APPENDIX E.1

Tank Waste and Farms

Common Elements of the Tank Waste and Farms Evaluation Unit Summary Templates

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PART E.1. COMMON ELEMENTS OF TANK WASTE AND FARMS EVALUATION UNITS

E.1.1. EXECUTIVE SUMMARY

Nine Tank Waste and Farms Evaluation Units (EUs) were identified for the Interim Report (CRESP 2015b) as indicated in Table E.1-1. These evaluation units (also denoted Tank Farm Evaluation Units, Tank Farm EUs or TF EUs), include the 149 Hanford single-shell tanks (SSTs) and 28 double-shell tanks (DSTs) and ancillary equipment and geographically co-located legacy disposal sites located in the Central Plateau on the Hanford Site.

EU LOCATION

The locations of the nine Tank Waste and Farms EUs are indicated in Table E.1-1.

RELATED EUS

The nine Tank Waste and Farms EUs listed in Table E.1-1, 200-E Groundwater (CP-GW-1), 200-W Groundwater (CP-GW-2), and 200 Area HLW Transfer Pipeline (CP-LS-7).

Table E.1-1. Tank and Waste Farms Evaluation Units and Tank Information included in the Final Report (corresponding co-located legacy sites not listed). These evaluation units include all 149 single-shell and 28 double-shell tanks on the Hanford Site.

Evaluation Unit	Tank Farm(s)	Waste Management Area(s)	Tank Type	No. of Tanks	Location	Section
CP-TF-1	241-T (T)	WMA T	Single-shell	16	200-West	Part 2
CP-TF-2	241-S/SX (S-SX)	WMA S-SX	Single-shell	27	200-West	Part 3
CP-TF-3	241-TX/TY (TX-TY)	WMA TX-TY	Single-shell	24	200-West	Part 4
CP-TF-4	241-U (U)	WMA U	Single-shell	16	200-West	Part 5
CP-TF-5	241-A/AX (A-AX)	WMA A-AX	Single-shell	10	200-East	Part 6
CP-TF-6	241-B/BX/BY (B-BX-BY)	WMA B-BX-BY	Single-shell	40	200-East	Part 7
CP-TF-7	241-C (C)	WMA C	Single-shell	16	200-East	Part 8
CP-TF-8	241-AN/AP/AW/AY/AZ (AN-AP-AW-AY-AZ)	Not applicable	Double-shell	25	200-East	Part 9
CP-TF-9	241-SY (SY)	Not applicable	Double-shell	3	200-West	Part 10

PRIMARY CONTAMINANTS, CONTAMINATED MEDIA AND WASTES

See information for the specific Tank Waste and Farms EU for information.

BRIEF NARRATIVE DESCRIPTION

Brief narratives are provided for each specific Tank Waste and Farms EU.

SUMMARY TABLES OF RISKS AND POTENTIAL IMPACTS TO RECEPTORS

Table E.1-2 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* (FW) is an individual located anywhere within the boundaries of the Tank and Waste Farms Evaluation Units (typically within the fence line surrounding the Tank Farm Waste Management Unit and those surrounding areas where tank wastes have been discharged into legacy waste sites). Quantitative estimates of radiological and toxicological consequences for a *Facility Worker* (either with or without controls) are not provided in the Tank Farms Documented Safety Analysis (DSA) (RPP-13033) or Hazard Evaluation Database Report (RPP-13482, Rev. 10-O); however, the results of a qualitative assessment of significant impacts to a *Facility Worker* (e.g., prompt death, serious injury, or significant radiological or chemical exposure) are provided in the DSA and described in the Hazard Evaluation Database Report. For the Tank Farms evaluation, it is assumed that the *Facility Worker* would be exposed to at least as severe consequences as the *Co-located Person* (see below) although there are circumstances (e.g., stack release) where the *Facility Worker* would likely be less impacted. Thus the *Facility Worker* receives the same rating as the analogous *Co-located Person* unless the *Facility Worker* is subject to a significant impact; in this case, the rating would be *High*.

A *Co-located Person (CP)* is an on-site individual located 100 meters from the boundary of the Tank and Waste Farms Evaluation Units. For the purpose of evaluating on-site postulated accidents in the Tank Farms DSA (RPP-13033), radiological and toxicological consequences for the *maximum onsite individual* are calculated at or beyond 100 m from the point of release at which the maximum dose occurs from a ground-level release. The individual may be further than 100 m from the release point for elevated releases from ventilation system stacks. The DSA provides estimates of likelihood and consequence for these workers *without controls* (i.e., "unmitigated"). When there are credited controls, the corresponding ("mitigated") likelihood and consequence are also provided. If no results (particularly consequences) are provided in the DSA for "mitigated" conditions (i.e., those with controls), then the ratings are assumed to be *Low* (otherwise the DOE Standard would indicate that additional controls would be required until consequences are sufficiently low to proceed).

The *Public* is represented by an individual located at the closest point on the Hanford Site security boundary, which is the bank of the Columbia River near the 100-B/C area 8,690 m N / NNW of the Tank Farm areas (RPP-13482, Rev. 7, p. 2-4). For the purpose of evaluating postulated off-site accidents in the Tank Farms DSA (RPP-13033), radiological and toxicological consequences for the *maximum offsite individual* are calculated at or beyond the Hanford Site boundary location at the distance from the point of release at which the maximum dose occurs.

Human health risks are based on unmitigated (uncontrolled conditions) consequences expressed as ratings ranging from *Not Discernible* (*ND*) and *Low* to *High*. The estimated mitigated consequence, that takes credited engineered and administrative controls and protections into consideration, is shown in parentheses.

Groundwater and Columbia River: Direct and potential impacts to groundwater resources and the Columbia River (including potential contaminant impacts on the benthic and riparian zones) have been evaluated for each of the TF EUs based on available information for the current state and for the future evaluation periods described in the Methodology Report (CRESP 2015a). These impacts are also expressed as ratings ranging from *Not Discernible* (*ND*) and *Low* to *Very High* in each TF EU section.

Ecological Resources: Ratings are based on the degree of physical disruption (and potential additional exposure to contaminants) in the current state and as a potential result of remediation options for the future evaluation periods as described in Chapter 7 of the Methodology Report (CRESP 2015a).

Cultural Resources: No ratings are provided for Cultural Resources. Table E.1-2 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. The Cultural Resources evaluation is specific to each TF EU and described in the appropriate section.

Table E.1-2. Impact Rating Summary for Human Health (unmitigated basis with mitigated basis provided in parentheses (e.g., "High (Low)").

Population or Resource		Evaluation Time Period Active Cleanup (to 2064) **Current Condition:** Maintenance & Monitoring (M&M)	Evaluation Time Period Active Cleanup (to 2064) **From Cleanup Actions:** Retrieval & Closure
Human Health	Facility Worker	***M&M***: Low-High[a] (Low-High)[a] ***Soil***: ND-High (ND-Low)	***Preferred method***: High (Low) ***Alternative***: High (Low)
	Co-located Person	***M&M***: Low-Moderate (Low) ***Soil***: ND (ND)	***Preferred method***: Low-Moderate (Low) ***Alternative***: Low-Moderate (Low)
	Public	***M&M***: Low (Low) ***Soil***: ND (ND)	***Preferred method***: Low (Low) ***Alternative***: Low (Low)
Environmental	Groundwater (A&B) from remaining vadose zone contamination	Single-shell Tank (SST) Farm EUs[c] 200-W Overall: *Low* to *High* CP-TF-1 (T): *High* -- Cr(tot), Cr-VI CP-TF-2 (S-SX): *High* -- Cr(tot), Cr-VI CP-TF-3 (TX-TY): *High* -- Tc-99, CCl_4, Cr(tot), Cr-VI CP-TF-4 (U): *Low* (all PCs) 200-E Overall: Medium to High CP-TF-5 (A-AX): *Med* -- Cr(tot), Cr-VI CP-TF-6 (B-BX-BY): *High* -- Tc-99, Cr(tot), Cr-VI CP-TF-7 (C): *Medium* -- I-129, Tc-99 Double-shell Tank (DST) Farm EUs[c] CP-TF-8 (200 East): *Low* (all PCs) CP-TF-9 (200 West): *ND*	SST Farm EUs[c] 200-W Overall: *Low* to *High* CP-TF-1 (T): *High* -- Cr(tot), Cr-VI CP-TF-2 (S-SX): *High* -- Cr(tot), Cr-VI CP-TF-3 (TX-TY): *High* -- Tc-99, CCl_4, Cr(tot), Cr-VI CP-TF-4 (U): *Low* (all PCs) 200-E Overall: Medium to High CP-TF-5 (A-AX): *Med* -- Cr(tot), Cr-VI CP-TF-6 (B-BX-BY): *High* – Tc-99, Cr(tot), Cr-VI CP-TF-7 (C): *Medium* -- I-129, Tc-99 DST Farm EUs[c] CP-TF-8 (200 East): *Low* (all PCs) CP-TF-9 (200 West): *ND*
	Columbia River from remaining vadose zone contamination	All SST and DST Farm EUs[d] Benthic: Not Discernible (all) Riparian: Not Discernible (all) Free-flowing: Not Discernible (all) **Overall**: Not Discernible	All SST and DST Farm EUs[d] Benthic: Not Discernible (all) Riparian: Not Discernible (all) Free-flowing: Not Discernible (all) **Overall**: Not Discernible
	Ecological Resources[b]	Refer to specific Tank and Waste Farms EU (Appendix E.2 – E.10)	Refer to specific Tank and Waste Farms EU (Appendix E.2 – E.10)

Population or Resource		Evaluation Time Period	
		Active Cleanup (to 2064)	
		Current Condition: Maintenance & Monitoring (M&M)	**From Cleanup Actions:** Retrieval & Closure
Social	Cultural Resources[(b)]	Refer to specific Tank and Waste Farms EU (Appendix E.2 – E.10)	Refer to specific Tank and Waste Farms EU (Appendix E.2 – E.10)

a. ***Industrial safety*** consequences range from low to high (based on the evaluation scale used) for both mitigated (with controls) and unmitigated (without controls). ***Radiological and toxicological*** consequences to facility workers are high (unmitigated) and low (mitigated).

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. Refer to Table E.1-3 for details. The Overall *High* ratings for the 200-West SST and Waste Farms EUs are driven by chromium (total and hexavalent) for most EUs; whereas, the U Tank Waste and Farms EU has a *Low* rating. The Overall *Medium* and *High* ratings for the 200-East SST Waste and Farms tend to be related to chromium (total and hexavalent) and I-129 with Tc-99 also driving risk. Uranium and Sr-90 would be risk drivers; however, they are predicted to be relatively immobile in the subsurface and Sr-90 will decay significantly during the evaluation periods. There is little variation across the evaluation periods.

d. Refer to Table E.1-4 for details. The ratings with respect to radionuclides are all Not Discernible. Overall *Medium* (benthic) and *High* (riparian zone) ratings for the 200-East SST Farm EUs would be related to hexavalent chromium from Central Plateau sources including others than those for the specific Tank and Waste Farms EU; however, well data indicate that contaminants are moving much more slowly than predicted in the TC&WM EIS (DOE/EIS-0391 2012), which was the basis for the evaluation. There is no variation across the evaluation periods.

SUPPORT FOR RISK AND IMPACT RATINGS FOR EACH POPULATION OR RESOURCE

Human Health

Current

Monitoring & Maintenance: The work being conducted associated with the Tank Farms in the 200 Areas (Hanford Central Plateau) can have impacts related to the following accidents:

Flammable gas accidents: This accident involves flammable gas deflagrations in waste storage vessels/containers (including SSTs) where the bounding event is a flammable gas deflagration from the steady-state generation and accumulation or a gas release event in a DST/SST.

Unmitigated Consequences: Facility Worker – High; CP – Moderate; Public – Low

Mitigation: Based on the results of hazard and accident analyses, safety-significant structures, systems, and components (SSC), Specific Administrative Controls (SAC), and Limiting Conditions for Operations (LCO) have been identified for the Tank Farms. The safety significant SSCs are:

- The *DST primary tank ventilation systems* maintain the concentration of flammable gases below the lower flammability limit in the DST headspace and induced gas release events.
- The *waste transfer primary piping systems* provide confinement of waste to protect the facility worker from flammable gas accidents.

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

Waste transfer leaks: This accident involves a wide spectrum of waste leaks where the bounding event is a fine spray leak using a high head waste transfer pump.

Unmitigated Consequences: Facility Worker – High; CP – Low-Medium; Public – Low

Mitigation: Based on the results of hazard and accident analyses, safety-significant structures, systems, and components (SSC), Specific Administrative Controls (SAC), and Limiting Conditions for Operations (LCO) have been identified for the Tank Farms. The safety significant SSCs are:

- The *waste transfer primary piping systems* to provide confinement of waste to decrease the frequency of a fine spray leak thus protecting the facility worker.
- The *hose-in-hose transfer line systems (HIHTL)* to provide confinement of waste thus decreasing the frequency of a fine spray leak and thus protecting the facility worker.
- The *isolation valves for double valve isolation* to limit the leakage of waste decreasing the consequences of a fine spray leak due to a misroute and thus protecting the facility worker.

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

Releases from a contaminated facility: This accident involves various release mechanisms (i.e., flammable gas deflagrations, fires, load handling accidents, or compressed gas system failures) in contaminated facilities.

Unmitigated Consequences: Facility Worker – High; CP – Low-Moderate; Public – Low

Mitigation: The safety significant SSCs for releases from a contaminated facility are the same as those defined above for waste transfer leaks.

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

Air blow accidents: This accident involves a waste release from a contaminated hose-in-hose transfer line (HIHTL) primary hose assembly and connected waste transfer piping system pressurized by compressed air where the bounding event is a small crack leak below the waste surface.

Unmitigated Consequences: Facility Worker – Low-Moderate; CP – Low-Moderate; Public – Low

Mitigation: Based on the results of hazard and accident analyses, safety-significant structures, systems have been identified for the Tank Farms. The safety significant SSCs are:

- *Compressed air system pressure relieving devices* to limit compressed air system pressure and thus mitigating the consequences of an air blow accident.
- The *waste transfer primary piping systems* to provide confinement of waste.

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

Industrial Safety: An extensive assessment of potential occupational health and safety hazards to Tank Farm workers was completed (Quilici 1993) where hazards were rated based on available information. Rated hazards included:[1]

- *"Low"*: chemicals (separate from vapor issue; see below), noise (task dependent), cold, asbestos (task dependent), electrical
- *"Moderate"*: heat stress, ergonomics (lifting), biological (insect bites), confined spaces

[1] These ratings of low, medium, and high are not to be confused with the rating system developed by CRESP for the Risk Review.

- *"High"*: heat stress (depending on variables), slips, trips, falls, moving vehicles

Among the unmitigated hazards related to the Hanford Tank Farms are reported exposures to vapors from the tanks where short-term, intermittent vapor exposure has led to respiratory irritation symptoms. In 2014 The Hanford Tank Vapor Assessment Team of the Savannah River National Laboratory concluded that available information suggested a causal link between tank vapor releases and the adverse health effects experienced by Hanford tank farm workers (SRNL 2014). Furthermore, an industrial hygiene program emphasizing full-shift exposure measurements and compliance with standard occupational exposure limits cannot adequately characterize the complex, episodic nature of likely tank vapor releases. The team recommended the increased use of personal respiratory protection, improved personal sampling, and further tank vapor characterization.

Unmitigated Consequences: Facility Worker – Low-High, CP – Low-High; Public – Not Discernible

Mitigation: The above ratings are subjective and many factors can affect the rating. A high hazard potential may not mean that much can be done to reduce the potential. For example, slips, trips, and falls remain important hazards throughout industry even when all regulations are met. Moving vehicle accidents also are always high on the list. Conversely, potential hazards associated more with environmental conditions, such as heat stress, noise, mechanical guarding, and chemical exposures usually can be monitored, defined, compared with regulations, and controlled.

Mitigated Consequences: Facility Worker – Low-High, CP – Low-High; Public – Not Discernible

Contaminated Soils: Facility workers are at risk when working in or around the Tank Farm waste tanks not only from tank contents (e.g., radioactive "shine"), vapors, and contaminated equipment, but also to contaminated soil. Exposure to such contaminants is limited because the tanks and contaminated soils in the Tank Farm areas are located below grade. However, during certain operations (e.g., waste tank sampling), there may be the potential for large exposures to radioactive contaminants near the tanks; however, the potential exposure would be very small outside the tank farm area.

Unmitigated Consequences: Facility Worker – Not Discernible (ND)-High, CP – ND; Public – ND

As indicated above, potential exposure to contaminants in the soil is limited because the tanks and contaminated soils in the Tank Farm areas are located below grade. Furthermore, a radiological control program (e.g., radiological work planning and access control) is in place for the Hanford Tank Farms further limits exposures to below accepted standards. Historically, sealing materials and limited engineered barriers have been applied to Tank Farm areas to help control the spread of potentially contaminated soils.

Mitigated Consequences: Facility Worker – Not Discernible (ND)-Low, CP – ND; Public – ND

Potential Impacts from Selected or Potential Cleanup Approaches

There is the potential for radiological, toxicological, industrial impacts to facility workers and co-located persons from accidents during both normal operations and remedial activities (both under the preferred and other alternatives) in the Tank Farms. These activities have been evaluated in the Tank Farms DSA (RPP-13033) as described in Section E.1.6.

Unmitigated Consequences: Facility Worker – High; CP – Low-Moderate; Public – Low

Mitigation: Safety-significant SSCs and controls have been defined (as described in Section E.1.6) to mitigate consequences associated with potential accidents during cleanup.

