F.2-4). The concentrations of activity in each zone were based on averages from the individual Geoprobe results. The sum of the zone volumes times the zone concentrations yielded an estimated total activity in a vadose zone plume[8] of 155,700 Ci of ^{137}Cs and 68,420 Ci of ^{90}Sr in the area up to 4 ft. beneath the B-Cell foundation. Two hydraulic hammer unit penetrometers that were inserted at an angle into the cobble layer showed that the level of contamination below the cobble layer is negligible compared to the level of contamination immediately below B Cell.

These results vary considerably from the PNNL modeling that was done with different type Geoprobes and contaminant migration assumptions which indicated that the ^{137}Cs and ^{90}Sr peak concentrations could be anywhere from 1-2 meters to as much as 4-11 meters below the B-Cell foundation.

The general verbally expressed consensus of WCH and EPA is that currently there is no short-term threat of the contaminants migrating to groundwater levels.

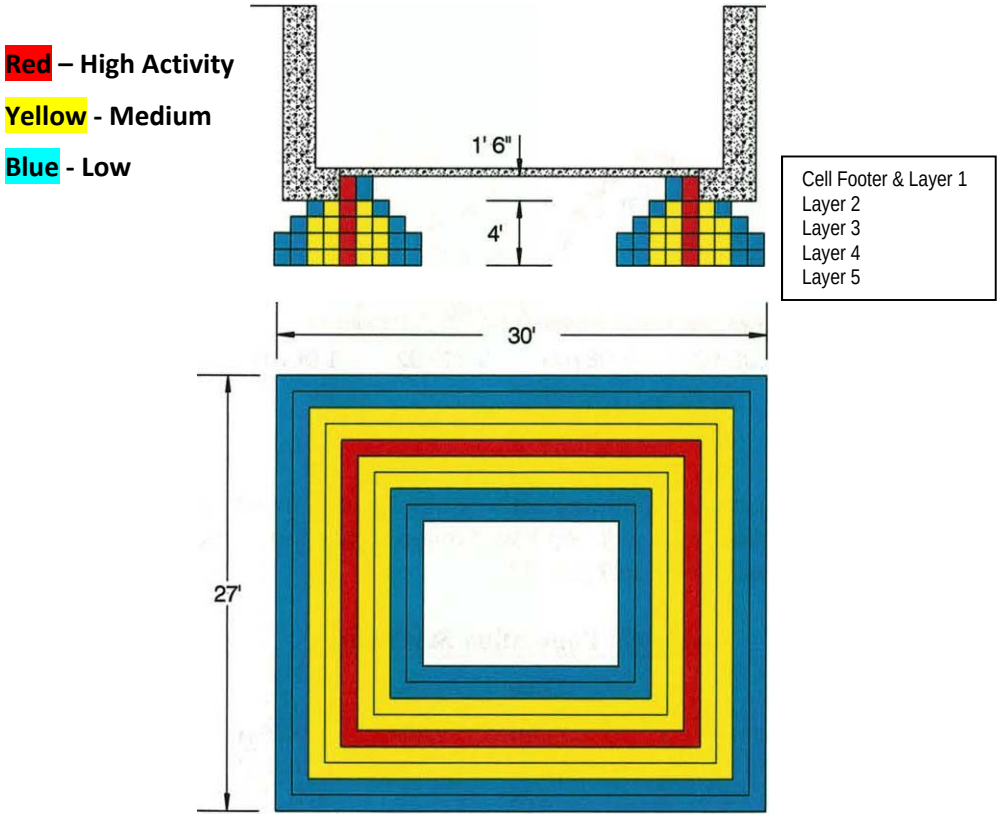

Figure F.2-4. Activity Profile Beneath B-Cell

[8] Washington Closure Hanford 2011, *Characterization of the Soil Contamination Under 324 B-Cell*, Calculation Sheet Project 618-10FR, Job No. 14655, Calc. No. 0300X-CA-N0140, Rev. 2, February 18, 2015.

Table F.2-2. Contaminant Inventory

Nuclide	Location	WIDS	Curies
Cs-137	Building	300-19 & 25	42,000
Cs-137	Soils	300-296[a]	464,069
Cs-137	Soils	300-296[b]	155,700
Sr-90	Building	300-19 & 25	23,000
Sr-90	Soils	300-296[a]	197,725
Sr-90	Soils	300-296[b]	68,400
Am-241	Building	300-19 & 25	56.7
Pu-239-240	Building	300-19 & 25	7.8

a. Estimated decayed amount of original spill material in 2014
b. Contained in vadose area plume area from footings to cobble layer (4 ft depth)

CONTAMINATION WITHIN PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

There is one trench (316-3 Trench) and one UPR (300-296) that represent the vadose zone inventory. The other sites are buildings. Remediation of the 316-3 waste site was performed from December 17, 2014, to April 30, 2015 and reclassified to Final Closed Out.