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

Environmental

Current

Groundwater: The ratings for potential impacts or threats to groundwater as a protected resource are described in the appropriate section for each Tank and Waste Farms EU and are summarized in Table E.1-3. The overall *High* ratings for the 200-West SST Farm EUs are driven by chromium (total and hexavalent) for most EUs with the TX-TY Tank and Waste Farms EU including chromium (total and hexavalent), carbon tetrachloride (CCl_4), and Tc-99. On the other hand, the U Tank and Waste Farms EU has a *Low* rating. The overall *Medium* and *High* ratings for the 200-East SST Farms tend to be related I-129 and chromium (total and hexavalent) with the B-BX-BY TF and C TF EUs also including Tc-99. Despite the large amounts of uranium and Sr-90 in the vadose zone, these primary contaminants are predicted to be relatively immobile in the Central Plateau and thus these ratings do not drive risks to groundwater.

Table E.1-3. Summary of Overall Groundwater Threat Ratings for the Hanford Tank and Waste Farms Evaluation Units[a]

	EU Name	EU	Current	Active Cleanup	Near-term Post-Cleanup
200-W SSTs	T Tank Farm	CP-TF-1	– Cr(tot), Cr-VI	– Cr(tot), Cr-VI	– Cr(tot), Cr-VI
	S-SX Tank Farms	CP-TF-2	– Cr(tot), Cr-VI	– Cr(tot), Cr-VI	– Cr(tot), Cr-VI
	TX-TY Tank Farms	CP-TF-3	– Tc-99, CCl_4, Cr(tot), Cr-VI	– Tc-99, CCl_4, Cr(tot), Cr-VI	– Tc-99, CCl_4, Cr(tot), Cr-VI
	U Tank Farm	CP-TF-4	– Various PCs	– Various PCs	– Various PCs
200-E SSTs	A-AX Tank Farms	CP-TF-5	– Cr(tot), Cr-VI	– Cr(tot), Cr-VI	– Cr(tot), Cr-VI
	B-BX-BY Tank Farms	CP-TF-6	– Tc-99, Cr(tot), Cr-VI	– Tc-99, Cr(tot), Cr-VI	– I-129, Tc-99, Cr(tot), Cr-VI
	C Tank Farms	CP-TF-7	– I-129, Tc-99	– I-129, Tc-99	– I-129
DSTs	200-East (DSTs)	CP-TF-8	– All PCs	– All PCs	– All PCs
	200-West (DSTs)	CP-TF-9	– All PCs	– All PCs	– All PCs

a. Ratings: ○ = Not Discernible ◔ = Low ◑ = Medium ◕ = High ● = Very High

Columbia River: The ratings for potential impacts or threats to groundwater as a protected resource are described in the appropriate section for each Tank and Waste Farms EU and summarized in Table E.1-4. Ratings with respect to radionuclides are all *Not Discernible* (*ND*). The TC&WM EIS screening results would suggest *Medium* (benthic) and *High* (riparian zone) ratings for the 200-East SST Farm EUs for hexavalent chromium; however, well data indicate that contaminants from the Central Plateau are moving toward the Columbia River much slower than predicted in the TC&WM EIS. These results are generally in agreement with the TC&WM EIS conclusions regarding the near-shore region of the Columbia River; that is, there are no adverse effects from groundwater releases to the Columbia River from radioactive or chemical contaminant of potential concern (DOE/EIS-0391 2012, Appendix P, pp. P–53-54). However, because of the uncertainties in such assessments, it is possible that long-term effects (i.e., after the Near-term, post-Cleanup period) are possible to aquatic biota from hexavalent chromium originating from the Central Plateau area (DOE/EIS-0391 2012, p. 2–235).

Table E.1-4. Summary of Columbia River Threat Ratings for the Hanford Tank and Waste Farms Evaluation Units[a]

	EU Name	EU	Current	Active Cleanup	Near-term Post-Cleanup
200-W	T Tank Farm S-SX Tank Farms TX-TY Tank Farms U Tank Farm	CP-TF-1 CP-TF-2 CP-TF-3 CP-TF-4	Benthic – ○ (all) Riparian – ○ (all) **Overall:** ○ [b]	Benthic – ○ (all) Riparian – ○ (all) **Overall:** ○ [b]	Benthic – ○ (all) Riparian – ○ (all) **Overall:** ○ [b]
200-E	A-AX Tank Farms B-BX-BY Tank Farms C Tank Farms	CP-TF-5 CP-TF-6 CP-TF-7	Benthic – ○ (all) Riparian – ○ (all) **Overall:** ○ [c]	Benthic – ○ (all) Riparian – ○ (all) **Overall:** ○ [c]	Benthic – ○ (all) Riparian – ○ (all) **Overall:** ○ [c]
200-E	200-East DSTs	CP-TF-8	Benthic – ○ (all) Riparian – ○ (all) **Overall:** ○ [d]	Benthic – ○ (all) Riparian – ○ (all) **Overall:** ○ [d]	Benthic – ○ (all) Riparian – ○ (all) **Overall:** ○ [d]
200-W	200-West DSTs	CP-TF-9	Benthic – ○ (all) Riparian – ○ (all) **Overall:** ○ [d]	Benthic – ○ (all) Riparian – ○ (all) **Overall:** ○ [d]	Benthic – ○ (all) Riparian – ○ (all) **Overall:** ○ [d]

a. Ratings: ○ = Not Discernible ◔ = Low ◑ = Medium ◕ = High ● = Very High

b. As described in Section E.2.5 (Appendix E.2) for the T TF EU, the screening analysis in the TC&WM EIS (DOE/EIS-0391 2012) was used to evaluate the potential for existing groundwater plumes or remaining vadose zone contamination from the 200 West TF EUs to impact groundwater. Because of the nature of the TC&WM EIS screening analysis, the evaluation was divided into the 200 West EUs and 200 East EUs. Water and contaminant travel time precludes radionuclide or chemical impacts to the Columbia River from the 200 West TF EUs during these evaluation periods.

c. As described in Section E.6.5 (Appendix E.6) for the A-AX TF EU, the screening analysis in the TC&WM EIS (DOE/EIS-0391 2012) was used to evaluate the potential for existing groundwater plumes or remaining vadose zone contamination from the 200 East TF EUs to impact groundwater. Because of the nature of the TC&WM EIS screening analysis, the evaluation was divided into the 200 West EUs and 200 East EUs. Based on the EIS screening results, radionuclides do not pose a threat to the Columbia River, but there are possible chemical threats (e.g., hexavalent chromium) to the Columbia River. However, well data suggest that any contaminant in the 200 East sources are moving much slower than predicted in the TC&WM EIS.

d. There are no current plumes associated with the DST TF EUs. Furthermore, vadose sources are either insignificant (200-E DSTs) or non-existent (200-W DSTs); thus there is insufficient vadose zone contamination to support plumes and impacts to the Columbia River.

Ecological Resources: Please refer to the appropriate Tank and Waste Farms EU section.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

Groundwater: The ratings for potential impacts or threats to groundwater as a protected resource are described in the appropriate section for each Tank and Waste Farms EU and are summarized in Table E.1-3. The overall *High* ratings for the 200-West SST Farm EUs are driven by chromium (total and hexavalent) for most EUs with the TX-TY Tank and Waste Farms EU including chromium (total and

hexavalent), carbon tetrachloride (CCl_4), and Tc-99. On the other hand, the U Tank and Waste Farms EU has a *Low* rating. The overall *Medium* and *High* ratings for the 200-East SST Farms tend to be related I-129 and chromium (total and hexavalent) with the B-BX-BY TF and C TF EUs also including Tc-99. Despite the large amounts of uranium and Sr-90 in the vadose zone, these primary contaminants are predicted to be relatively immobile in the Central Plateau and thus these ratings do not drive the risks to groundwater. The variation across the evaluation periods is very small.

Columbia River: The ratings for potential impacts or threats to groundwater as a protected resource are described in the appropriate section for each Tank and Waste Farms EU and summarized in Table E.1-4. Ratings with respect to radionuclides are all *Not Discernible*. The TC&WM EIS screening results would suggest *Medium* (benthic) and *High* (riparian zone) ratings for the 200-East SST Farm EUs for hexavalent chromium; however, well data indicate that contaminants from the Central Plateau are moving toward the Columbia River much slower than predicted in the TC&WM EIS. There is no variation across the evaluation periods because of how the analysis was performed. Predictions from the TC&WM EIS were used that included sources in addition to those for the TF EUs.

Ecological Resources: Please refer to the appropriate Tank and Waste Farms EU section as ratings can vary across TF EUs.

Social

Current

Cultural Resources: Please refer to the appropriate Tank and Waste Farms EU section as evaluations can vary across TF EUs.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

Cultural Resources: Please refer to the appropriate Tank and Waste Farms EU section as evaluations can vary across TF EUs.

Considerations for Timing of the Cleanup Actions

There is potential for additional tank degradation and further leaks and contaminant transport through the vadose and saturated zones if Tank Farm closure activities are delayed. There is also potential risk from direct radiation and tank waste contaminants to workers (and ecological receptors) from routine Tank Farm operations. However, there would be no *additional* risk to facility workers, co-located persons, or the public if cleanup is delayed.

Near-Term, Post-Cleanup Risks and Potential Impacts

The preferred HLW tank closure alternative includes 99 percent retrieval of waste from the single-shell tanks (SSTs) for staging in double-shell tanks and treatment elsewhere onsite[2]; operations and necessary maintenance, waste transfers and associated operations, and upgrades to existing tanks or construction of waste receipt facilities (DOE/EIS-0391 2012, Chapter 2, p. 2-321). SST closure operations include filling the tanks and ancillary equipment with grout to immobilize residual waste contaminants. Disposal of contaminated equipment and soil would occur on site. Decisions on the extent of soil removal and/or treatment would be made on a tank farm or Waste Management Area basis through the RCRA closure permitting process. The tanks would be stabilized with grout, and an engineered modified RCRA Subtitle C barrier put in place followed by post-closure care.

[2] According to the Hanford Tri-Party Agreement (TPA), the retrieval limits are 360 ft^3 and 30 ft^3 for 100-Series and 200-Series tanks, respectively, (Ecology, EPA, and DOE 1996, Appendix H, p. H-5).

Thus workers and the public would be isolated from the residual contamination in the tanks by both grout and soil cover. Tank waste contamination already in the vadose and saturated zones would experience reduced infiltrating water (the primary driver for the release and transport of contaminants) because of the surface barrier.

Continued monitoring could result in some disturbance to the Ecological Resources in the T TF EU, and buffer lands. Remediation may improve habitat through re-vegetation (and increased monitoring may lead to increases in exotic species, and changes in species composition).

Indirect effects to trail may be permanent (Cultural Resources). Permanent indirect effects to viewshed are possible from capping. Permanent effects may be possible due to presence of contamination if capping occurs.

E.1.2. ADMINISTRATIVE INFORMATION

OU AND/OR TSDF DESIGNATION(S)

The Hanford single-shell tank (SST) farms will be closed under the rubric of Waste Management Areas (WMAs). There are seven WMAs that correspond to the seven Tank Waste and Farms EUs for the Hanford SSTs and two EUs that correspond to the DST farms as indicated in Table E.1-1.

REGULATORY STATUS

DOE is the responsible agency for the closure of all single-shell tank (SST) waste management areas (WMAs) and double-shell tank (DST) farms through post closure, in close coordination with other closure and cleanup activities of the Hanford Central Plateau (CP). Washington State has a program that is authorized under RCRA and implemented through Washington State's Hazardous Waste Management Act (HWMA) and its associated regulations; Ecology is the lead regulatory agency responsible for the closure of the SST system. Specifically, the SSTs are regulated under RCRA as modified in 40 CFR Part 265, Subpart F and HWMA (HWMA, RCW 70.105 and its implementing requirements in the Washington State dangerous waste regulations [WAC 173-303-400]). EPA is the support regulatory agency providing oversight of the state's authorized program. The 200 Areas of the Hanford Site (where the Tank and Waste Farms EUs are located) were placed by EPA on the National Priorities List (NPL). The completion of remediation of the 200 Areas overall will eventually be finalized via CERCLA decisions made by the EPA, and permitting decisions made by Ecology. The primary focus of SST remedial activities involves retrieval of the wastes and transfer to DSTs prior to closure; the relationship among the tank waste retrieval work plans and the overall tank waste retrieval and closure process is described in Appendix I of the Hanford Federal Facility Agreement and Consent Order (HFFACO), along with requirements for the content of TWRWPs.

Decisions concerning the closure of the Hanford double-shell tank (DST) farms are pending; however, it is assumed for the purpose of this Review that the DSTs will be closed in a similar fashion to the SSTs after the SST waste has been staged and treated using the DSTs.

APPLICABLE CONSENT DECREE OR TPA MILESTONES

Federal Facility Agreement and Consent Order, 1989 and amended through June 16, 2014: Milestone M-045-00; Lead Agency Ecology: *Complete the closure of all Single Shell Tank Farms by 01/31/2043*

EU Designation: CP-TF-1 through CP-TF-9

RISK REVIEW EVALUATION INFORMATION

Completed: Revised August 24, 2015

Evaluated by: K. G. Brown

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

E.1.3. SUMMARY DESCRIPTION

CURRENT AND FUTURE LAND USE

All current land-use activities in the 200-West and 200-East Areas (where the Hanford Tank Farms are located) are *industrial* in nature (Hanford 200-Area ROD[3]). All four (future) land-use scenarios listed in the Comprehensive Land Use Plan (CLUP) indicate that the 200-West and 200-East Areas are denoted *Industrial-Exclusive* (DOE/EIS-0222-F). An industrial-exclusive area is "suitable and desirable for treatment, storage, and disposal of hazardous, dangerous, radioactive, and nonradioactive wastes" (DOE/EIS-0222-F).

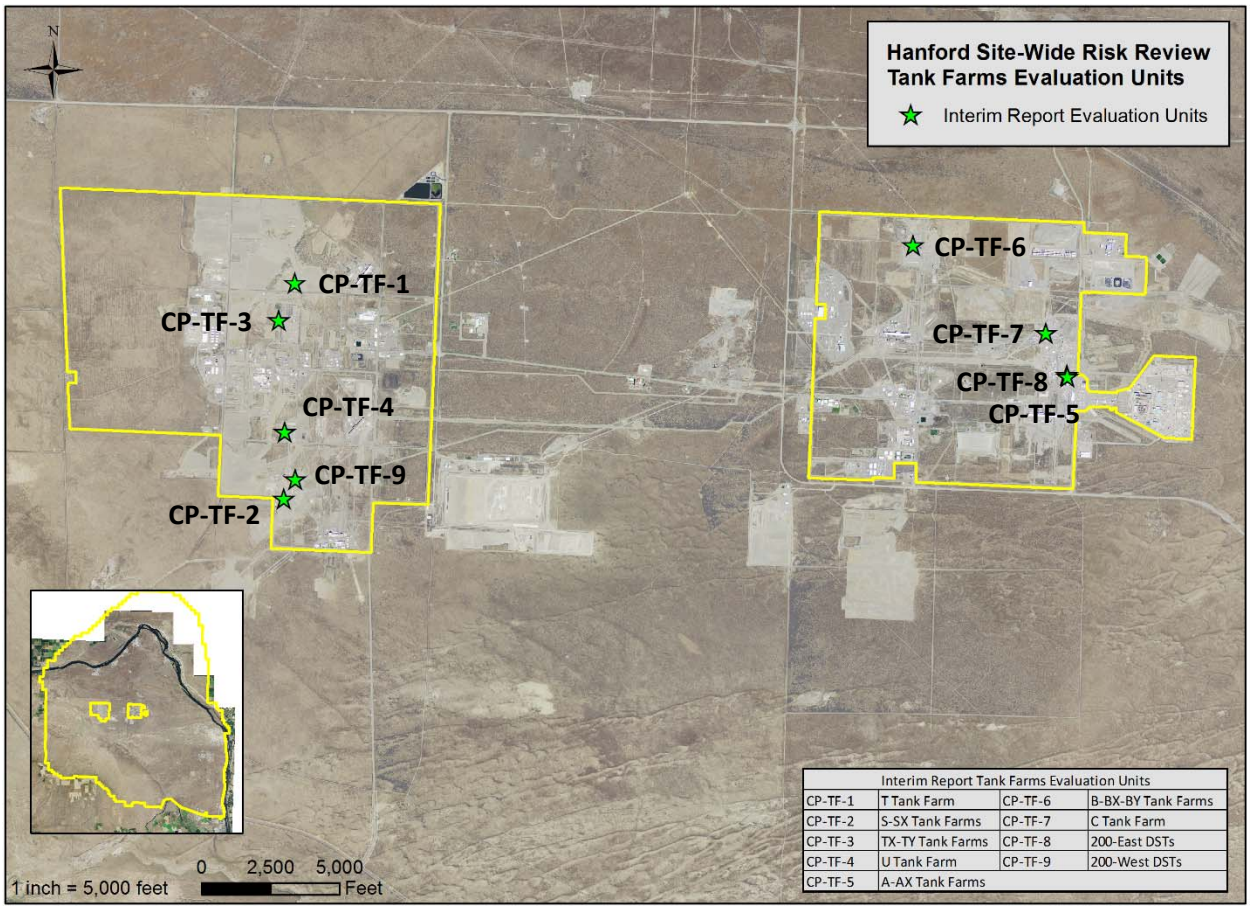
PRIMARY EU SOURCE COMPONENTS

The primary source components (legacy source sites, waste tanks and ancillary equipment, groundwater plumes, operating facilities, etc.) are described in the specific sections as indicated in Table E.1-1.