High Level Waste Tanks and Ancillary Equipment

Two shielded underground vaults (HLV and LLV) in the 324 Building are equipped with tanks for temporary storage of liquids. Each vault contains four stainless tanks. These tanks had been used as temporary holding tanks for feed solutions, feedstock tanks for process solutions, or collection tanks for effluents from project activities. The HLV and LLV tanks had also been used to store mixed waste solutions. In 1996, both the HLV and LLV tanks were emptied and the HLV tanks were flushed to satisfy Tri-Party Agreement Milestone M-89-01.

Detailed inventories are provided in Table F.2-3, Table F.2-4, and Table F.2-5. All values are to 2 significant figures. The source document should be consulted for greater precision data. The sum for each primary contaminant is shown in the first row. Table F.2-6 provides a summary of the evaluation of threats to groundwater as a protected resource from saturated zone and remaining vadose zone contamination associated with the evaluation unit.

Vadose Zone Contamination

There is one trench (316-3 Trench) and one UPR (300-296) that represent the vadose zone inventory. Of the Group A and B primary contaminants in the vadose zone, the Sr-90 contamination is from the 300-296 UPR (Table F.2-4).

Groundwater Plumes

Contaminant migration has been limited to the shallow soils directly below the 324 building as a result of water discharges through the B-Cell that has been sealed after discovery of the initial release. Infiltration of water is prevented by the building's reinforced concrete structure and floor. The general verbally expressed consensus of WCH and EPA is that currently there is no short-term threat of the contaminants migrating to groundwater levels. The primary threat of water infiltration is from rupture of the pressurized water pipe serving the building's fire suppression system; measures to mitigate this risk should be considered.

EU Designation: RC-DD-1 (Building 324)

Facilities for D&D

See above

Operating Facilities

Not Applicable

Table F.2-3. Inventory of Primary Contaminants[a]

WIDS	Description	Decay Date	Ref[b]	Am-241 (Ci)	C-14 (Ci)	Cl-36 (Ci)	Co-60 (Ci)	Cs-137 (Ci)	Eu-152 (Ci)	Eu-154 (Ci)	H-3 (Ci)	I-129 (Ci)
All	Sum			57	NR	NR	NR	510,000	NR	NR	NR	NR
300-19	Process Building	Unknown	EIS-S	57	NR	NR	NR	42,000	NR	NR	NR	NR
300-25	Process Building	Unknown	EIS-S	NR	NR	NR	NR	NR	NR	NR	NR	NR
316-3[c]	Trenches	Unknown	EIS-S	NR	NR	NR	NR	NR	NR	NR	NR	NR
300-296	UPR	2014[d]		NR	NR	NR	NR	460,000	NR	NR	NR	NR

a. NR = Not reported for indicated EU
b. EIS-S = DOE/EIS-0391 2012
a. Contaminated sediments excavated and removed in 1963; trench backfilled in 1965; removal, treatment, and disposal planned. (DOE/EIS-0391 2012, Appendix S)
b. Estimated decayed amount of original spill material in 2014

Table F.2-4. Inventory of Primary Contaminants (cont)[a]

WIDS	Description	Decay Date	Ref[b]	Ni-59 (Ci)	Ni-63 (Ci)	Pu (total) (Ci)	Sr-90 (Ci)	Tc-99 (Ci)	U (total) (Ci)
All	Sum			NR	NR	7.8	220,000	NR	NR
300-19	Process Building	Unknown	EIS-S	NR	NR	7.8	NR	NR	NR
300-25	Process Building	Unknown	EIS-S	NR	NR	NR	23,000	NR	NR
316-3[c]	Trenches	Unknown	EIS-S	NR	NR	NR	NR	NR	NR
300-296	UPR	2014[d]		NR	NR	NR	200,000	NR	NR

a. NR = Not reported for indicated EU
b. EIS-S = DOE/EIS-0391 2012
c. Contaminated sediments excavated and removed in 1963; trench backfilled in 1965; removal, treatment, and disposal planned. (DOE/EIS-0391 2012, Appendix S)
d. Estimated decayed amount of original spill material in 2014

Table F.2-5. Inventory of Primary Contaminants (cont)[a]

WIDS	Description	Ref[b]	CCl4 (kg)	CN (kg)	Cr (kg)	Cr-VI (kg)	Hg (kg)	NO3 (kg)	Pb (kg)	TBP (kg)	TCE (kg)	U (total) (kg)
All	Sum		NR	NR	NR	NR	10	NR	NR	NR	NR	NR
300-19	Process Building	EIS-S	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
300-25	Process Building	EIS-S	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
316-3[c]	Trenches	EIS-S	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
300-296	UPR		NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

a. NR = Not reported for indicated EU
b. EIS-S = DOE/EIS-0391 2012
c. Contaminated sediments excavated and removed in 1963; trench backfilled in 1965; removal, treatment, and disposal planned. (DOE/EIS-0391 2012, Appendix S)

Table F.2-6. Summary of the Evaluation of Current Threats to Groundwater as a Protected Resource from Saturated Zone (SZ) and Remaining Vadose Zone (VZ) Contamination associated with the Evaluation Unit

PC	Group	WQS	Porosity[a]	K_d (mL/g)[a]	ρ (kg/L)[a]	VZ Source M^{Source}	SZ Total M^{SZ}	Treated[c] M^{Treat}	VZ Remaining M^{Tot}	VZ GTM (Mm^3)	VZ Rating[d]
C-14	A	2000 pCi/L	0.18	0	1.84	---	---	---	---	---	*ND*
I-129	A	1 pCi/L	0.18	0.2	1.84	---	---	---	---	---	*ND*
Sr-90	B	8 pCi/L	0.18	22	1.84	1.98E+05 Ci	---	---	1.98E+05 Ci	1.09E+05	*Low*[(e)]
Tc-99	A	900 pCi/L	0.18	0	1.84	---	---	---	---	---	*ND*
CCl4	A	5 µg/L	0.18	0	1.84	---	---	---	---	---	*ND*
Cr	B	100 µg/L	0.18	0	1.84	---	---	---	---	---	*ND*
Cr-VI	A	48 µg/L[b]	0.18	0	1.84	---	---	---	---	---	*ND*
TCE	B	5 µg/L	0.18	2	1.84	---	---	---	---	---	*ND*
U(tot)	B	30 µg/L	0.18	0.8	1.84	---	---	---	---	---	*ND*

a. Parameters obtained from the analysis provided in Attachment 6-1 to Methodology Report (CRESP 2015).

b. "Model Toxics Control Act—Cleanup" (WAC 173‑340) Method B groundwater cleanup level for hexavalent chromium.

c. Treatment amounts from the 2015 Hanford Annual Groundwater Report (DOE/RL-2016-09, Rev. 0).

d. Groundwater Threat Metric rating based on Table 6-3, Methodology Report (CRESP 2015).

e. There is no driving force for Sr-90 to move in the subsurface over the next 150 years unless the current cover provided by the building structure (concrete floor and foundation) is removed or another source of water is introduced. The rupture of the pressurized water pipe serving the building's fire suppression system could provide necessary water infiltration for movement. Thus a *Low* rating would apply for the Active Cleanup period (and after) to account for uncertainties.

PART VI. POTENTIAL RISK/IMPACT PATHWAYS AND EVENTS

CURRENT CONCEPTUAL MODEL

Narrative description of pathways and barriers to receptors and conditions/events that can lead to completed pathways

Pathways and Barriers: (1. description of institutional, natural and engineered barriers (including material characteristics) that currently mitigate or prevent risk or impacts, 2. Time scale from loss of each barrier to realization of risk or impacts)

Briefly describe the current institutional, engineered and natural barriers that prevent release or dispersion of contamination, risk to human health and impacts to resources:

What nuclear and non-nuclear safety accident scenarios dominate risk at the facility? What are the response times associated with each postulated scenario?

Large amounts of radioactive material have been removed from the building, but as much as 65,000 curies of ^{137}Cs and ^{90}Sr dispersible activity remains, especially in A-Cell, B-Cell, and vault tank areas. Additionally, as noted earlier, soil under B-Cell is highly contaminated from ^{137}Cs-^{90}Sr solution that leaked through the hot cell liner in 1986. The contaminated soil represents the largest quantity of radioactive material associated with the 324 Facility. There is some uncertainty in the exact quantities and locations, so conservative bounding assumptions were used in the most current DSA prepared by the contractor Washington Closure Hanford.

A 1995 PNNL study indicates the structural design of the REC and SMF cannot withstand an earthquake having a peak ground acceleration greater than 0.139 g. This seismic capacity is insufficient to withstand an earthquake with a peak ground acceleration of 0.2 g required for a Hanford Hazard Category 2 facility. The study concludes that structural damage would result in a loss of confinement of radiological materials in the hot cells. The resulting shock/vibration would suspend radioactive and hazardous materials and the seismic loading would breach the structural integrity of the building, resulting in an uncontrolled release to the environment.