LOCATION AND LAYOUT MAPS

Figure E.1-1 shows the locations of the Tank Waste and Farms EUs within the Central Plateau of the Hanford Site. Detailed views of the waste tanks, ancillary equipment, legacy source units in each Tank and Waste Farms EU are provided in the relevant EU description as indicated in Table E.1-1.

[3] http://www.epa.gov/region10/pdf/sites/hanford/200/hanford_200_rod.pdf



Interim Report Tank Farms Evaluation Units			
CP-TF-1	T Tank Farm	CP-TF-6	B-BX-BY Tank Farms
CP-TF-2	S-SX Tank Farms	CP-TF-7	C Tank Farm
CP-TF-3	TX-TY Tank Farms	CP-TF-8	200-East DSTs
CP-TF-4	U Tank Farm	CP-TF-9	200-West DSTs
CP-TF-5	A-AX Tank Farms		

Figure E.1-1. General Location of the Hanford Tank and Waste Farms Evaluation Units. The location of the 200-East and 200-West Areas in relation to the Hanford Site Boundary is shown in the inset.

E.1.4. UNIT DESCRIPTION AND HISTORY

EU FORMER/CURRENT USES(S)

The 177 underground waste storage tanks at the Hanford Site were constructed in groups of similarly designed structures called tank farms. Eighteen tank farms are distributed between the 200 East and 200 West areas and are connected by a cross-site transfer line that allows for waste transfers between the areas. Over 50 million gallons of waste are stored in the tank farms. The tanks contain a mixture of liquid, sludge, and saltcake (precipitated solid salts) waste with both radioactive and chemically hazardous constituents. Liquids in the tanks exist as supernatant (liquid above solids) and interstitial liquid (liquid filling the voids between solids). Sludge consists primarily of solids (hydrous metal oxides) precipitated by the neutralization of acid wastes. Saltcake, when present, generally exists from evaporation of water from the waste. These waste types do not necessarily exist as distinct layers but may be intermingled at the interface (RPP-13033).

LEGACY SOURCES

Each Single-shell Tank (SST) Waste and Farms EU has legacy sources (often cribs, trenches, and contaminated near-tank soil sites) associated with it. Please refer to each SST Waste and Farms EU for additional details.

WASTE TANKS

Hanford Single-Shell Tanks

Of the 18 tank farms, 12 are single-shell tank farms that contain 149 of the 177 tanks. The single-shell tank farms, constructed between 1943 and 1964, are in groups of 4 to 18 tanks and are divided between the 200 East and 200 West areas. The original single-shell tank design was a reinforced concrete shell and dome with an internal liner (structurally independent from the reinforced concrete tank) of mild carbon steel covering the bottom and sidewalls. The first single-shell tanks were designed with operating volumes of 530,000 gallons. The succeeding generations of single-shell tanks were built with operating volumes of 758,000 gallons and 1 million gallons. Included among the 149 single-shell tanks are 16 smaller tanks that share the same design as the larger tanks, but have operating volumes of only 55,000 gallons. A typical single-shell tank configuration is shown in Figure E.1-2 (RPP-13033).

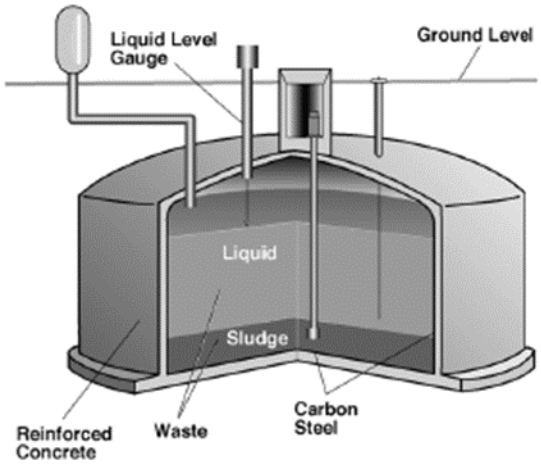


Figure E.1-2. Typical Hanford Single-Shell Tank Design

Hanford Double-Shell Tanks

To provide additional storage capacity, 28 double-shell tanks were built in six tank farms between 1968 and 1986. Five of these tank farms are located in the 200 East Area, and one is located in the 200 West Area. All double-shell tanks are similar in design and each has a storage capacity of approximately 1 million gallons. A typical double-shell tank configuration is shown in Figure E.1-3 (RPP-13033).

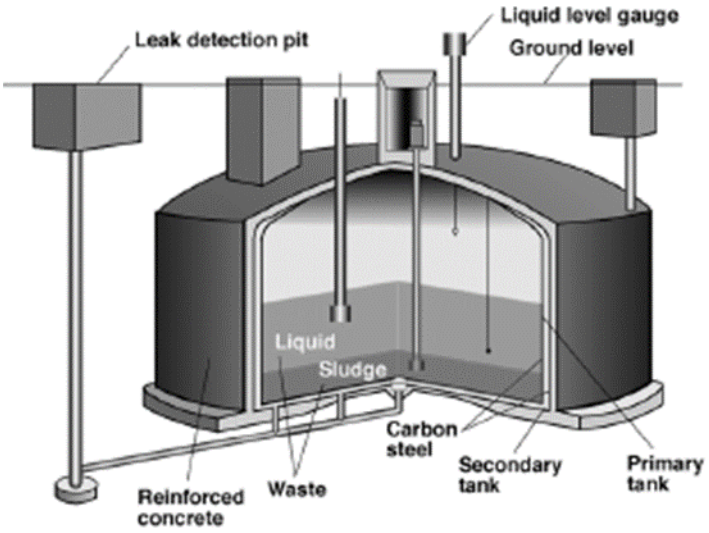


Figure E.1-3. Typical Hanford Double-Shell Tank Design

Each double-shell tank consists of a carbon-steel primary tank and a carbon-steel secondary tank within a protective reinforced concrete shell. The primary tank contains waste, is freestanding, and rests on an insulating concrete pad. The insulating pad rests on the secondary tank and was cast with air distribution and drain grids to provide for leak detection, to maintain a uniform tank bottom temperature, to facilitate heat removal, and to eliminate pockets of water condensation. The secondary tank is 5 feet larger in diameter than the primary tank, providing an air space, or annulus, that separates the two steel tank walls. The secondary tank serves as a barrier to the environment in the event that the primary tank leaks. No double-shell tanks are known to have leaked to the environment.

Classification of Waste in Tanks

The waste in the Hanford single- and double-shell tanks is currently classified as high-level waste (HLW) based on source (reprocessing of spent nuclear fuel: first and second cycle raffinate and other waste streams created by nuclear reprocessing). However, there may be as many as 11 Hanford tanks (T and B Tank Farms) that contain wastes that potentially could be reclassified as contact-handled TRU (CH-TRU) waste (Figure E.1-4) (Tingley, et al. 2004). It has been estimated that processing these 11 tanks for disposal at WIPP could shorten WTP operation by up to 1 year and save as many as 100 canisters of HLW glass. These tanks are undergoing a classification analysis to determine whether the waste may be properly and legally classified as CH-TRU. To change the classification from HLW to TRU, DOE would have to follow the appropriate steps in DOE 435.1.

GROUNDWATER PLUMES

There are existing groundwater plumes in the 200-West and 200-East Areas that result from contamination from the Hanford SSTs and legacy sources. The tank and vadose zone sources are described in detail in the corresponding SST Waste and Farms EU section. The resulting plumes are described in Appendix D.5 and Appendix D.6 for the 200-East (CP-GW-1) and 200-West (CP-GW-2) areas, respectively.

D&D of Inactive Facilities – Not Applicable

Operating Facilities

The Hanford single-shell tanks (SSTs) were declared a non-compliant treatment, storage, and disposal (TSD) facility under RCRA. Furthermore, there was a Congressional mandate that prohibited waste additions to Hanford SSTs after January 1, 1981[4]. Because of concerns with risks resulting from SSTs, the tank waste retrieval process currently planned at Hanford consists of two general phases: 1) retrieving wastes from SSTs to double-shell tanks (that are RCRA-compliant) for staging and subsequent tank closure and 2) mixing of the retrieved and staged SST waste for delivery to treatment facilities at the WTP. Because of the prohibition on waste additions to the Hanford SSTs,[5] the SSTs in the seven SST Waste and Farms EUs are not considered Operating Facilities for this review. However, the double-shell tanks (DSTs) in the two DST Waste and Farms EUs are considered Operating Facilities for this Review since they will be used to process the single-shell tank waste.

Ecological Resources Setting – Please refer to Specific Tank Waste and Farms EU for details.

Cultural Resources Setting – Please refer to Specific Tank Waste and Farms EU for details.

Figure E.1-4. Location of Potential CH-TRU Tanks in the 200 East and 200 West Area Tank Farms (After Figure 4 in (DOE 2013))

[4] Berman presentation on July 29, 2009, entitled "Hanford Single-Shell Tank Integrity Program." Available at www.em.doe.gov.

[5] Berman presentation on July 29, 2009, titled "Hanford Single-Shell Tank Integrity Program." Available at www.em.doe.gov.

E.1.5. WASTE AND CONTAMINATION INVENTORY

Several models have been used to estimate characteristics of the Hanford tank wastes based on historical information (Remund, et al. 1995). For example, the Hanford Defined Wastes/Tank Layering Model (HDW/TLM) (Agnew 1994) was used to estimate tank contents for all 149 single-shell tanks (Brevick et al., 1994). Tank wastes are categorized based on the major waste types (primary and secondary) that were deposited in them and on process histories. A chemical composition is specified for each waste type, and tanks are identified by volume percentages of all possible waste types (based on historic information). The chemical compositions are then volume averaged to get a final waste composition estimate for each single-shell tank.

The primary and secondary waste stream designations based on the HDW/TLM for the 149 Hanford single-shell tanks are shown in Table E.1-5. The wastes in the Tank and Waste Farms Evaluation Units can be summarized as (Remund et al. 1995):

- CP-TF-1 (T TF) – 1st cycle decontamination from bismuth phosphate process, lanthanum fluoride finishing waste, and Purex and REDOX cladding wastes
- CP-TF-2 (S-SX TFs) – redox wastes and salt and slurry cake from evaporator campaigns
- CP-TF-3 (TX-TY TFs) – salt cake from evaporator campaigns T1 and T2
- CP-TF-4 (U TF) – aluminum cladding Redox wastes, salt and slurry cake from evaporator campaigns
- CP-TF-5 (A-AX TFs) – salt cake and slurry from evaporator campaigns A1 and A2 and washed Purex sludge
- CP-TF-6 (B-BX-BY TFs) – salt cake from evaporator campaigns B and BY, metal waste from bismuth phosphate process, 1st / 2nd cycle decontamination from bismuth phosphate process, and lanthanum fluoride finishing waste
- CP-TF-7 (C TF) – 1st cycle decontamination from bismuth phosphate process, aluminum cladding Purex wastes, metal waste from bismuth phosphate process, and ferrocyanide sludge

There are other, more recent estimates of what is currently in the Hanford waste tanks (e.g., the best-basis inventory); however, the SSTs were declared a non-compliant treatment, storage, and disposal (TSD) facility under RCRA (RPP-46459, Rev. 3). Furthermore, there was a Congressional mandate that prohibited waste additions to Hanford SSTs after January 1, 1981[6]. Thus the information presented in Table E.1-5 should be a reasonable snapshot of the major waste streams in the Hanford SSTs. Individual waste types identified in Table E.1-5 are defined in Table E.1-6.

The 28 double-shell tanks were built between 1968 and 1986 to provide additional storage capacity for tank wastes. SST waste has been transferred to the DSTs for subsequent treatment elsewhere on the Hanford Site.

CONTAMINATION WITHIN PRIMARY EU SOURCE COMPONENTS

Please refer to Specific Tank Waste and Farms EU Appendices for inventories associated with legacy source sites, waste tanks and ancillary equipment, and vadose zone contamination. The groundwater plumes associated with the SST Farm EUs are described in Appendix D.5 and Appendix D.6. The D&D

[6] Berman presentation on July 29, 2009, entitled "Hanford Single-Shell Tank Integrity Program." Available at www.em.doe.gov.

facilities are not applicable. The Operating Facilities inventories are described in the DST Waste and Farms EUs Sections.

Table E.1-5. HDW/TLM Primary ("1") and Secondary ("2") Waste Stream Designations for the 149 Hanford Single-Shell Tanks using the Types Defined in Table E.1-6 (Remund et al. 1995)

CP-TF EU	Tank	1C44-51/CW	1C52-56/CW	1CFeCN	224	2C44-51	2C52-56	A1-SC	A2-SS	AR	B	BL	B-SC	BY-SC	CWP/Al56-60	CWP/Al61-72	CWR/Al52-60	CWR/Al61-67	MW44-51	MW52-56	P'56-62	P'63-67	PFeCN/1	PFeCN/2	R'52-58	R'59-67	R-SC	S1-SC	S2-SS	SRR/FMJ	T1-SC	T2-SC	TFeCN	UR/TBP	Z/PFP
1	T-101																	1	2																
1	T-102															1			2																
1	T-103															1																2			
1	T-104		1																																
1	T-105		2			1																													
1	T-106		1														2																		
1	T-107	1																																	
1	T-108	2																													1				
1	T-109																														1				
1	T-110					1	2																												
1	T-111					2	1																												
1	T-112						1																												
1	T-201				1																														
1	T-202				1																														
1	T-203				1																														
1	T-204				1																														
2	S-101																								1			2							
2	S-102																											2	1						
2	S-103																											1	2						
2	S-104																	2							1										
2	S-105																								2			1							
2	S-106																	2										1							
2	S-107																								1							2			
2	S-108																								2			1							
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2	S-110																								2			1							
2	S-111																								2			1							
2	S-112																								2			1							
2	SX-101																								1			2							
2	SX-102																											1	2						
2	SX-103																								2			1							
2	SX-104																								2			1							
2	SX-105																								2			1							
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2	SX-110																									1	2								
2	SX-111																								1	2									
2	SX-112																								1	2									
2	SX-113																								1										
2	SX-114																									2	1								
2	SX-115																									1	2								

CP-TF EU	Tank	1C44-51/CW	1C52-56/CW	1CFeCN	224	2C44-51	2C52-56	A1-SC	A2-SS	AR	B	BL	B-SC	BY-SC	CWP/AI56-60	CWP/AI61-72	CWR/AI52-60	CWR/AI61-67	MW44-51	MW52-56	P'56-62	P'63-67	PFeCN/1	PFeCN/2	R'52-58	R'59-67	R-SC	S1-SC	S2-SS	SRR/FMJ	T1-SC	T2-SC	TFeCN	UR/TBP	Z/PFP
3	TX-101																								1							2			
3	TX-102																		2													1			
3	TX-103																		2													1			
3	TX-104																		2													1			
3	TX-105																			2												1			
3	TX-106																								2							1			
3	TX-107																			2												1			
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3	TX-111		2																													1			
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3	TX-116																														1	2			
3	TX-117																														2	1			
3	TX-118																															1			2
3	TY-101			1																											2				
3	TY-102																														2	1			
3	TY-103																															2		1	
3	TY-104																																	1	
3	TY-105																																	1	
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4	U-111																											2	1						
4	U-112	1																							2										
4	U-201																1																		
4	U-202																1																		
4	U-203																1																		
4	U-204																1																		
5	A-101							1	2																										
5	A-102							1	2																										
5	A-103							1		2																									
5	A-104									1											2														
5	A-105																					1													
5	A-106							1	2																										
5	AX-101							1	2																										
5	AX-102							1			2																								
5	AX-103							1														2													
5	AX-104																					1													
6	B-101											2	1																						

CP-TF EU	Tank	1C44-51/CW	1C52-56/CW	1CFeCN	224	2C44-51	2C52-56	A1-SC	A2-SS	AR	B	BL	B-SC	BY-SC	CWP/AI56-60	CWP/AI61-72	CWR/AI52-60	CWR/AI61-67	MW44-51	MW52-56	P'56-62	P'63-67	PFeCN/1	PFeCN/2	R'52-58	R'59-67	R-SC	S1-SC	S2-SS	SRR/FMJ	T1-SC	T2-SC	TFeCN	UR/TBP	Z/PFP
6	B-102												1						2																
6	B-103												1						2																
6	B-104	1				2																													
6	B-105	2											1																						
6	B-106												1																						
6	B-107	1																																	
6	B-108	2											1																						
6	B-109												1			2																			
6	B-110					1																2													
6	B-111					1																2													
6	B-112					2								1																					
6	B-201				1																														
6	B-202				1																														
6	B-203				1																														
6	B-204				1																														
6	BX-101											2							1																
6	BX-102															2			1																
6	BX-103															2			1																
6	BX-104																		1																
6	BX-105																		1																
6	BX-106																		1																
6	BX-107	1																																	
6	BX-108	1																																	
6	BX-109	2																																1	
6	BX-110	1												2																					
6	BX-111	2												1																					
6	BX-112	1											2																						
6	BY-101													1					2																
6	BY-102													1					2																
6	BY-103													1		2																			
6	BY-104													1										2											
6	BY-105													1										2											
6	BY-106													1									2												
6	BY-107													1									2												
6	BY-108													2									1												
6	BY-109													1					2																
6	BY-110													1									2												
6	BY-111													1					2																
6	BY-112													1					2																
7	C-101															2																		1	
7	C-102														2	1																			
7	C-103									2						1																			
7	C-104															1														2					
7	C-105														1	2																			
7	C-106									1		2																							
7	C-107	1																												2					
7	C-108	2																																1	
7	C-109	2																															1		
7	C-110	1																																	
7	C-111	1													2																				
7	C-112															2																	1		