A fire in B-Cell is a high consequence event because of the potential for radiological release of dispersible ^{137}Cs and ^{90}Sr still remaining. However, flammable and combustible liquids (e.g., ethanol, hydraulic fluid, lubricants) are not present in the hot cells in bulk quantities. Lubricants are present in equipment such as overhead cranes. The combustible loading in the REC consist of mixed combustibles on the floors, wire insulation, and plastic sleeves on the manipulators. The largest combustible inventory in the hot cells is the oil that fills the cell windows. The structure of the window has barriers to prevent leakage of oil into the cell. The inside surface of the windows would have to be breached by heat from a fire or by mechanical damage to provide a means for the window oil to become involved in a cell fire. Without involving the oil from the windows, the combustible loading maintained in the B-Cell is not sufficient to result in a significant radiological release.

What are the active safety class and safety significant systems and controls?

The building's ventilation, HEPA filtration and 150-foot exhaust stack provide active safety systems to minimize the consequences of radioactive and chemical contaminates releases to the air inside and outside the hot cells.

What are the passive safety class and safety significant systems and controls?

A seismic event that exceeds the structural design may still be sufficient to enable workers to escape/evacuate Building 324 or areas being worked on before complete or critical area collapse, given the immense size and configuration of the building and cells. Cell operating procedures restrict quantity and use of flammable liquids and combustible materials inside the cells. Washington Closure Hanford and DOE sites training and emergency preparedness, and training and experience of Hanford Fire Department provide passive safety class and safety significant systems and controls.

What are the current barriers to release or dispersion of contamination from the primary facility? What is the integrity of each of these barriers? Are there completed pathways to receptors or are such pathways likely to be completed during the evaluation period?

Building 324 is a substantial concrete and steel structure, with a poured-in-place reinforced concrete foundation structure. The superstructure is insulated fluted steel industrial panel supported on a structural steel frame. The parapeted roof has a slightly sloped steel deck covered with concrete with gravel-finished built-up roofing. The hot cell walls are constructed of 1.2-meter-thick, high-density concrete or 1.4-meter-thick, normal-density concrete. There is no known evidence of deterioration. Confinement of radioactive particulate matter within the shielded cells is provided by a directed airflow through a high-efficiency particulate air (HEPA) filtered ventilation system. Thus, there is minimal to no risk or a release or dispersion of contaminants to the outside. In general, several barriers in the 324 Building preclude the release of radioactive or other hazardous materials, consistent with the DOE-Hanford defense-in-depth concept.

Workers within the building currently involved in S&M activities wear protective equipment and monitoring devices that have proven to be effective barriers to exposure in recent years on the basis of the contractor's and the site's safety record.

Contaminates under B-Cell do not represent a risk to workers or the public in their current configuration. Workers are not directly exposed to the material because it is located below grade beneath a concrete slab and portions of the 324 Building. And because the contamination remains underground, there is not a dispersion pathway for the material to reach the atmosphere. Migration of the material through the soil into groundwater requires a driving force, such as a large source of water.

What forms of initiating events may lead to degradation or failure of each of the barriers?

A strong seismic event that causes the catastrophic collapse of the building would release some radioactive contaminants inside the building and/or to the environment, but the robustness of the cells and building configuration will reduce the potential impacts.

In its current state, the greatest risk to the contaminates in the soils is an event such as the rupture of the buildings fire protection water line that would release a sufficient amount of water on the ground closest to the B-Cell that would cause the ^{137}Cs and ^{90}Sr to migrate into groundwater.

What are the primary pathways and populations or resources at risk from this source?

If a significant release of water to the contaminated soil area occur, the contaminants could eventually make their way to the Columbia River. Although the level of contamination at the point of entry into the groundwater would likely represent a violation of State and/or Federal clean water standards, it is believed that its eventual mixing with the large Columbia River would cause it to dissipate and not cause any risk to the public. However, there may be high levels of ^{137}Cs and ^{90}Sr in the hyporheic transition zone that might impact aquatic organisms that reside in this zone e.g., salmon eggs.

What is the time frame from each of the initiating events to human exposure or impacts to resources?

It is unknown and dependent on the amount of liquid being sufficient to cause considerable migration of the contaminants.

Are there current on-going releases to the environment or receptors?

Not at this time

POPULATIONS AND RESOURCES CURRENTLY AT RISK OR POTENTIALLY IMPACTED

Facility Worker

S&D Workers inside the building may be exposed to residual radioactive and chemical contaminants, but are protected by special equipment. Workers outside Building 324 are not directly exposed to the contaminated soils because they are located below grade beneath a concrete slab and portions of the building. And because the contamination remains underground, there is not a dispersion pathway for the material to reach the atmosphere.

Co-Located Person (CP)

CPs are not directly exposed to the contaminated soils because they are located 100 meters away from the building, and the soils are below grade beneath a concrete slab and portions of the building. And because the contamination remains underground, there is not a dispersion pathway for the material to reach the atmosphere. There is a low risk of exposure through dispersal of radioactive materials from an accident at the building site.