CP-TF EU	Tank	1C44-51/CW	1C52-56/CW	1CFeCN	224	2C44-51	2C52-56	A1-SC	A2-SS	AR	B	BL	B-SC	BY-SC	CWP/Al56-60	CWP/Al61-72	CWR/Al52-60	CWR/Al61-67	MW44-51	MW52-56	P'56-62	P'63-67	PFeCN/1	PFeCN/2	R'52-58	R'59-67	R-SC	S1-SC	S2-SS	SRR/FMJ	T1-SC	T2-SC	TFeCN	UR/TBP	Z/PFP
7	C-201																		1																
7	C-202																		1																
7	C-203																		1																
7	C-204																		1																
	Primary	12	3	1	8	4	2	0	7	2	0	0	7	13	1	5	4	1	12	0	0	2	1	0	10	2	2	16	5	0	4	16	2	7	0
	Secondary	8	3	0	0	3	1	4	0	2	1	3	1	2	2	7	1	3	15	2	1	3	3	2	11	5	2	5	6	2	5	6	0	2	1

Table E.1-6. Hanford HDW/TLM Model Types (i.e., waste identifiers) as used in Table E.1-5 (Remund et al. 1995)

Model Type	Definition	Model Type	Definition
1C44-51/CW	1st cycle decontamination from bismuth phosphate process, 1944-1951 - includes cladding waste	MW44-51	metal waste from bismuth phosphate process, 1944-1951
1C52-56/CW	1st cycle decontamination from bismuth phosphate process, 1952-1956 - includes cladding waste	MW52-56	metal waste from bismuth phosphate process, 1952-1956
1CFeCN	ferrocyanide scavenged, 1st decontamination process supernates	P'56-62	Purex high level waste, 1956-1962
224	lanthanum fluoride finishing waste from 224-U	P'63-67	Purex high level waste, 1963-1967
2C44-51	2nd cycle decon waste from bismuth phosphate process, 1944-1951	PFeCN/1	ferrocyanide sludge produced by in-plant scavenging of waste from uranium recovery, using 0.005 M ferrocyanide
2C52-56	2nd cycle decon waste from bismuth phosphate process, 1952-1956 - includes supernates formerly cribbed at T Plant	PFeCN/2	same as PFeCN1, except using 0.0025 M ferrocyanide
A1-SC	salt cake from evaporator campaign A1	R'52-58	redox waste, 1952-1958
A2-SS	salt slurry from evaporator campaign A2	R'59-67	redox waste, 1959-1967
AR	AR Solids = washed Purex sludge - also used to derive strontium recovery waste	R-SC	salt cake from evaporator run of redox wastes
B	high level waste from Purex Acidified Waste - also refers to aluminum	S1-SC	salt cake from evaporator campaign S1
BL	low level waste from all operations	S2-SS	salt slurry from evaporator campaign S2
B-SC	salt cake from evaporator campaign B	SRR/FMJ	strontium recovery waste from sluiced Purex sludge
BY-SC	salt cake from evaporator campaign BY	T1-SC	salt cake from evaporator campaign T1
CWP/Al56-60	aluminum cladding Purex wastes, 1956-1960	T2-SC	salt cake from evaporator campaign T2
CWP/Al61-72	aluminum cladding Purex wastes, 1961-1972	TFeCN	ferrocyanide sludge produced by in-tank or in-farm scavenging in CN
CWR/Al52-60	aluminum cladding Redox wastes, 1952-1960	UR/TBP	tri-butyl phosphate waste from solvent-based uranium recovery operation in 1950s
CWR/Al61-67	aluminum cladding Redox wastes, 1961-1967	Z/PFP	234-5Z waste from Z-Plant plutonium finishing

The Waste Tank Summary Report for Month Ending November 30, 2016 (Templeton, AM 2016) provides a table of the retrieval status of all tanks undergoing retrieval, which is substantially duplicated in Table E.1-7 to note the current status of these tanks and their nominal volume of remaining waste. The Waste Tank Summary Report should be consulted for detailed notes concerning these tanks.

Table E.1-7. Tanks in Retrieval Status - substantially duplicated from Waste Tank Summary Report for Month Ending November 30, 2016 (Templeton, AM 2016). The Waste Tank Summary Report should be consulted for detailed notes concerning these tanks.

Tank (241-)	Status	Comments	Nominal Volume of Remaining Waste (kgal)
AY-102	Ongoing	Retrieval in progress - retrieval initiated 3/3/2016	44.3
C-101	Complete	Declared "Retrieved to Limit of First and Second Retrieval Technologies," 9/25/2013	5.5
C-102	Complete	Declared "Retrieved to Limit of First and Second Retrieval Technologies," 11/30/2015	15.5
C-103	Complete	Declared "Retrieval Completed,'' 8/23/2006	2.5
C-104	Complete	Declared "Retrieval Completed," 8/17/2012	1.8
C-105	Ongoing	Retrieval in progress - retrieval initiated 6/11/2014	30.4
C-106	Complete/In Review	Declared "Retrieval Completed," 12/31/2003	2.8
C-107	Complete	Declared "Retrieved to Limit of Third Retrieval Technology," 9/30/2014	10.2
C-108	Complete	Declared "Retrieved to Limit of Modified Sluicing Technology," 3/22/2012	3.3
C-109	Complete	Declared "Retrieved to Limit of Modified Sluicing Technology," 9/12/2012	1.9
C-110	Complete	Declared "Retrieval Completed," 10/30/2013	1.8
C-111	Complete	Declared "Retrieval Completed," 8/29/2016	4.9
C-112	Complete	Declared "Retrieval Completed," 512912014	10
C-201	Complete	Declared "Retrieval Completed," 3/23/2006	0.14
C-202	Complete	Declared "Retrieval Completed," 8/11/2005	0.15
C-203	Complete	Declared "Retrieval Completed,'' 3/2412005	0.14
C-204	Complete	Declared "Retrieval Completed," 12/11/2006	0.14
S-112	Complete	Declared "Retrieval Completed," 3/2/2007	2.4

E.1.6. POTENTIAL RISK/IMPACT PATHWAYS AND EVENTS

The Documented Safety Analysis (DSA) represents a common safety analysis across all Hanford tank farms, including safety concerns and safety measures (RPP-13033). The facilities covered by the TF DSA include:

- SSTs, DSTs, catch tanks, double-contained receiver tanks (DCRTs), and inactive miscellaneous underground storage tanks (IMUSTs)
- 204-AR Waste Unloading Facility
- 244-AR and 244-CR Vaults
- Cribs, ditches, and ponds
- 616 Facility
- Vertical storage units

- Waste transfer system
- 242-S and 242-T Evaporators
- 241-AX-IX Ion Exchanger
- ITS-1 In-Tank Solidification System
- 241-SX-401 and 241-SX-402 Condenser Shielding Buildings
- 241-A-431 Ventilation Building
- 241-C-801 Cesium Loadout Facility
- Unplanned release sites

However, risks and potential impacts in each Tank and Waste Farms EU are specific, and any potential impacts not captured by the Tank Farms DSA (RPP-13033) will be discussed within the specific Tank and Waste Farms EU section.

CURRENT CONCEPTUAL MODEL

Safety Accident Scenarios that Dominate Risk at the Facility and Response Times

The potential accidents evaluated in the Tank Farms DSA include: flammable gas accident leading to fire/explosion; nuclear criticality resulting in a localized high-energy event; waste transfer leak or air blow accident leading to a spill, leak, or aerosolized spray; release from a contaminated facility; excessive load resulting in partial or total tank (dome) failure; mixing of incompatible materials resulting in unwanted chemical reactions; tank bump leading thermally-induced release; and filter failure leading to unfiltered releases of contaminants (RPP-13033).

There are four accidents designated as *anticipated*[7] for the Hanford waste tanks *if no controls were in place* (i.e., unmitigated):

- *Flammable gas accidents* – This accident involves flammable gas deflagrations in waste storage vessels/containers (including SSTs) where the bounding event is a flammable gas deflagration from the steady-state generation and accumulation or a gas release event in a DST/SST.
- *Waste transfer leaks* – This accident involves a wide spectrum of waste leaks where the bounding event is a fine spray leak using a high head waste transfer pump.
- *Releases from a contaminated facility* – This accident involves various release mechanisms (i.e., flammable gas deflagrations, fires, load handling accidents, or compressed gas system failures) in contaminated facilities.
- *Air blow accidents* – This accident involves a waste release from a contaminated hose-in-hose transfer line (HIHTL) primary hose assembly and connected waste transfer piping system pressurized by compressed air where the bounding event is a small crack leak below the waste surface.

A nuclear criticality accident is considered *beyond extremely unlikely* (BEU) (i.e., a frequency of less than or equal to once in a million operating years) (RPP-13033). The flammable gas accident (specifically a

[7] An anticipated event has frequency greater than once in 100 operating years (RPP-13033). In other words, these accidents are “anticipated” because they have occurred at least once before. External and natural events are not treated separately since they lead to the same accident types.

detonation in a DST/SST) and waste transfer leaks (specifically a fine spray when using a high head pump) were selected as bounding accidents for evaluation proposes in the TF DSA.

For the four anticipated accidents listed above, only the waste transfer leak had an onsite radiological total effective dose (consequence) > 100 rem. None of the design basis accidents had an offsite dose greater than the 25-rem Evaluation Standard that would require Safety-Class SSCs. For onsite toxicological consequences, both the waste transfer leak and air blow accidents are < Protective Action Criteria[8] (PAC) 3, and all accidents had off-site toxicological consequences of < PAC-2. Qualitatively, only the air blow accident (of the four accidents listed above) *was not* judged to represent a significant impact to a facility worker (i.e., result in "prompt death, serious injury, or significant radiological or chemical exposure to the facility worker") (RPP-13033).

Other representative accidents have consequences that are less than onsite worker guidelines and do not pose significant facility worker hazards. However, defense-in-depth features have been selected for these accidents (RPP-13033):

- SST failure may be caused by excessive concentrated loads or excessive uniform loads, excessive vacuum, load drops, or seismic events and failures of other tanks; dome loading requirements are selected as the defense-in-depth protection feature.
- SST failure could result from chemical reactions resulting from mixing incompatible materials; paperwork must be verified to ensure that the correct chemical is being delivered has been selected as a defense-in-depth feature.
- Contaminated soils may be released (from a crib, ditch, pond) from unplanned excavations or drilling into contaminated soils or ruptures of underground pressurized lines in contaminated soils; environmental air permitting requirements and the excavation permitting process are selected as defense-in-depth features.
- A thermally induced upset (e.g., steam bump in an SST liner gap) could cause a failure in an SST.

There are other representative accidents (aboveground tank or structure failure, transportation-related waste sample handling accidents, filtration failures, organic solvent fires, etc.) with consequences less than the guidelines for an onsite worker, do not pose significant facility worker hazards, and have no defense-in-depth features.

Hanford Tank Farm Vapor Exposures

Among the unmitigated hazards related to the Hanford Tank Farms are reports of respiratory symptoms attributed to vapors from the tank wastes[9]. Short-term, intermittent vapor exposure has been associated with respiratory irritation symptoms. Dozens of workers have sought medical attention for

[8] Protective Action Criteria (PAC) may be used "to evaluate the severity of the event, to identify potential outcomes, and to decide what protective actions should be taken" and may be used "to estimate the severity of consequences of an uncontrolled release and to plan for an effective emergency response". There are benchmark values (i.e., PAC-1, -2, and -3) for a set of evaluated chemicals. Each successive benchmark represents an increasingly severe effect involving a higher exposure level: 1) mild, transient health effects, 2) irreversible or other serious health effects that could impair the ability to take protective action, and 3) life-threatening health effects. http://orise.orau.gov/emi/scapa/chem-pacs-teels/.

[9] Washington River Protection Solutions (WRPS) is the DOE Tank Operations Contractor responsible for managing Hanford tank wastes and preparing it for delivery to the Waste Treatment and immobilization Plant. WRPS created a website (https://hanfordvapors.com/) to provide background information, data, and news concerning the Hanford Vapors issue.

non-specific symptoms, and such events have occurred for more than a decade (NIOSH 2004), although the specific offending agent(s) and sources have not been identified.

An independent review of WRPS Tank Farm Chemical Vapors Strategy (jointly requested by WRPS and Hanford Challenge) found (Hanford Concerns Council 2010) that the proposed periodic sampling strategy should be expanded to strengthen the exposure assessment process, the WRPS job hazard analysis should be expanded, and site Industrial Hygienists should expand their capabilities (especially when quantitative data are not available).

In 2014 The Hanford Tank Vapor Assessment Team (TVAT) of the Savannah River National Laboratory concluded that available information suggested a causal link between tank vapor releases and the adverse health effects reported by Hanford tank farm workers (SRNL 2014). Furthermore, an industrial hygiene program emphasizing full-shift (8 hour) exposure measurements and compliance with standard occupational exposure limits may not adequately characterize the complex, episodic nature of short-term tank vapor exposures. Such "bolus" excursions may be sufficient to trigger symptoms in sensitive workers, without causing any exceedances of Action Levels or OSHA Permissible Exposure Limits. The TVAT recommended the increased use of personal respiratory protection, improved personal sampling, and further tank vapor characterization.

In 2016, at the request of the DOE Office of River Protection (DOE-ORP) and WRPS, the National Institute for Occupational Safety and Health (NIOSH) visited the Hanford Site to conduct a review of tank farms worker safety and health programs. The NIOSH team reviewed documentation and reports from previous worker health and safety evaluations and obtained information regarding the health and safety programs of both WRPS and DOE. The NIOSH team concluded that WRPS and DOE have (NIOSH 2016)[10]

- "taken positive steps, invested considerable resources, created a comprehensive OSH program, developed detailed procedures, hired staff, and established technical worker-management groups to help resolve concerns regarding exposure to tank farm vapors and gases."
- "collected a significant amount of data they believe demonstrates worker exposures are very low (i.e., well below OELs), not toxicologically significant, and provide evidence there is no, or minimal, health risk to workers in the tank farms."

However, workers continued to report odors and symptoms that they attributed to exposure to tank farm chemicals. In 2016 WRPS in conjunction with the Union has enhanced the safety culture, developed a more transparent web-based information system (hanfordvapors.com) and expanded use of both mandatory and voluntary respiratory protection, including powered air-purifying respirators (PAPRs). Vapor Control Zones, where vapor concentration may exceed an Action Level have entry requirements, including required respirators. In other zones respirator use is voluntary (https://hanfordvapors.com/protect-workers/vapors-management-strategy/administrative-controls/). The Action Level is typically 50% of the Permissible Exposure Limit, which is based on an 8 hour time-weighted average, so intermittent, "bolus" releases may go undetected.

Safety Class and Safety Significant Systems and Controls

No safety-class structures, systems, and components (SSC) were identified for tank farm operations (RPP-13033).

Based on the results of hazard and accident analyses, *safety-significant* structures, systems, and components (SSC); technical safety requirements (TSR), including Specific Administrative Controls (SAC),

[10] DOE has invested $50 million in the last two years to increase worker protection and is working on an additional $65 million in additional improvements.

Limiting Conditions for Operations (LCO), and Key Elements of Administrative Controls; and defense-in-depth features have been identified for protection of the public, onsite workers, and facility workers (RPP-13033).

Flammable Gas Accidents

The following Safety-Significant SSC for flammable gas accidents in the Hanford Tank Farms are identified in the DSA (RPP-13033, p. T3.3.2.4.1-4):

- *DST primary tank ventilation systems* to maintain the concentration of flammable gases below the lower flammability limit (LFL) in the DST headspace for steady-state releases and induced gas release events (GREs) due to water or chemical additions and waste transfers into DSTs.
- *Waste transfer primary piping systems* to provide confinement of waste including to protect the facility worker from flammable gas accidents in a DST annulus due to a misroute.

The following flammable gas controls for the Hanford Tank Farms are defined (RPP-13033, p. T3.3.2.4.1-5&6):[11]

- *LCO: DST Primary Tank Ventilation Systems* for all DSTs ensures the DST primary tank ventilation systems are operable and operating to prevent flammable gas hazards from steady-state releases and slow, continuing induced gas releases following water additions, chemical additions, and waste transfers into DSTs.
- *SAC: SST Steady-State Flammable Gas Control* for all SSTs except those in the 241-AX and 241-SX Tank Farms to protect the facility worker from a flammable gas deflagration due to steady-state flammable gas releases in an SST by monitoring the flammable gas concentration, verifying passive ventilation for 241-B-203 and 241-B-204, and taking action to reduce the flammable gas concentration or eliminate potential ignition sources prior to the flammable gas concentration exceeding the LFL.
- *SAC: DST Induced Gas Release Event Flammable Gas Controls* for all DSTs to protect the facility worker from a flammable gas deflagration in a DST due to an operations induced GRE by requiring evaluations of waste transfers from DSTs and water additions, chemical additions, and waste transfers into DSTs to determine restrictions or required controls to prevent an induced GRE flammable gas deflagration. [12]
- *LCO: DST Induced Gas Release Event Flammable Gas Control* for all DSTs (when required) to ensure the DST primary tank ventilation systems are operable and operating to prevent flammable gas hazards from induced GREs during water additions, chemical additions, and waste transfers into DSTs.
- *SAC: DST Annulus Flammable Gas Control* for all DSTs to protect the facility worker from a flammable gas deflagration in a DST annulus caused by steady-state flammable gas releases

[11] There are additional controls related to DCRTs; inactive/miscellaneous tanks/facilities and waste intruding equipment; and waste packaging that are external to the waste tanks.