Public

The contamination remains underground or within the hot cells, there is not a dispersion pathway for the material to reach the atmosphere and travel outside the site boundary.

Groundwater

Migration of the contaminants through the soil into groundwater requires a driving force (source of water to mobilize the contamination). This driver is not present at this time. The Sr-90 is not expected to move in the subsurface over the next 150 years that would typically lead to a rating of ND. However, because of the large remaining inventory, proximity of the contamination to the Columbia River, and shallow groundwater in the river area, a rating of *Low* is used for the Active Cleanup period.

The rupture of the pressurized water pipe serving the building's fire suppression system is a potential accident scenario that could provide necessary water infiltration for movement.

Columbia River

Migration of the contaminants through the soil into groundwater requires a driving force (source of water) to mobilize the contamination, which would have to travel to groundwater and then to the river. However, this driving force is not present, which leads to a rating of ND.

Ecological Resources

- The EU consists entirely of level 0 resources.
- No species listed by the US Fish and Wildlife Service or listed by Washington State as species of conservation concern were observed within or in the vicinity of the EU.
- No level 3 or higher habitat resources exist within a 231 m radius of the unit.

- Because the EU lies within and adjacent to a highly disturbed industrial area, the cleanup activities associated with the 324 building would not be expected to impact habitat connectivity.

Cultural Resources

- There are no known recorded archaeological sites or TCPs located within the 324 Building EU.
- The 324 Building is a contributing property within the Manhattan Project/Cold War era Landscape with documentation required is located within the 324 Building EU. In accordance with the 1998 *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan (*DOE/RL-97-56), all documentation requirements have been completed for this property.

Archaeological sites, buildings and TCPs located within 500 meters of the EU

- The numerous buildings within 500 m of the EU that are all contributing properties within the Manhattan Project/Cold War Era Landscape with documentation required and are within 500 meters of the 324 building EU. In accordance with the 1998 *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan (*DOE/RL-97-56), all documentation requirements have been completed for these properties.
- The numerous buildings within 500 m of the EU that are all contributing properties within the Manhattan Project/Cold War Era Landscape with no documentation required and are within 500 meters of the 324 building EU. In accordance with the 1998 *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan (*DOE/RL-97-56), all documentation requirements have been completed for these properties.
- There are five archaeological sites located within 500 meters of the 324 Building EU. These include one isolated find, three National Register-eligible sites, and a State-Registered archaeological district associated with the Native American Precontact and Ethnographic Landscape and one isolated find associated with the Pre-Hanford Early Settlers and Farming Landscape.

Recorded TCPs Visible from the EU

- There are no known recorded TCPs known to be visible from the 324 Building EU or within the immediate vicinity.

CLEANUP APPROACHES AND END-STATE CONCEPTUAL MODEL

Selected or Potential Cleanup Approaches

In December 2011, WCH[9] reviewed and considered about one hundred means and methods for waste removal, stabilization, treatment, packaging, and disposal of the contaminated soil beneath Building 324, and narrowed them down to fourteen remediation alternatives that were evaluated against regulatory, protection of human health, proven technology and other screening criteria. A total of 15 attributes were used in the scoring, with each being assigned a weight of 1-4 in terms of its relative importance to achieving the remediation objective and then a risk priority score of 1-8 to represent the likelihood and consequence of an accident or negative event. The higher weight and risk score the better the alternative. The maximum total score for any remedial alternative was 280.

[9] Remediation Alternatives Evaluation for Contaminated Soil Beneath the 324 Building, WCH-503, Rev. 0, December 2011

Of the fourteen, the four that had strong scores (166-204) and were consistent with the Final ROD involved those that extract the contaminated soil up through the B-Cell floor, utilize the existing facility's ventilation system to move it with grout to the C and D Cells, and take advantage of the existing Radiochemical Engineering Complex hot cell structure for containment and shielding. The two alternatives that graded highest (239 and 240) on these same criteria were procedures that would stabilize the contamination in place and leave the contamination in situ with a cap over the site to allow for radiation decay and safer removal and final remediation at a later date. Each of the soil remediation strategies will require a different D&D strategy for the building and hot cells.

Work to stabilize and deactivate Building 324 has been limited since 2012 so as to adequately review these and other alternatives. AREVA was awarded a $19 million contract in January 2014 to design, construct and operate a pilot project designed as "proof of concept" for the remote retrieval of high activity radioactive soils beneath building 324 by September 2015. This method will significantly increase the level of ^{137}Cs and ^{90}Sr within the building's B, C and D Cells, and will necessitate that the outer building shell be demolished and that the three hot cells each be removed in whole or part as monoliths and transported to ERDF for permanent disposal. The early estimate was for the soil mitigation work to be completed about Fall 2016, but possible changes to funding availability in FY 2016 have put this next step on hold, as well as the follow-on demolition of the building and removal and transport of the hot cells to ERDF. Removal of the 324 Building, and the hot cells would be performed under the CERCLA Action Memorandum #2 for the 300 Area Facilities. In addition, closure of the TSD units in the 324 Building would be performed under the RCRA Closure Plan.

No public information has been made available to date regarding the status and results of AREVA's prototype development of the proposed remote excavation process. WCH contract is expiring and it is being replaced by CH2M Hill in September 2016. DOE submitted a Class 2 Modification Request to the Hanford Dangerous Waste Permit in June, which is based on a revised 324 Building Closure Plan[10] developed by CH2M Hill. It modifies the proposed process of extracting the contaminated soils through the floor and estimates that it will require seven years to complete the cleanup of the building and 300-296 contaminated soils. It determined that there is insufficient space in the hot cells adjacent to the B-Cell to accept all of the contaminated soils that it believes would need to be removed up through the B-Cell floor. The objective will now be to remove a sufficient amount of contaminated soil to reduce dose rates to those acceptable in order to complete remediation of remaining contaminated soils using conventional excavation means after the building and foundation are removed. Following completion of the revised through-cell retrieval, the excavation beneath B-Cell will be backfilled with stabilizing agents such as grout or controlled density fill (i.e., self-leveling grout).

The total duration of the four phases of the revised 324 Building closure project will encompass a total of seven years once planning activities are completed.

Two alternatives graded higher than the currently chosen soil remediation method with regard to the Attributes of Radiation Safety, Air Impacts, Contamination Control, Ability to Construct and Operate, and Availability of Equipment/Services, and equal or similar scores to the chosen method for Attributes such as Industrial and Occupational Safety, Administrative Feasibility, and Proven Technology/Process. They are:

- *Grout Injection into Waste Matrix After Building Removal, Leaving Bottom of B Cell in Place, Install Geo-Membrane Cap*. With the structure in place and an operational building ventilation

[10] 324 Building Dangerous Waste Management Units Closure Plan, DOE/RL-96-73, Revision 4, CH2MHill Plateau Remediation Company, June 2016.

system, a drill rig will be placed into B Cell and holes will be drilled to provide access to soil beneath B Cell. Contaminated soil will be stabilized by pumping a high-strength grout into the underlying soil. Following stabilization and demolition of the majority of the Building, the stabilized monolith (consisting of the bottom of B Cell and the contaminated soil) will be left in place and an engineered cap will be constructed over the newly formed monolith to prevent infiltration of water.

- *Inject Polymer and/or Grout Layer Under Contamination, Leaving Bottom of B Cell in Place, Install Geo-Membrane Cap*. With the structure in place and an operational building ventilation system, the bottom of B Cell will be filled with grout material to stabilize contamination. Following the demolition of the 324 Building including the upper portion of B Cell, a horizontal barrier system will be installed under the monolith. The barrier system will consist of a cone-shaped barrier constructed of a polymer and/or grout layer beneath the bottom of contamination. An engineered cap will be constructed over the B Cell area.

Long-term surveillance and maintenance of the 300-296 site would be required in both these instances until the contaminated soils and engineered cap are removed. However, leaving contamination in place was deemed by WCH to be inconsistent with the Final 300 Area ROD and CERCLA documentation for the 300 Area. In addition, regulators (U.S. Department of Energy, Richland Operations, and U.S. Environmental Protection Agency) have indicated that they believe in situ alternatives are not acceptable and would be unfavorable with respect to qualitative consideration of "modifying criteria. These alternative processes would thus require revisions to the CERCLA documents and Final 300 Area ROD.

However, a new study was conducted by WCH in October 2014 and findings of the data analysis were issued in February 2015. As noted earlier, this study produced very different results from the 2011-12 analysis of the soil contamination in terms of how deep the ^{137}Cs and ^{90}Sr contaminates may have migrated, and more importantly that they have migrated horizontally to as much as 4 feet outside the B-Cell foundation footprint. These results raise large uncertainties that will need to be considered before proceeding with the currently chosen method of excavation through the B-Cell floor. This recent study was undertaken nearly four years after the analysis of remediation alternatives for the contaminated soil (WCH-503) and two years after execution of the Final ROD for the Hanford 300 Area that required the application of remove, treat, dispose (RTD) processes such as the current plan to excavate the contaminated soils through the floor of the B-Cell. That soil remediation method may prove to not be technically feasible and sufficiently safe because of the extensive horizontal migration of the ^{137}Cs and ^{90}Sr to outside the B-Cell foundation structure, and other alternatives such as in-situ treatment may require further consideration.

Building 324 is being currently maintained in a safe S&M mode pending completion and evaluation of the AREVA pilot project results and inclusion of the new 2014-15 data.