[12] In 2012 the Defense Nuclear Facilities Safety Board submitted Recommendation 2012-2, *Hanford Tank Farms Flammable Gas Safety Strategy* that identified the need to take actions to reduce risk posed by flammable gas events at the Hanford Tank Farms. DOE responded with an Implementation Plan including a revision to the DSA to include a new control that measures ventilation flow through each DST on a periodic basis, supplementing the existing flammable gas monitoring control. This DSA revision also placed requirements on operability of the in-service and standby primary ventilation trains. DOE is working towards installing safety-significant (SS) instrumentation for real-time monitoring of the ventilation exhaust flow from each DST.

from waste in the DST annulus by monitoring the DST annulus waste level and taking action to control the flammable gas concentration or eliminate potential ignition sources if a significant quantity of waste is detected in the DST annulus.

The key elements related to flammable gas accidents in the Hanford Tank Farms are (RPP-13033, p. T3.3.2.4.1-7):

- *DST and SST Time to Lower Flammability Limit (LFL)* to protect assumptions used to develop surveillance frequencies and action completion times in the LCO DST Primary Tank Ventilation Systems and SACs: SST Steady-State Flammable Gas Control and DST Annulus Flammable Gas Control.
- *Ignition Controls* to establish requirements consistent with NFPA requirements for eliminating potential flammable gas ignition sources; to evaluate activities, equipment, and materials to determine the applicability of and compliance with ignition source control requirements; and to be an important contributor to defense-in-depth by applying ignition controls for the spontaneous GRE hazard in DSTs 241-AN-103, 241-AN-104, 241-AN-105, 241-AW-101, and 241-SY-103.
- *Waste Characteristics Controls* to protect assumptions used to develop controls for flammable gas deflagrations due to GRE by preventing the formation of waste gel in DSTs and SSTs.
- *Emergency Preparedness* to establish emergency preparedness requirements to reduce the risk from seismic induced flammable gas accidents in DSTs.

As an indication of the likelihood of flammable gas-related accidents in the Hanford Tank Farms, the hydrogen generation rates (HGRs) and times to lower flammability limit (LFL) are provided for each tank in each Tank and Waste Farms EU Summary Section. A summary showing those tanks with times to lower flammability limit under the zero ventilation scenario (i.e., most restrictive) of less than 6 months[13] is provided in Figure E.1-5. Most of the tanks shown are double-shell tanks in the 200-East Area.

[13] Typical response times of 14 and 30 days are shown in Figure E.1-5 for reference.

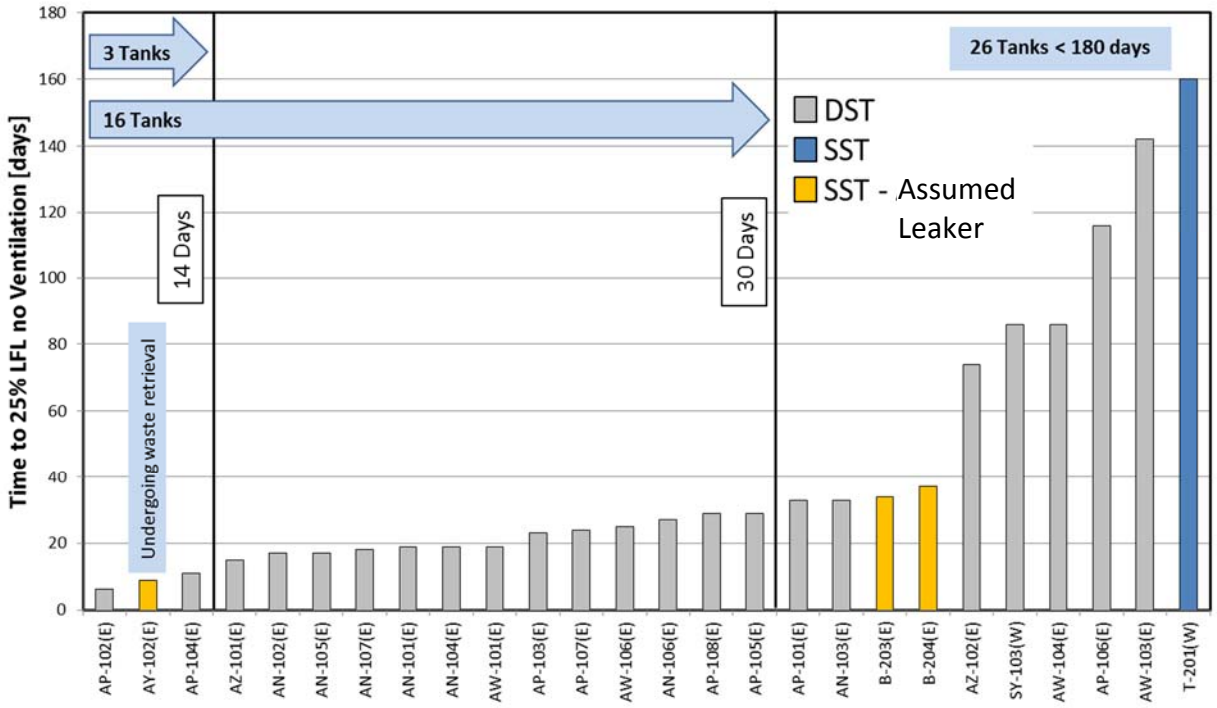

Figure E.1-5. Time to 25% Lower Flammability Limit for Tanks with Less Than 6 Months (assuming no ventilation) (RPP-5926, Rev. 17). The location (E = 200-East or W = 200-West) is provided after the Tank Name.

Nuclear Criticality

No Safety Significant SSCs or controls related to nuclear criticality were identified in the Tank Farm DSA.

Waste Transfer Leak Accidents and Release from a Contaminated Facility

The following Safety-Significant SSC related to waste transfer leak accidents and release from contaminated facilities are identified (RPP-13033, p. T3.3.2.4.3-2):

- *Waste transfer primary piping systems* to provide confinement of waste to decrease the frequency of a fine spray leak, which also protects the facility worker from wetting spray/jet/stream leaks into a normally occupied area and from flammable gas deflagrations in a waste transfer-associated structure due to a waste transfer leak.
- *Hose-in-hose transfer line systems (HIHTL)* to provide confinement of waste thus decreasing the frequency of a fine spray leak and thus protecting the facility worker from wetting spray/jet/stream leaks into a normally occupied area and from flammable gas deflagrations in a waste transfer-associated structure due to a waste transfer leak; this is also an important contributor to defense-in-depth by providing secondary confinement of leaks in the HIHTL primary hose assemblies.
- *Isolation valves for double valve isolation* to limit the leakage of waste (through valve leakage) decreasing the consequences of a fine spray leak due to a misroute and thus protecting the facility worker from wetting spray/jet/stream leaks into a normally occupied area and from flammable gas deflagrations in a waste transfer-associated structure (or other facility) due to a misroute.

The following waste transfer leak and release from contaminated facilities control for the Hanford Tank Farms is defined (RPP-13033, p. T3.3.2.4.1-5&6):

- *SAC: Double valve isolation* to ensure that safety-significant isolation valves for double valve isolation are in the closed or block flow position when used to physically disconnect waste transfer primary piping systems, HIHTL primary hose assemblies, and interfacing water systems to limit waste leakage into the physically disconnected systems thus decreasing the consequences of a fine spray leak due to a misroute and protecting the facility worker from a wetting spray/jet/stream leak and from a flammable gas deflagration in a waste transfer-associated structure (or other facility) due to a misroute.

The key element related to waste transfer leak accidents and release from contaminated facilities in the Hanford Tank Farms is (RPP-13033, p. T3.3.2.4.1-7):

- *Waste transfer-associated structure cover installation and door closure* which is an important contributor to defense-in-depth by providing secondary confinement of leaks into waste transfer-associated structures.

Air Blow Accidents

The following Safety-Significant SSC related to air blow accidents are identified (RPP-13033, p. T3.3.2.4.5-2):

- *Compressed air system pressure relieving devices* to limit compressed air system pressure and thus mitigating the consequences of an air blow accident.
- *Waste transfer primary piping systems* to provide confinement of waste.

No controls were defined for air blow accidents related to the Hanford Tank Farms.

External and Natural Events

No Safety Significant SSCs or controls related to external or natural events were identified in the Tank Farm DSA. The external events evaluated in the DSA include aircraft crash, vehicle accident, range fire, and rail accident. The external event frequencies range from beyond extremely unlikely (BEU) for accidents like commercial or military aircraft impacting a tank or facility to anticipated for range fires. The consequences, which relate to the operating accidents described above, would not be increased. The natural events evaluated in the DSA include lightning, high winds, earthquakes, volcanic eruptions / ashfall, severe dust storms, heavy snow, hail storms, and floods. For natural events, frequencies range from not credible for floods to anticipated for extreme temperatures, high winds, hail storms, and dust storms. The only unique aspect related to natural events is the possibility that these events cause multiple failures. It was considered unreasonable to expect all releases to be at their highest estimated releases for individual accidents (RPP-13033, p. 3.3.2.4.7-3). The consequences, which relate to the operating accidents described above, would not be increased and are those for operating accidents.

Tank Farm Safety Analysis Summary

A summary of selected results (i.e., those that are iconic or are anticipated or with significant consequences) for the representative accidents in the DSA both unmitigated (“without controls”) and mitigated (“with controls”) is provided in Table E.1-8.

Table E.1-8. Representative Accidents without (above) and with (below) Controls Summary (RPP-13033)

Accident	Accident Type	Frequency[e]	Onsite radiological consequence	Offsite toxicological consequence[f]	Onsite toxicological consequence[f]	Significant impact to worker[a]
DST headspace deflagration due to an induced gas release event	Flammable gas / Release from Contaminated Facility	Anticipated (---)[b]	< 100 rem (---)[b]	< PAC-2 (---)[b]	< PAC-3 (---)[b]	Yes
Deflagration in waste-intruding equipment	Flammable gas / Release from Contaminated Facility	Anticipated (---)[b]	< 100 rem (---)[b]	< PAC-2 (---)[b]	< PAC-3 (---)[b]	No
Deflagration in a waste sample container	Flammable gas / Release from Contaminated Facility	Anticipated (---)[b]	< 100 rem (---)[b]	< PAC-2 (---)[b]	< PAC-3 (---)[b]	No
Nuclear criticality	Nuclear criticality	Beyond Extremely Unlikely (---)[b]	< 100 rem (---)[b]	< PAC-2 (---)[b]	< PAC-3 (---)[b]	No
Fine spray leak during a transfer using a high head waste transfer pump	Waste transfer leak	Unlikely (Prevented)[c]	> 100 rem (--)[c]	< PAC-2 (--)[c]	> PAC-3 (--)[c]	Yes
Fine spray leak due to a misroute during a transfer using a high head waste transfer pump	Waste transfer leak	Extremely Unlikely (Extremely Unlikely)[c]	> 100 rem (< 5 rem) [c]	< PAC-2 (< PAC-2) [c]	> PAC-3 (< PAC-2) [c]	Yes
Waste release from a HIHTL primary hose assembly and connected waste transfer primary piping system during compressed air blowout	Air blow / Waste transfer leak	Anticipated (Anticipated)[c]	< 100 rem (< 5 rem)[c]	< PAC-2 (< PAC-2)[c]	< PAC-3 (< PAC-2)[c]	No
Waste release from a waste transfer primary piping system encasement during encasement pneumatic testing	Air blow / Waste transfer leak	Anticipated (Prevented)[c]	< 100 rem (--)[c]	< PAC-2 (--)[c]	< PAC-3 (--)[c]	No
External Events Natural Events[d]	External events (e.g., aircraft crash, vehicular accident, range fire) and natural events (e.g., lightning, high winds, earthquakes, volcanic, dust, floods) are initiators of operational accidents listed above but do not create unique accidents that would change the overall ratings.					

a. Qualitatively judged to result in prompt death, serious injury, or significant radiological or chemical exposure to the facility worker.

b. No results due to credited preventative or mitigative safety-significant SSCs or TSR SACs provided in the DSA; it is assumed that the consequences would be sufficiently low or additional controls would be required.

c. Mitigated frequency and consequences from credited preventative or mitigative safety-significant SSCs or TSR SACs provided in the DSA.

d. Natural events can initiate multiple common cause accidents (e.g., more than one flammable gas deflagration), but do not increase the cumulative consequences beyond those shown above.

e. Likelihoods: A – Anticipated (> 10^{-2}/yr); U – Unlikely (10^{-2} – 10^{-4}/yr); Extremely Unlikely (10^{-4} – 10^{-6}/yr); and BEU – Beyond Extremely Unlikely (<10^{-6} /yr).

f. Protective Action Criteria (PAC) may be used "to evaluate the severity of the event, to identify potential outcomes, and to decide what protective actions should be taken" and may be used "to estimate the severity of consequences of an uncontrolled release and to plan for an effective emergency response". There are benchmark values (i.e., PAC-1, -2, and -3) for a set of evaluated chemicals. Each successive benchmark represents an increasingly severe effect involving a higher exposure level: 1) mild, transient health effects, 2) irreversible or other serious health effects that could impair the ability to take protective action, and 3) life-threatening health effects.[14]

The accident analysis represented in Table E.1-8 can be summarized according to the process outlined in Chapter 4 of the Methodology Report where likelihoods (or frequencies) range from beyond extremely unlikely to anticipated and impacts (or consequences) range from Low to Very High (CRESP 2015a). An example summary for onsite impacts related to the Hanford Tank Farms is provided in Table E.1-9.

Table E.1-9. Initiating Events and Onsite (Facility Worker and Co-located Person) Consequences for the Tank Farms (adapted from RPP-13033). Note all Offsite (Public) Consequences for Credible Events are <5 rem or <PAC-1 Corresponding to a Consequence Level of Low.

EVENT TYPE[a]	Likelihood[b]/Impact[c]			Discussion
	Active Cleanup	Near-term	Long-term	
Flammable Gas Accident	A/L-M* (---/L)	NA (---)	NA (---)	Flammable gas deflagration in waste storage vessels/containers (ranging from DSTs to SSTs to waste packaging drums).
Nuclear Criticality	BEU/L (---/L)	NA (---)	NA (---)	Nuclear criticality in waste tanks/vessels. Near- and long-term assessments based on 99% retrieval of tank wastes assuming less than critical mass remaining. A nuclear criticality is deemed not credible.
Waste Transfer Leak	A/H* (EU/L)	NA (NA)	NA (NA)	Involves a broad spectrum of waste leaks. The bounding event is a fine spray leak using a high head waste transfer pump.
Release from Contaminated Facility	A/L-M* (---/L)	NA (NA)	NA (NA)	Involves release mechanisms (i.e., flammable gas deflagrations, fires, load handling accidents, or compressed gas system failures) in contaminated facilities. Bounding event is a flammable gas deflagration in a waste transfer-associated structure.
Air Blow Accident	A/L-M (A/L)	NA (NA)	NA (NA)	Involves a waste release from a contaminated HIHTL primary hose assembly and connected waste transfer primary piping system that is pressurized by compressed air.
External Events	These accidents are captured by the above operating events.			Events evaluated include aircraft crash, vehicular accident, range fire
Natural Events[d]				Events evaluated include lightning, high winds, earthquakes, volcanic, dust, floods

a. RPP-13033, Tank Farms Documented Safety Analysis (DSA). Only the representative accidents (without controls or unmitigated) are considered; however, the likelihood/impact is assessed both without controls or unmitigated (top pair) and with controls or mitigated (bottom pair).

[14] http://orise.orau.gov/emi/scapa/chem-pacs-teels/

b. Likelihoods: A – Anticipated (> 10^{-2}/yr); U – Unlikely (10^{-2} – 10^{-4}/yr); Extremely Unlikely (10^{-4} – 10^{-6}/yr); and BEU – Beyond Extremely Unlikely (<10^{-6}/yr). NA – Not applicable.

c. Consequence Levels: L – Low (*Co-located*: <25 rem TED or <PAC-2 and *Public*: <5 rem TED or <PAC-1); M – Moderate (*Co-located:* ≥25 rem TED or ≥PAC-2 and *Public:* ≥5 rem TED or ≥PAC-1); and H – High (*Facility Worker:* Prompt death, serious injury, or significant exposure and *Co-located:* ≥100 rem TED or ≥PAC-3 and *Public:* ≥25 rem TED or ≥PAC-2) (DOE-STD-3009-2014). An asterisk (*) indicates that there is an event that is qualitatively judged to result in prompt death, serious injury, or significant radiological or chemical exposure to the facility worker. NA – Not applicable.

d. Natural events can initiate multiple common cause accidents (e.g., more than one flammable gas deflagration), but do not increase the cumulative consequences beyond those shown above.

Summary of Mitigated Risks and Potential Impacts

Hazards associated with potential high-consequence accidents primarily relate to the characteristics of the tank waste constituents. With controls (i.e., mitigated), the air blow accident remains anticipated, however, with low consequences to both workers (<5 rem total effective dose for the air blow accident) and the offsite public (Table E.1-9). All mitigated accidents have *Low* consequence ratings. The nuclear criticality accident has been deemed not credible.

The air blow accident and most other accidents evaluated in the DSA pertain during the Active Cleanup period (to 2064). After closure, the single shell tank farms will likely have at least 99% of the waste retrieved and the tanks filled with grout and covered with a cap that would mitigate the events related to the Tank and Waste Farms EUs; these events involve fire and natural events that degrade barriers and increase infiltration of water. The manner in which the DSTs will be closed after tank wastes are treated is still to be determined.