Contaminant Inventory Remaining at the Conclusion of Planned Active Cleanup Period

Both cleanup alternatives will remove or fully stabilize the contaminated soils, and Building 324 will either entirely or mostly be demolished, and then transported to ERDF. The alternative approach would leave a soil monolith and engineered cap in the industrial 300 Area for 100+ years, whereas the DOE's preferred method would remove all contaminates and the building by 2020.

Risks and Potential Impacts Associated with Cleanup

Both cleanup alternatives will put cleanup workers at risk. The DOE preferred method of soil remediation was determined to have a greater potential for workers to be exposed to radiological contamination and dose rates if they are required to enter B-Cell for maintenance and/or repair of

equipment. In addition, the sealing of C and D cells may expose workers to radioactive material in the form of dust and debris.

In addition, studies indicate that Building 324 could not withstand an earthquake with a peak ground acceleration greater than 0.139 g (Hanford HC-2 facilities require minimum of 0.2 g horizontal acceleration capacity). Facility worker consequences could be higher due to possible building collapse during worker preparation of the radiology contaminated interior, and even more so as the very highly contaminated soils currently located beneath B-Cell are excavated and brought into and permanently stored in the B, C and D Cells, as proposed under the preferred DOE soil cleanup methodology.

The alternative method would require an engineered cap over the contaminated soil area, but the area is proposed to remain restricted to industrial uses. About 15-16 facilities will remain in operational use, including Buildings 318, 325, 331 and 350 which PNNL modified in 2009-10 ($34 million in 325 alone) and will continue to use.

POPULATIONS AND RESOURCES AT RISK OR POTENTIALLY IMPACTED DURING OR AS A CONSEQUENCE OF CLEANUP ACTIONS

Facility Worker

See above

Co-located Person

Low risk from accident on building site that would cause sufficient aerial release of contaminates to reach Co-located Person.

Public

Low risk from accident on building site that would cause sufficient aerial release of contaminates to reach Public

Groundwater

Migration of the contaminants through the soil into groundwater requires a driving force (i.e., source of water) to mobilize the contamination. This driver is not present at this time. The Sr-90 is not expected to move in the subsurface over the next 150 years that would typically lead to a rating of ND. The rupture of the pressurized water pipe serving the building's fire suppression system is a potential accident scenario that could provide necessary water infiltration for movement. However, because of the large remaining inventory, proximity of the contamination to the Columbia River, and shallow groundwater in the river area, a rating of *Low* is used.

Columbia River

Migration of the contaminants through the soil into groundwater requires a driving force (source of water) to mobilize the contamination that would then have to travel through groundwater to the river. Such a driving force does not current exist. This leads to a rating of ND.

Ecological Resources

No ecological resources are in this EU, and thus there are no effects

Cultural Resources

Personnel, car, and truck traffic on paved roads as well as use of heavy equipment will not have any direct impact on archaeological resources because there is no disturbance to soil/ground or alteration to the landscape. Assuming heavy equipment locations and staging areas have been cleared for cultural

resources, then it is assumed adverse effects would have been resolved and/or mitigated. If heavy equipment locations and staging areas have not been cleared, this could result in artifact breakage and scattering, compaction and disturbance to the soil surface and immediate subsurface, thereby compromising stratigraphic integrity of an archaeological site. TCPs may be directly affected if personnel are on roads located on TCP and if personnel are unaware of cultural resource sensitivity, appropriate behaviors and protocols. For traffic on paved roads located on TCP, direct effects include visual, auditory and vibrational alterations to landscape/setting. Heavy equipment may cause direct effects to TCPs including destruction of culturally important plants, physical attributes of the TCP and introduction of noise and vibrations also altering the setting. These actions may interfere with traditional uses of TCP. Revegetation activities may cause direct effects to TCPs include physical alteration to or restoration of TCP depending on how the area is recontoured and what plants are selected for revegetation.

Indirect effects from personnel, car, and truck traffic on paved roads as well as use of heavy equipment may lead to the introduction of invasive plant species or removal of culturally important plants that alters the landscape/setting for roads located within the viewshed and noise-scape of TCP. Existing road causes no alteration to viewshed or noise-scape. Presence of vehicles may result in visual, auditory and vibrational alterations to landscape/setting. Remediation actions may lead to visual alteration of landscape/setting. Introduction of noise alters landscape/setting. Introduction of equipment and buildings may interfere with traditional uses of TCP. Revegetation could lead to indirect effects from visual alterations to setting depending on how the area is recontoured and what plants are selected for revegetation.

ADDITIONAL RISKS AND POTENTIAL IMPACTS IF CLEANUP IS DELAYED

There is no risk to the Facility Worker, CP or Public if cleanup of the soils or building is delayed. There is no known physical deterioration occurring in Building 324 or its several hot cells, and recent measures were taken to improve the condition of its interior and to prevent rain from reaching soils covering the recent excavation. Studies indicate that the contaminants are not moving from their current location in the soils and thus not threatening groundwater, although additional groundwater monitoring is recommended to ensure that contaminants do not migrate toward the River and provide early indication of any change. There are potential benefits to near-term measures that prevent infiltration to the soils (e.g., covers or in-situ grouting) and allow time for an order of magnitude decrease in radiation levels due to natural decay (ca. 90 years) or allowing natural attenuation to achieve long-term environmental safety.

NEAR-TERM, POST-CLEANUP STATUS, RISKS AND POTENTIAL IMPACTS

Both cleanup alternatives will remove or fully stabilize the contaminated soils, and Building 324 will either entirely or mostly be demolished, and then transported to ERDF. The currently proposed methodology would remove the Cs and Sr, but it is unclear if an attempt will be made to remove 100% of the contaminants or if a portion will be allowed to remain and decay. This work would be completed by 2020. The alternative approach would encapsulate these contaminants in a presumably safe soil monolith, and the Building 324 foundation and engineered cap would protect it from water infiltration for 50-100 years. The engineered cap, including sub-surface B-Cell walls and other Building 324 foundation would then be removed and transported to ERDF along with the soil monolith.

POPULATIONS AND RESOURCES AT RISK OR POTENTIALLY IMPACTED AFTER CLEANUP ACTIONS (FROM RESIDUAL CONTAMINANT INVENTORY OR LONG-TERM ACTIVITIES)

Table F.2-7. Populations and Resources at Risk

Population or Resource		Risk/Impact Rating	Comments
Human	Facility Worker	Not Discernible (ND)	No workers will be present.
	Co-located Person	ND	None
	Public	ND	None
Environmental	Groundwater (A&B) from vadose zone[(a)]	*Low* (Sr-90)	Contaminant migration through the soil into groundwater requires a driving force (source of water) to mobilize the contamination. Driver not present at this time. Sr-90 is not expected to move in the subsurface over the next 150 years typically leading to a rating of ND. However, the *Low* rating is applied to account for uncertainties.
	Columbia River from vadose zone[(a)]	ND	Migration of the contaminants through the soil into groundwater requires a driving force (source of water to mobilize the contamination). This leads to a rating of ND.
	Ecological Resources[(b)]	ND-Low	Any risk depends upon the quality and quantity of re-vegetation following remediation. Could be a risk from invasion of exotic species.
Social	Cultural Resources[(b)]	**Native American:** Direct: Unknown Indirect: Known **Historic Pre-Hanford:** Direct: Known Indirect: None **Manhattan/Cold War**: Direct: None Indirect: None	No expectations for impacts to known cultural resources.

a. Threat to groundwater or Columbia River for Group A and B contaminants remaining in the vadose zone.

b. For both Ecological and Cultural Resources see Appendices J and K, respectively, for a complete description of Ecological Field Assessments and literature review for Cultural Resources. Ecological ratings are described in Table 4-11 of the Final Report.

LONG-TERM, POST-CLEANUP STATUS – INVENTORIES AND RISKS AND POTENTIAL IMPACT PATHWAYS

The currently proposed methodology would remove the Cs and Sr, but it is unclear if an attempt will be made to remove 100% of the contaminants or if a portion will be allowed to remain and decay. This

work would be completed by 2020. The alternative approach would encapsulate these contaminants in a presumably safe soil monolith, and the Building 324 foundation and engineered cap would protect it from water infiltration for 100 years. The engineered cap, including sub-surface B-Cell walls and other Building 324 foundation would then be removed and transported to ERDF along with the soil monolith.

PART VII. SUPPLEMENTAL INFORMATION AND CONSIDERATIONS

The Final Hanford 300 Area ROD contains the following under Declaration of the Record of Decision; 4.0 Description of the selected remedies and ROD Amendment: (page iii)

"Principal threat wastes exist in three waste sites in 300-FF-2. Soil in waste site 300-296 below the 324 building, vertical pipe units at the 618-10 and 618-11 burial ground waste sites and caissons at 618-11 contain principal threat waste. Under the selected remedy for 300-FF-2, all principal threat waste will be treated where practicable to reduce the toxicity, mobility, contamination or radiation exposure, including some that will be treated in-situ prior to removing the waste for disposal. Treatment will be with grout or an alternative method approved by EPA during remedial design." This would appear to permit implementation and use of the alternative soil remediation option which involves injecting a grout or polymer into and/or under the waste matrix beneath Building 324. The majority of the building would be demolished and transported to ERDF for disposal; however, the B-Cell foundation would remain and used as part of an engineered cap over the area. The monolith contaminants would be removed in 50-100 years and transported to ERDF.

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