Institutional, Engineered, and Natural Barriers

In general, the Tank Farm Vadose Zone Program implemented several interim measures to mitigate impacts from past tank farm leaks and discharges (i.e., limiting contaminant mobility by controlling the amount of water introduced into the shallow vadose zone) (DOE/ORP-2008-01, p. 11-1):

- Installation of well caps on dry wells
- Decommissioned monitoring wells and drywells
- Tested and decommissioned waterlines
- Construction of surface water control measures (berms and gutters)
- Construction of surface barriers.

The waste tanks themselves are the primary barriers to the further spread of tank waste contaminants to the environment (albeit waste has leaked in the past and may be currently leaking from some tanks). However, the risk of further leaks from the tanks has been largely mitigated by interim stabilizing (i.e., removing the supernatant and drainable liquid from the tanks and transferring to DSTs). The barriers represented by the tanks are then coupled with the large vadose zone (~64-71 meters (Hartman 2000, p. 4.12)) and travel through the saturated zone to off-site areas (e.g., Columbia River) where receptors could be exposed. Restrictions on use of site groundwater also represent a barrier to exposure. Because of relatively long travel times, natural attenuation of the radionuclides with relatively short half-lives (when compared to travel times) is also a barrier. Furthermore, the large flow in the Columbia River tends to dilute the concentration of any contaminants to which receptors might be exposed via the surface water pathway.

Structural Integrity of Tanks

The *structural integrity* of the Hanford SSTs and DSTs is being evaluated per a Tri-Party Agreement to "determine the SST system integrity, and whether or not the SST tank system is adequately designed and has sufficient structural strength and compatibility with the waste to be stored or treated to ensure that it will not collapse, rupture, or fail" (RPP-10435, Rev. 0). Based on the SST integrity assessment (RPP-10435, Rev. 0), the reinforced concrete SST structures were concluded to have an adequate collapse margin so that continued safe storage of interim-stabilized waste could continue. "However, given the tank leak history and current condition of the tank liners, long-term leak integrity, for the liquids remaining in the tanks, cannot be proven for any of the SSTs" (RPP-10435, Rev. 0).

To ensure adequate margin against dome collapse through closure, potential reinforced concrete degradation mechanisms were reviewed including the primary potential degradation mechanisms for the SSTs (RPP-10435, Rev. 0):

- Corrosion of reinforcing bars,
- Degradation of concrete mechanical properties from high temperature exposure, and
- Exposure of the concrete to caustic waste in leaking tanks and resulting damage.

Based on the structural integrity assessment and evaluations of possible degradation mechanisms, the SSTs were declared structurally adequate (RPP-10435, Rev. 0). Because of the relatively benign operating environment and reduced liquid waste volumes, future degradation is assumed to be small and the dome collapse margin will remain adequate through closure.

The most significant structural uncertainty pertains to the condition of the concrete basemat and footing, which cannot be inspected. However, dome surveillance indicates no current evidence of significant distress in the dome. Periodic monitoring of the SST domes is needed to maintain sufficient confidence in the SST structural integrity for future operations through closure (RPP-10435, Rev. 0.

Mitigation of Past Contamination

Interim measures were completed to minimize contaminant infiltration from artificial water sources such as waterline leaks or surface run-on. These interim measures include (RPP-23752, Rev. 0, p. xvi):

- Emplacing upgradient surface water run-on control measures (barriers and diversions).
- Performing leak tests of the waterlines to tank farms. No leaks in the tank farm area were detected at the time of the survey. The raw water lines serving tank farms were cut and capped in 2001.
- Verifying that the sanitary waterlines to Tank Farm had been cut and capped.
- Capping existing drywells to prevent water intrusion.
- Decommissioning pre-1980 monitoring wells at Tank Farm.

A number of groundwater (GW) interim remedial actions have been conducted in the 200-UP-1 and 200-ZP-1 Operable Units (OUs). In the 200-UP-1 OU, these actions include past activities and three active remedies that were operating at the end of 2015: the U Plant area P&T system (uranium plume), and the iodine‑129 plume hydraulic control system (extraction and injection well locations are shown in Figure 11‑3). (EPA 2012; DOE/RL-2016-09, Rev. 0):

- *216-U-1 Crib and 216-U-2 Crib Groundwater Interim Remedial Action (1985)*: An interim remedial action was designed to pump and treat groundwater below these cribs. Pumping

started in June 1985 and continued until November 1985. The system removed 687 kg of uranium via ion exchange treatment.

- *200-UP-1 Groundwater OU Interim Remedial Action (1997, amended in 2009 & 2010)*: A pilot-scale treatability test consisting of a P&T system was constructed adjacent to the 216-U-17 Crib. Phase I operations commenced September 1995 and continued until February 1997. The test demonstrated that the ion exchange resin and granular activated carbon were effective at removing Tc-99, uranium, and carbon tetrachloride from groundwater. Based on the success of the treatability study, an interim action (i.e., groundwater extraction and treatment system) was implemented. Cleanup started in 1997 and met its remedial action objective of reducing highest concentrations to below 10 times the cleanup level of 48 µg/L for uranium and 10 times the maximum contaminant level of 900 pCi/L for Tc-99. This system removed 220.5 kg of uranium, 127 g (2.17 Curies) of Tc-99, 41 kg of carbon tetrachloride, and 49,000 kg of nitrate. The system was shut down in 2012.
- *WMA S-SX Groundwater Extraction System*: A groundwater extraction system for Tc-99 was constructed in 2011 and started operation in August 2012. The design consists of a three-well extraction system, aboveground pipelines, and a transfer building to pump extracted groundwater to the 200 West Groundwater Treatment Facility for treatment and reinjection. As of the 2015, the system has extracted 510 million L (135 million gal) of groundwater and removed 2.18 Ci of Tc-99; 22,600 kg of nitrate; 36.1 kg of chromium; and 39.5 kg of carbon tetrachloride (CCl_4) from the aquifer (DOE/RL-2016-09, Rev. 0, p. 11-39).
- *U Plant Pump and Treat (P&T) System*: This system was designed primarily to remediate the uranium plume from the 216-U-1/2 Cribs near U Plant, but the system also removes Tc-99, nitrate, and carbon tetrachloride (CCl_4). Construction of the remedy was completed in 2015 and the system was brought online in September 2015. A total of 65.4 million L (17.3 million gal) of groundwater was pumped, and 1.8 kg of uranium, 0.19 Ci of Tc-99, 22,300 kg of nitrate, and 5.3 kg of carbon tetrachloride (CCl4) were removed from the aquifer (DOE/RL-2016-09, Rev. 0, p. 11-37).
- *I-129 Plume Hydraulic Control*: The 2012 interim action ROD (EPA 2012) requires containment of the I-129 plume while treatment technologies are evaluated. Hydraulic control will be achieved by locating injection wells for the 200 West P&T on the downgradient side of the plume. The injection wells began operating in October 2015; however, it is too early to assess the effect of their operation on hydraulic gradients in the area and migration of the I-129 plume (DOE/RL-2016-09, Rev. 0, p. 11-46). No contamination has been removed using this action.

The last two remedial actions were started during 2015, while the WMA S-SX P&T system has been operating since 2012. The final ROD for the 200-UP-1 OU will be pursued when future groundwater impacts are adequately understood and potential technologies to treat I-129 are completed (EPA 2012).

In addition to the actions above, the following actions have been or are being taken to address groundwater contamination in the 200-ZP-1 OU:

- *200-ZP-1 OU Interim Remedial Action (1995)*: In 1996, a pump-and-treat system was started to reduce the mass of carbon tetrachloride (as well as secondary contaminants TCE and chloroform) in the groundwater primarily from waste sites south and east of the Plutonium Finishing Facility (DOE/RL-2012-03, Rev. 0). This action was completed and the interim P&T system was deactivated in May 2012 (with startup of the 200 West Area P&T facility). From 1994 through 2015, the P&T system removed 23,175 kg of carbon tetrachloride (CCl_4); 265 kg of

chromium; 242 pCi of I-129; 928,806 kg of nitrate; 6.21 Ci of Tc-99; 37.73 kg of trichloroethene (TCE); no tritium (H-3); and 11.1 kg of uranium (DOE/RL-2016-09, Rev. 0, p. 12-25). By 2015, remedial activities (also see below) had removed a total of 103,282 kg of the estimated 570,000 to 920,000 kg of carbon tetrachloride (CCl_4) discharged to the ground (DOE/RL-2016-09, Rev. 0, p. 12-20).

- *200-ZP-1 Record of Decision (2008)*: The 200-ZP-1 Record of Decision was issued in 2008 and selected P&T, MNA, and Institutional Controls (ICs) to remediate contaminated groundwater including impacting the direction of groundwater flow and further reducing the levels of carbon tetrachloride present and migrating towards the 200-UP-1 OU. The P&T system was started in 2012 and removed 3,580 kg of carbon tetrachloride, 91.24 kg of chromium, 0.000242 µCi of I-129, 243,905 kg of nitrate, 98.03 g (1.5 Ci) of Tc-99, and 15.49 kg of TCE, and 1.08 kg of U[15] by 2013 (DOE/RL-2014-32, Rev. 0, p. ZP-25).
- *200-PW-1 Interim Record of Decision (1992)*: Soil vapor extraction (SVE) was implemented as an interim action in 1992 to remove carbon tetrachloride from the vadose zone in 200-PW-1 overlying the 200-ZP-1 groundwater (DOE/RL-2014-32, Rev. 0). The system has removed 80,107 kg of carbon tetrachloride to date; however, the mass removed each year had been decreasing (DOE/RL-2014-32, Rev. 0, p. ZP-28). The system did not operate in 2013.

The 200-BP and 200-PO OUs have neither interim nor final RODs with groundwater being monitored under requirements of the Atomic Energy Act of 1954 (AEA), Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), and Resource Conservation and Recovery Act of 1976 (RCRA). The 200-PO-1 OU is being monitored to determine the impact to groundwater prior to determining the path forward for remedial action[16]. For 200-BP-5, the following actions are being conducted:

- *Perched Water Treatability Study*: A perched water treatability test (200-DV-1) was conducted at WMA B-BX-BY to remove uranium. By 2013, approximately 691,000 L of perched water containing approximately 373 kg of nitrate, 0.022 Ci of Tc-99, and 31.9 kg of uranium was extracted (DOE/RL-2013-22, Rev. 0; DOE/RL-2014-32, Rev. 0, page BP-8). In 2015 DOE continued the treatability test to investigate the feasibility of contaminant removal until August 2015 when the extraction was temporarily discontinued to enhance perched water removal by adding two new perched water well (completed in December 2015). Control of the extraction system was transferred to 200 West P&T operations where the perched water treatability test also transitioned to a CERCLA removal action planned to start operating in 2016. In 2015 a total of 194,660 L (51,429 gal) of water was removed, containing 84.1 kg of nitrate, 0.005 Ci of Tc-99, and 17 kg of uranium (DOE/RL-2016-09, Rev. 0, p. 9-10).
- *Waste Management Area (WMA) C Tank Waste Retrieval*: Tank wastes are currently being retrieved from WMA C. Waste retrieval has been completed in ten of the 16 tanks, has been completed to various limits of technology in five other tanks, and retrieval is in progress in the remaining tank (Templeton 2016).

DOE is scheduled to submit a 200-BP-5 and 200-PO-1 OU Feasibility Study Report and Proposed Plan(s) to Ecology in 2018 (Ecology, EPA, and DOE 1996, Milestone M-015-21A).

[15] Uranium is not a contaminant of concern for the 200-ZP-1 OU; it is including to track 200-UP-1 groundwater treated.

[16] Tank 241-AY-102 is undergoing waste retrieval operations (Templeton 2016); however, this tank has not been a source of environmental contamination although waste has leaked into the tank annulus.

Events that could lead to Degradation or Failure of Barriers

The HLW tanks, that represent the primary barriers to significant tank waste release, were originally built for limited operations. Past practices including the intentional discharge of tank waste liquids (at least some of which is retained in vadose zone pore spaces) may present a larger and much more uncertain source than leaks and even current tank waste for some constituents. However, there is an increased likelihood that there could be additional or increased leaking for those Tank Farm tanks storing liquids as the tanks age. Both accidents and degradation/aging processes (e.g., carbonation) could lead to eventual tank failure. For example, a series of possible accidents involving SSTs and DSTs were evaluated in the DSA (RPP-13033). There may also be unplanned excavation or drilling in the areas near the tank farm that could disturb contaminated soil. The DSA indicates that the flammable gas accident, waste transfer leak, air blow accident, and release from a contaminated facility would be anticipated without controls (Table E.1-9). With controls, both a flammable gas accident and an air blow accident would be anticipated during waste transfer.

A specific analysis of the structural integrity of 241-C-106 (SST) was also made for *in situ* load conditions (Julyk 1994). In this study, tank failure modes fell into two categories: local (concrete cracking and spallation, shear failures, and crushing and rebar bond and splice failures) and global (structural instability associated with either collapse or buckling). However, based on the structural integrity assessment and evaluations of possible degradation mechanisms, the SSTs have been declared structurally adequate (RPP-10435, Rev. 0).

The thick vadose zone under the Tank Farms and generally arid climate result in natural infiltration rates of between less than detection to more than 100 mm/yr (RPP-13033). Present conditions (e.g., bare ground and coarse sand and gravel surfaces) in and around the Tank Farms are conducive to higher infiltration rates than would be expected on undisturbed ground within the 200 Areas. Thus the vadose zone is currently acting as both a barrier and, in some areas, a secondary source for tank waste contaminants. Episodic groundwater recharge may occur following periods of high precipitation, especially if combined with topographic depressions, highly permeable surface deposits such as gravel, and where the land is denuded of vegetation (RPP-13033), which would also increase infiltration through the vadose zone[17]. The vadose and saturated zones have been contaminated from the Tank and Waste Farms EU wastes; however, the travel times from the waste tanks to potential receptors has been sufficiently long that no off-site receptors are known to have been exposed to tank wastes other than tritium.

Primary Pathways and Populations or Resources at Risk

The primary pathway represented is release of contaminants from the Tank and Waste Farms EUs and ancillary equipment (primary sources) and legacy source sites including cribs, trenches, and contaminated vadose zone (exposure medium and secondary source) through the vadose zone (medium) to the saturated zone (medium and receptor) to the Columbia River (medium and receptor) to various biological and human receptors (receptors) that can be potentially exposed by external radiation and dermal, inhalation (vapors), or ingestion routes. There are current restrictions on Hanford groundwater use so this path is not currently complete and considered to remain under federal control in perpetuity.

[17] Because the waste tanks divert water, there are areas of low moisture content and regions of higher moisture denoted an ”umbrella effect” (RPP-23752); thus there is increased flux in the vadose zone in the areas around the tanks due to the resulting focused flow. Similar effects can be seen in cribs. It is assumed that the potential impact of the variation in moisture is captured by the range of recharge rates evaluated in this Review.

There are complete pathways for the exposure of ecological receptors to vadose zone contaminants in the Tank Farm legacy source areas. Mitigation efforts (e.g., pump-and-treat, surface water control, interim capping) are underway to reduce contaminant migration and potential exposure to ecological receptors. There will also be other possible pathways (ingestion, external radiation and dermal, inhalation) from residual wastes to human and ecological receptors after institutional controls are lifted.

Time Frames for Human Exposure or Impacts to Resources

Several tanks may constitute primary source (tank wastes via leaking) and secondary sources (vadose zone pore spaces from legacy sources) that are releasing contaminants into the Hanford subsurface environment. The primary driver for contaminant transport following release from a tank is infiltrating water (vadose zone) and recharge rate to saturated zone influencing contaminant movement toward the Columbia River. However, the tanks still represent a major barrier to additional large-scale contaminant release, and there are interim measures (e.g., pump-and-treat, surface water control, interim capping) underway to mitigate additional transport of materials. The typical initiating events including likelihood and impacts related to HLW tanks are provided in Table E.1-8. The four event types (i.e., flammable gas accident, waste transfer leak, air blow accident, and release from a contaminated facility) from the DSA (RPP-13033) that would be anticipated without controls and the iconic nuclear criticality accident.

The relatively long residence times in the Hanford saturated zone are consistent with recharge conditions for a semi-arid site; however, there is variation in expected residence times (PNNL-6415 Rev. 18, p. 4-72). Groundwater travel time from the 200 East Area to the Columbia River is relatively fast, ~10-30 years (PNNL-6415 Rev. 18, p. 4.72) because of 1) the large recharge volume from wastewater disposed in the 200 Areas between 1944 and mid-1990s (although the gradient produced from this practice is flattening out) and 2) the relatively high permeability of Hanford formation sediments (that are below the water table). Travel time from the 200 West Area is longer because of the lower permeability of Ringold Formation sediments. Groundwater from the 200 West Area has moved about 6 km (3.7 mi) during the past 50 years (or approximately 0.1 km/yr) (PNNL-6415 Rev. 18, p. 4.72). Travel times from the 200 Areas to the Columbia River are expected to decrease because of the reduced hydraulic gradient from the discontinued wastewater recharge in the 200 Areas.

Current Releases from the Tank and Waste Farms EUs to the Environment

The nine Tank and Waste Farms EUs evaluated in this study comprise the single-shell and double-shell tanks, ancillary equipment, and legacy source sites (cribs, trenches, near-tank soil) associated with the tank farms. A number of SSTs are *assumed* to be capable of further leaking into the environment if there are drainable liquids in the tank (Table E.1-10). For the SSTs, there are Tank Farms (e.g., TX-TY and B-BX-BY) where more than one-half of the tanks are denoted as assumed leakers. However, as much of the pumpable liquid wastes (supernatant and drainable liquids) in the SSTs has been transferred to the DSTs during the interim stabilization project (Weyns 2014). Only one DST (AY-102) is classified as an assumed leaker; however, the small quantities of leaked tank waste have been found and are confined to the tank annulus.

There are also 19 SSTs where water has intruded into the tanks (primarily from rainfall and snow melt) increasing the water levels in the tanks (Templeton 2016).

Table E.1-10. Hanford Tank Status Summary (Templeton 2016)

EU	Description	Area	Total No. of Tanks (by TF)	No. of Sound Tanks (No. w/ WI)[c]	No. of Assumed Leakers (No. w/ WI)[c]	Supernate (kgal)	Drainable (kgal)
CP-TF-1	T Tank Farm	200-W	16	9(1)	7(3)	31	215
CP-TF-2	S-SX Tank Farms[a]	200-W	S: 12 SX: 15	11(1) 7(2)	1(0) 8(0)	3 0	346 299
CP-TF-3	TX-TY Tank Farms	200-W	TX: 18 TY: 6	10(0) 1(1)	8(0) 5(0)	2 9	316 55
CP-TF-4	U Tank Farm	200-W	16	12(3)	4(0)	8	331
CP-TF-5	A-AX Tank Farms	200-E	A: 6 AX: 4	4(1) 4(0)	2(0) 0(0)	12 0	141 66
CP-TF-6	B-BX-BY Tank Farms	200-E	B: 16 BX: 12 BY: 12	6(1) 7(1) 7(1)	10(1) 5(2) 5(1)	14 35 0	246 136 417
CP-TF-7	C Tank Farm[b]	200-E	16	10(0)	6(0)	0	---
CP-TF-8	200-East DSTs – AN/ AP/AW/AY/AZ	200-E	AN: 7 AP: 8 AW: 6 AY: 2 AZ: 2	7(0) 8(0) 6(0) 1(0) 2(0)	0(0) 0(0) 0(0) 1(0)[d] 0(0)	3802 7485 4398 424 160	---
CP-TF-9	200-West DSTs – SY	200-W	3	3(0)	0(0)	1599	---
SSTs	Single-shell Farms	---	149	88(11)	61(5)	83	2353
DSTs	Double-shell Farms	---	28	27	1[d]	17868	---

a. S-112 Retrieval Completed 03/02/07 - Total waste 2,387 gallons; sludge/saltcake 2,263 gallons; and supernate 124 gallons (Weyn 2014).

b. C-102, C-103, C-104, C-106, C-110, C-111, C-112, C-201 through C-204 – Declared "Retrieval Completed".
C-101, C-107, C-108, and C-109 – Retrieved to various limit(s) of technology.
C-105 – Retrieval in progress.

c. WI = Water intrusion

d. Primary tank for 241-AY-102 has leaked into the secondary tank but not into the environment.

POPULATIONS AND RESOURCES CURRENTLY AT RISK OR POTENTIALLY IMPACTED

Facility Worker: Both regular and construction workers are at risk from wastes (including vapors and direct radiation exposure) and activities related to on-going Tank Farm operations. Controls have been implemented to limit radiological and toxicological risks to workers.

Co-Located Person (CP): Co-located persons may be at risk from wastes (including vapors and direct radiation exposure) during on-going Tank Farm operations. Controls have been implemented to limit radiological and toxicological risks to workers and other persons in this area.

Public: The Tank Farms, which are in a secure and controlled area that prevents intentional and inadvertent intruders, are several miles interior to the Hanford Site boundary so any potential impact via the air pathway to the general public would be minimal. Hanford groundwater use is restricted so there is no significant pathway to the public.

Groundwater: There are existing plumes (e.g., chromium, Tc-99, I-129, and nitrate) associated with the Tank and Waste Farms EUs including legacy source sites (e.g., past leaks, cribs and trenches) that represent impacts (e.g., exceed drinking water standards) to groundwater as a protected resource. Evaluations are provided for each of the Groundwater EUs (200-East and 200-West) in Appendix D.1 through Appendix D.6 and Tank and Waste Farms EUs in the appropriate sections.

Columbia River: Tank Farm primary contaminants have migrated through the vadose zone and into the saturated zone but have not reached the nearshore or surface water portions of the Columbia River in measureable concentrations (except for tritium which is a Group C primary contaminant per the Groundwater Framework (Chapter 6) in the Methodology Report (CRESP 2015a). Thus there is no significant current impact to the Columbia River; however, it is projected that plumes from the Central Plateau (especially those from 200-East) may impact the Columbia River in the future; however, not within the evaluation period. Evaluations are provided for each of the Groundwater and Tank and Waste Farms EUs in the appropriate sections.

Ecological Resources: Evaluations are provided for each of the Tank and Waste Farms EUs in the appropriate section.

Cultural Resources: Evaluations are provided for each of the Tank and Waste Farms EUs in the appropriate section.

CLEANUP APPROACHES AND END-STATE CONCEPTUAL MODEL

Selected or Potential Cleanup Approaches

The preferred HLW tank closure alternative includes 99 percent retrieval of waste (by volume) from the SSTs[18] for staging in DSTs and treatment elsewhere onsite; operations and necessary maintenance, waste transfers and associated operations, and upgrades to existing tanks or construction of waste receipt facilities (DOE/EIS-0391 2012). SST closure operations include filling the tanks and ancillary equipment with grout to immobilize residual waste. Disposal of contaminated equipment and soil would occur on site. Decisions on the extent of soil removal or treatment would be made on a tank farm or waste management area basis through the RCRA closure permitting process. The tanks would be stabilized with grout, and an engineered modified RCRA Subtitle C barrier put in place followed by post-closure care. The other tank closure alternatives evaluated in the TC&WM EIS (other than No Action) tended to be a variation on the above theme. The proposed duration of each phase is illustrated in Figure E.1-6.

[18] According to the Hanford Tri-Party Agreement (TPA), the retrieval limits are 360 ft^3 and 30 ft^3 for 100-Series and 200-Series tanks, respectively, (Ecology, EPA, and DOE 1996, Appendix H, p. H-5).

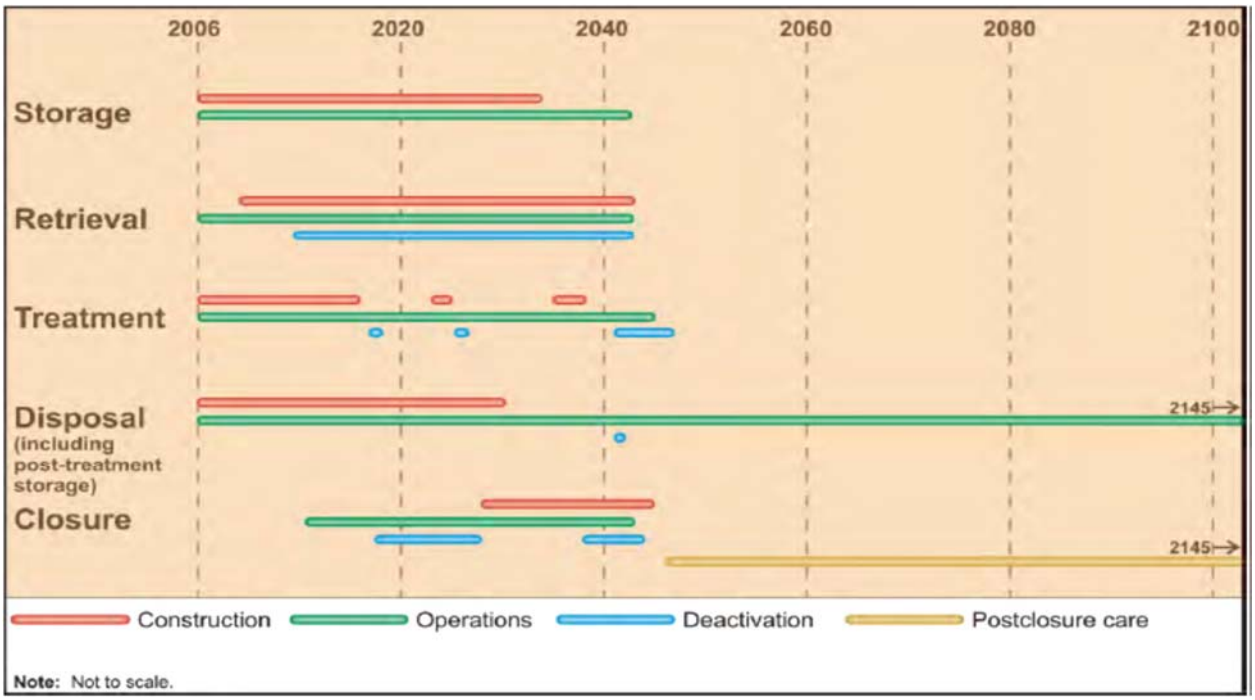

Figure E.1-6. Preferred Tank Closure Alternative Proposed Schedule (DOE/EIS-0391 2012, p. 2-73)

Contaminant Inventory Remaining at the Conclusion of Planned Active Cleanup Period:

The projected single- and double- shell tank inventories remaining after planned (99%) retrieval activities are provided in Table E.1-11 and Table E.1-12. However, residual tank waste contaminants will remain in the vadose and saturated zone after planned cleanup activities are completed. Estimates of the residual contaminants related to the 200 Areas are described in Appendix D.5 (CP-GW-1) and Appendix D.6 (CP-GW-2) and the appropriate Tank and Waste Farms EU sections.

Table E.1-11. Selected Hanford Single-Shell Tank Radionuclide Inventories after 99% Retrieval is Complete (BBI[19]; Templeton 2016)

Analyte	CP-TF-1	CP-TF-2		CP-TF-3		CP-TF-4	CP-TF-5		CP-TF-6			CP-TF-7	
Radionuclide (Ci)	**T**	**S**	**SX**	**TX**	**TY**	**U**	**A**	**AX**	**B**	**BX**	**BY**	**C**	**Total**
H-3	2.10E-01	3.28E+00	2.62E+00	2.74E+00	4.50E-02	1.85E+00	2.83E-01	1.64E-01	1.02E-01	5.38E-01	3.68E+00	1.43E+00	1.69E+01
C-14	5.51E-02	6.50E-01	4.12E-01	6.51E-01	1.94E-02	4.55E-01	1.24E-01	8.67E-02	5.17E-02	7.42E-02	7.80E-01	1.15E-01	3.47E+00
Sr-90	1.18E+03	1.75E+04	1.02E+05	4.66E+03	2.29E+03	6.17E+03	5.78E+04	1.76E+04	4.67E+03	6.79E+03	1.05E+04	2.54E+05	4.85E+05
Tc-99	1.42E+00	2.16E+01	1.44E+01	2.44E+01	9.62E-01	1.64E+01	6.43E+00	3.38E+00	2.13E+00	3.34E+00	1.50E+01	3.37E+00	1.13E+02
I-129	6.71E-04	2.17E-02	1.57E-02	2.54E-02	8.56E-04	1.60E-02	3.43E-03	3.37E-03	1.02E-03	2.93E-03	2.34E-02	1.67E-02	1.31E-01
Cs-137	4.73E+02	1.58E+04	1.88E+04	1.85E+04	5.14E+02	1.74E+04	7.14E+03	4.52E+03	1.93E+03	2.74E+03	1.61E+04	3.63E+04	1.40E+05
Chemical (kg)	**T**	**S**	**SX**	**TX**	**TY**	**U**	**A**	**AX**	**B**	**BX**	**BY**	**C**	**Total**
Chromium	1.16E+02	9.69E+02	1.06E+03	4.63E+02	6.84E+01	4.84E+02	1.34E+02	6.46E+01	1.08E+02	2.29E+02	7.46E+02	8.59E+01	4.53E+03
Nitrate	5.91E+03	7.64E+04	5.10E+04	1.20E+05	6.20E+03	4.23E+04	5.39E+03	4.00E+03	1.74E+04	1.39E+04	5.61E+04	1.85E+03	4.01E+05
Uranium	2.87E+02	4.79E+02	3.38E+02	6.13E+02	3.01E+02	4.06E+02	1.23E+02	2.18E+01	3.81E+02	8.52E+02	6.83E+02	1.16E+04	1.60E+04

Table E.1-12. Selected Hanford Double-Shell Tank Chemical Inventories after 99% Retrieval is Complete (BBI[19]; Templeton 2016)

Analyte	CP-TF-8					CP-TF-9	
Radionuclide (Ci)	**AN**	**AP**	**AW**	**AY**	**AZ**	**SY**	**Total**
H-3	1.39E+00	1.58E+00	1.90E+00	7.50E-02	5.13E-01	1.08E-01	5.57E+00
C-14	6.26E-01	5.55E-01	3.76E-01	2.88E-02	1.46E-01	8.57E-02	1.82E+00
Sr-90	5.29E+04	2.67E+04	2.98E+03	7.36E+04	6.95E+04	2.63E+03	2.28E+05
Tc-99	3.98E+01	4.58E+01	2.88E+01	1.53E+00	1.84E+01	1.66E+01	1.51E+02
I-129	5.92E-02	6.46E-02	3.34E-02	2.67E-03	1.36E-02	1.40E-02	1.87E-01
Cs-137	6.83E+04	7.19E+04	3.87E+04	5.62E+03	5.02E+04	1.32E+04	2.48E+05
Chemical (kg)	**AN**	**AP**	**AW**	**AY**	**AZ**	**SY**	**Total**
Chromium	2.45E+02	2.37E+02	1.48E+02	4.66E+01	5.22E+01	7.74E+02	1.50E+03
Nitrate	4.20E+04	5.22E+04	2.88E+04	1.44E+03	7.40E+03	1.02E+04	1.42E+05
Uranium	9.70E+02	2.29E+01	5.54E+02	3.46E+01	8.70E+01	7.60E+01	1.75E+03

[19] Best Basis Inventory (BBI) Summary (February 2017). The current version of the BBI is stored online and can be accessed using the Tank Waste Information Network System (TWINS) at: https://twinsweb.labworks.org/ (July 2015). Fifteen of the 16 C Tank Farm tanks have either been completely retrieved or retrieved to limits of technology, where Tank 241-C-105 is actively being retrieved (Templeton 2016). The current volume is 30 kgal where the volume after retrieval would be 360 ft^3 (2.7 kgal) that is used to update the inventories.

Risks and Potential Impacts Associated with Cleanup:

Tank closure activities specific to the Tank and Waste Farms EUs include retrieval of SST waste for treatment elsewhere onsite; operations and necessary maintenance, waste transfers and associated operations, and upgrades to existing tanks or construction of waste receipt facilities; filling the tanks and ancillary equipment with grout; disposal of contaminated equipment and soil; and installing an engineered modified RCRA Subtitle C barrier followed by post-closure maintenance. The information in Table E.1-8 and Table E.1-9 suggests that there are anticipated events associated with Tank Farm closure operations that may have moderate impacts. Controls have been put in place to address events with known significant risks (RPP-13033).

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

Facility Worker: As described in Section E.1.1, regular and construction workers will be at risk from exposure to direct radiation and waste contaminants during Tank Farm retrieval and closure operations. Controls will be implemented to limit radiological and toxicological risks to workers.

Co-located Person: As described in Section E.1.1, these persons may be at risk from exposure to direct radiation and waste contaminants during Tank Farm retrieval and closure operations. Controls will be implemented to limit radiological and toxicological risks to persons in these areas.

Public: The Tank Farms, which are in secure and controlled areas that prevent intentional and inadvertent intruders, are several miles interior to the Hanford Site boundary so the impact from the air pathway (e.g., dust) or other pathways (e.g., surface water, traffic, or transportation accidents) to the general public is considered low even during closure activities. Hanford groundwater use will be restricted during this period so there is no significant pathway to the public. These results would be different if portions of the site are opened for public access more proximate to the 200 Areas.

Groundwater: There will be a continuing impact during this period to groundwater (as a protected resource) from mobile Tank Farm primary contaminants (e.g., chromium, Tc-99, I-129, and nitrate) currently with plumes that exceed thresholds. These impacts are described in either Appendix D.5 or Appendix D.6 for CP-GW-1 (200-East) or CP-GW-2 EU (200-West), respectively.

Furthermore, there are primary (e.g., tank wastes) and secondary contaminant sources (legacy source sites) in the vadose zone that pose a continuing risk to groundwater. Specific ratings for individual Tank and Waste Farms EUs are developed in the corresponding Tank and Waste Farms EU sections. The vadose zone (VZ) GTM values for the Group A and B primary contaminants for the Single-Shell Tank (SST) Farm EUs translate to overall ratings for the Active Near-term and Post-Cleanup period from *Low* (CP-TF-4 for WMA U) to *High* (e.g., CP-TF-6 for WMA B-BX-BY) (Table E.1-3)[20].

Potential impacts from the 200-East and 200-West DST Farm EUs (CP-TF-8 and CP-TF-9, respectively) to groundwater were rated as *Low* and *Not Discernible* (*ND*), respectively, for all contaminants and evaluation periods.

The WMA S-SX groundwater extraction system; the U Plant Pump and Treat System, and I-129 Plume Hydraulic Control in 200-UP and the 200-West Area Pump and Treat system in 200-ZP are assumed to be operational during this evaluation period, which will be treating groundwater contamination.

[20] The vadose zone inventory of Sr-90 would translate to *Very High* ratings in multiple TF EUS; however, its relative immobility in the subsurface (compounded by radioactive decay) indicated that Sr-90 would not be a risk driver.

Columbia River: Based on the screening evaluation in the TC&WM EIS (DOE/EIS-0391 2012) and summarized in Table E.1-4, no radioactive contaminants are predicted to be discharged to the Columbia River in concentrations that would pose risk to benthic or riparian zone receptors. Similarly, because of the large dilution effect in the Columbia River, the free-flowing ratings are *Not Discernible* for all the Tank and Waste Farms EUs for all contaminants and evaluation periods.

However, based on the TC&WM EIS, some chemical contaminants (nitrate and chromium) were predicted to be discharged into the Columbia River in concentrations above benthic and riparian threshold values before the end of the Active Cleanup period[21] that would result in *Medium* benthic and *High* riparian zone ratings. However, well data suggest that water and contaminants are moving toward the Columbia River much more slowly than predicted leading to *Not Discernible* ratings.

Potential impacts from the 200-East and 200-West DST Farm EUs (CP-TF-8 and CP-TF-9, respectively) to the Columbia River receptors were rated as *Not Discernible* (*ND*) for all contaminants and evaluation periods.

Ecological Resources:

Truck and heavy equipment on roads through non-target areas or remediation site, as well as heavy, wide hoses, carry seeds or propagules on tires, injure or kill vegetation or animals, make paths, cause greater compaction of soil, displace animals and disrupt behavior/reproductive success. Also seeds and propagules can be dispersed from soil from truck or blowing from heavy equipment. Effects continue if hoses remain or are moved over time. Heavy equipment often leads to permanent or long-term compaction, destruction of soil invertebrates. Compaction can decrease plant growth in those areas, decrease abundance and diversity of soil invertebrates, and prevent fossorial snakes or mammals from using the area. Compaction of soils may permanently destroy areas of the site with intense activity. Effects continue if hoses remain or are moved over time. Additional water from dust suppression could lead to more diverse and abundant vegetation in areas that receive water, which could encourage invasion of exotic species. The latter could displace native plant communities. Excessive dust suppression activities could lead to compaction, which can decrease plant growth in those areas, decrease abundance and diversity of soil invertebrates, and prevent fossorial snakes or mammals from using the area. Irrigation for re-vegetation requires a system of pumps and water, resulting in physical disturbance. Repeated irrigation from the same locations could result in some soil compaction, which can decrease plant growth in those areas, decrease abundance and diversity of soil invertebrates, and prevent fossorial snakes or mammals from using the area. Soil removal can cause complete destruction of existing ecosystem, all of the above effects on adjacent sites, but these effects are potentially more severe because of blowing soil (and seeds) and the potential for exposure of dormant seeds. In the re-vegetation stage, there is the potential for invasion of exotic species, changing the species diversity of native communities. During remediation, radionuclides or other contaminants could be released or spilled on the surface, and depending upon the type and quantity, could have adverse effects on the plants and animals on site. Caps and other containment systems can disrupt local resources and drainage; often non-native plants used on caps (which can become exotic/alien adjacent to the containment site).

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

[21] The results were the same for both the No Action and Landfill Closure scenarios.

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. Construction of buildings, staging areas, caps, and other containment systems, and/or soil removal activities are assumed to have been cleared for cultural resources and any adverse effects would be resolved and/or mitigated. If building locations and staging areas have not been reviewed for cultural resources this could result in compaction and disturbance to the soil surface and throughout the subsurface leading to permanent adverse effects to the surface and subsurface integrity of an archaeological site by destroying the stratigraphic relationships of the soil, archaeological artifacts and features as well as all proximal information associated with archaeological artifacts and features.

Construction of buildings and staging areas can have direct effects to TCPs including destroying physical attributes of TCP, destruction of culturally important plants, alteration of the setting and introduction of noise and vibrations also altering the setting. These actions may interfere with traditional uses of TCP. In some instances the waste site is considered an archaeological site and/or pockets of undisturbed soils and potentially intact archaeological material are present. In these instances, effects could include preservation of artifacts in-situ if any information had already been gleaned from archeological site testing prior to capping. Otherwise, capping could result in compaction and compression of artifacts by destroying the stratigraphic relationships of the soil, archaeological artifacts and features as well as all proximal information associated with archaeological artifacts and features. Direct effects to TCPs include permanent alteration of physical setting and design of TCP, permanent viewshed impacts and possibly permanent interference with traditional use 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. Contamination remaining in situ may have direct effects including permanent physical alteration of TCP, and lead to permanent intrusion in long-term use and access to TCP.

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. During construction, indirect effects could result in temporary auditory, visual and vibrational effects. 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. Remaining contamination could lead to indirect effects from permanent intrusion, which could limit the use and access to TCP.

ADDITIONAL RISKS AND POTENTIAL IMPACTS IF CLEANUP IS DELAYED

There is potential for additional tank degradation and further leaks and contaminant transport through the vadose and saturated zones if Tank Farm closure activities are delayed. There is also potential risk

from direct radiation and tank waste contaminants to workers (and ecological receptors) from routine Tank Farm operations.

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

The preferred Hanford tank closure alternative includes 99 percent retrieval of waste from the SSTs (although this may not be practically achievable in all tanks) for staging in DSTs and treatment elsewhere onsite; operations and necessary maintenance, waste transfers and associated operations, and upgrades to existing tanks or construction of waste receipt facilities (DOE/EIS-0391 2012, Chapter 2, p. 2-321)[22]. SST closure operations include filling the tanks and ancillary equipment with grout to immobilize residual waste contaminants. Disposal of contaminated equipment and soil would occur on site. Decisions on the extent of soil removal and/or treatment would be made on a tank farm or waste management area basis through the RCRA closure permitting process. The tanks would be stabilized with grout, and an engineered modified RCRA Subtitle C barrier put in place followed by post-closure care.

Thus workers and the public would be isolated from the residual contamination in the tanks by both grout and soil cover. Tank waste contamination already in the vadose and saturated zones would experience reduced infiltrating water (the primary driver for the release and transport of contaminants) because of the surface barrier.

[22] According to the Tri-Party Agreement (Ecology, EPA, and DOE, 1998), retrieval limits for residual wastes are 360 ft^3 and 30 ft^3 for 100-Series and 200-Series tanks, respectively, corresponding to the 99% waste retrieval goal as defined in TPA Milestone M-45-00.

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

Table E.1-13. Summary of Populations and Resources at Risk or Potentially Impacted after Cleanup

Population or Resource		Impact Rating	Comments
Human	Facility Worker	Low	Workers will be low risk from exposure to direct radiation and waste contaminants after waste retrieval, grouting, and capping.
	Co-located Person	Low	These persons will be at low risk from exposure to direct radiation and waste contaminants after waste retrieval, grouting, and capping.
	Public	Not Discernible (ND)	The Tank Farms will be in secure and controlled areas that prevent intentional and inadvertent intruders. No complete groundwater pathway and no impact from air pathway.
Environmental	Groundwater (A&B) from vadose zone	Overall Ratings: SST Farm EUs 200-W: Low to High 200-E: Medium to High DST Farm EUs Not Discernible (ND) to Low	GTM values for Group A and B PCs (modified by transport and decay, where appropriate). High ratings in 200-W primarily related to chromium in both groundwater and vadose zone. High ratings in 200-E driven by chromium and I-129 in vadose zone.
	Columbia River from vadose zone	All SST and DST Tank Farm EUs Benthic: Not Discernible (all) Riparian: Not Discernible (all) Free-flowing: Not Discernible (all) **Overall**: Not Discernible	The ratings with respect to radionuclides are all ND. Only chemicals (nitrate and chromium) are predicted (DOE/EIS-0391 2012) to have near-shore concentrations that could threaten the River ecology. However, due to transport considerations based on well data, contaminant are unlikely to impact the River.
	Ecological Resources[(a)]	Refer to individual Tank Farm /Groundwater EUs	Refer to individual Tank Farm /Groundwater EUs
Social	Cultural Resources[(a)]	Refer to individual Tank Farm /Groundwater EUs	Refer to individual Tank Farm /Groundwater EUs

a. 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

After closure, the Tank and Waste Farms EUs are expected to have waste tanks and ancillary equipment grouted in place with residual contamination in tanks, ancillary equipment, and legacy source sites (e.g., cribs, trenches, and soil). Mobile primary contaminants have migrated from Tank and Waste Farms EU sources through the vadose zone to the saturated zone and will continue to move through the vadose zone and groundwater posing a continuing threat to groundwater as a protected resource. An engineered modified RCRA Subtitle C barrier will be emplaced over the tank farm site to reduce infiltrating water and contaminant migration for the time that the cap performs according to specifications. Upon cap failure, the recharge rate would likely increase significantly and thus so will the primary driver for contaminant transport. However, waste retrieval operations and grouting activities would help reduce the potential for release from residual waste source terms.

Because closure activities (including waste retrieval and surface barrier emplacement) would help isolate workers and the public from residual contamination, worker and public impacts are expected to remain *Low* during the Long-Term, Post-Cleanup period. The continuation of remedial actions such as pump and treat would help reduce groundwater contamination. The emplacement of a surface barrier would help reduce recharge in the areas near the Tank Farms; however, an evaluation of the groundwater transport analysis in the TC&WM EIS (DOE/EIS-0391 2012) indicated that the impacts of reduced recharge on groundwater contamination near the Tank Farms is mixed based on the area being considered. Furthermore, consideration of surface barrier emplacement (and its impact on recharge and transport) was predicted to have little impact on the nearshore region of the Columbia River. This result is not due to an ineffective barrier but instead likely due to large amounts of contaminants already in the subsurface and possible impacts from sources outside the Tank Waste and Farms EUs that were considered in the TC&WM EIS evaluation. Thus the ratings summarized in Table E.1-13 were not altered significantly based on long-term impacts or differing recharge assumptions.

Ecological Resources: Personnel, car, and pick-up truck traffic through non-target and remediated areas will likely no longer cause an effect on the ecological resources, unless heavy traffic caused ruts. If alien/exotic species became established during remediation, their presence could continue to affect the ecological resources. Permanent effects remain in the area of site with barrier or cap. Permanent effects remain in area surrounding cap or containment, depending upon traffic and current activities. During remediation, radionuclides or other contaminants released or spilled on the surface could have long-term effects if the contamination remained, and plants did not recolonize or thrive. Such disruptions could affect the associated animal community.

Cultural Resources: Personnel, car and truck traffic on paved roads will likely have no direct effects on the cultural resources assuming the resources were not disturbed during remediation. If the remedial action included construction of buildings, cap or other type of containment then there are permanent effects in the area of the site. If archaeological resources or TCPs were directly or indirectly damaged or altered during construction of buildings or cap, cumulative effects include continued erosion and adverse effects to both archaeological site and TCP. If contamination is left behind and controlled by a barrier or other containment, then permanent effects to the cultural resources may occur in the area. If archaeological resources or TCPs were directly or indirectly damaged or altered during contamination, then cumulative effects include permanent adverse effects to both archaeological site and TCP.

E.1.7. SUPPLEMENTAL INFORMATION AND CONSIDERATIONS

The primary risk drivers related to the Tank and Waste Farms EUs will be contaminated groundwater and residual vadose zone contamination that could lead to additional groundwater contamination and possible impact to Columbia River benthic and riparian receptors. There is a restriction on groundwater use in the 200 Areas, except for treatment and monitoring (Ranade 2009). Furthermore, appropriate use restrictions (including that on groundwater use) will be attached to any real estate transaction if DOE transfer property to other entities. The restriction on groundwater use needs to remain in place in perpetuity to maintain the safety margins considered in this review. Possible impacts to benthic and riparian receptors along the River Corridor would not be moderated by the aforementioned groundwater restrictions on use.

APPENDIX E.2

Tank Waste and Farms

CP-TF-1 (T Tank Waste and Farm)
Evaluation Unit Summary Template

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PART E.2. CP-TF-1 T SINGLE-SHELL TANK WASTE AND FARM (200-W)

E.2.1. EXECUTIVE SUMMARY

Much of the information related to the T Tank and Waste Farms Evaluation Unit (EU) is organized around the corresponding Waste Management Area (namely WMA T) that is regulated under the Resource Conservation and Recovery Act (RCRA) as modified in 40 CFR Part 265, Subpart F and Washington State's Hazardous Waste Management Act (HWMA, RCW 70.105 and its implementing requirements in the Washington State dangerous waste regulations [WAC 173-303-400]) (Horton 2006).

EU LOCATION:

North-Central part of 200-West on the Hanford Reservation; Central Plateau

RELATED EUS

S-SX Tank Waste and Farms (CP-TF-2), TX-TY Tank Waste and Farms (CP-TF-3), U Tank Waste and Farms (CP-TF-4), A-AX Tank Waste and Farms (CP-TF-5), B-BX-BY Tank Waste and Farms (CP-TF-6), C Tank Waste and Farms (CP-TF-7), 200-East DST Waste and Farms (CP-TF-8), 200-West DST and Waste Farms (CP-TF-9), 200-E Groundwater Plumes (CP-GW-1), 200-W Groundwater Plumes (CP-GW-2), and 200 Area Waste Transfer Pipeline (CP-LS-7)

PRIMARY CONTAMINANTS, CONTAMINATED MEDIA AND WASTES

The TC&WM EIS describes tank wastes as including radioactive (tritium or H-3, C-14, Sr-90, Tc-99, I-129, Cs-137, U-233, U-234, U-235, U-238, Np-237, Pu-239, and Pu-240)[23] and non-radioactive contaminants (chromium, mercury, nitrate, lead, total uranium, and PCBs) of potential concern (DOE/EIS-0391 2012, Appendix D). The tank wastes contain saltcake, sludge, and supernatant phases. Contaminated media related to the T Tank Farm include ancillary equipment and surrounding vadose zone (including cribs and trenches) down to the saturated zone (for some mobile contaminants) from past and current discharges. The Record of Decision for the 200-ZP-1 Operable Unit (OU) (EPA 2008) associated with WMA T and WMA TX-TY identifies Tc-99, I-129, chromium, and nitrate (NO3) as tank waste constituents that must be addressed in cleanup. The 2015 Groundwater Monitoring Report (DOE/RL-2016-09, Rev. 0) lists tank wastes including chromium, nitrate, I-129, Tc-99, H-3, and uranium and non-tank wastes including carbon tetrachloride (CCl_4) and trichloroethene (TCE) for the 200-ZP groundwater interest area (GWIA) that corresponds to the 200-ZP-1 OU[24].

After evaluating the contaminants associated with T Tank Farm tanks, ancillary equipment, legacy sources, and contaminated vadose zone, the primary contaminants from the tank wastes that drive

[23] Other isotopes considered include U-232 and U-236 and Pu-238, Pu-241, and Pu-242 to be consistent with other EUs. These additional uranium and plutonium isotopes are included in the totals presented but are not used for rating because 1) uranium toxicity impacts (represented by total uranium drives corresponding risks and 2) plutonium has been found relatively immobile in the Hanford subsurface and has not been identified as a risk driver for groundwater impacts.

[24] There is a one-to-one correspondence between each groundwater Operable Unit (e.g., 200-ZP-1), which is a regulatory construct under CERCLA that breaks sites on the National Priorities List (NPL) into smaller, more manageable areas denoted "Operable Units", and a groundwater interest area (GWIA) that is drawn to better represent the plumes on the Hanford Site based on geographic region.

human health risk to groundwater associated with the T Tank and Waste Farms Evaluation Unit are: Tc-99, I-129, chromium, and H-3. Those primary contaminants that may drive risk from groundwater discharge to the Columbia River are nitrate and chromium; however, any potential impacts are highly uncertain[25]. Cs-137 and Sr-90 are important from a safety standpoint and uranium isotopes, plutonium isotopes, and tritium are iconic constituents; these contaminants are included in the inventory summary even though they are not considered risk drivers for impacts to or from groundwater in this Review. Carbon tetrachloride (CCl_4) and trichloroethene (TCE) are not tank wastes and thus are captured in Appendix D.6 for the CP-GW-2 EU (200-ZP GWIA).

BRIEF NARRATIVE DESCRIPTION

Waste Management Area T (WMA T) occupies approximately 32,000 m^2 (7.9 acres) and contains 16 underground single-shell tanks (SSTs) constructed in 1943 and 1944 (Horton 2006, p. 2.1) that constitute the T Tank Farm. The Tank Farm contains 12 carbon steel tanks with capacities of 2×10^6 liters (530 kGal) and four smaller carbon steel tanks with capacities of 2×10^5 liters (55 kGal) in additional to ancillary equipment (e.g., diversion boxes, pumps, valves, and pipes). The SSTs in WMA T began receiving waste in 1944 and were in use until 1980 when the tanks were removed from service. The tanks received primarily high-level metal and first cycle waste from chemical processing (bismuth phosphate process) of uranium-bearing spent fuel rods. When there was a shortage of tank capacity, supernatant from tanks was sent to cribs. Waste management operations created a complex intermingling of tank wastes; natural processes resulted in settling, stratification, and segregation of waste components.

Historic liquid waste disposal practices as well as leaks and unplanned release has resulted in contamination near the T Tank Farm as summarized in Section E.2.3.

The SSTs in WMA T have been interim stabilized (i.e., liquid transferred to DSTs to <50 kgal drainable interstitial liquid and <5 kgal of supernatant). Initial corrective actions (including berms, ditches, water line testing and sealing, and a partial cover) have been implemented at WMA T (Horton 2006, p. 2.2; Zhang, et al. 2009).

SUMMARY TABLES OF RISKS AND POTENTIAL IMPACTS TO RECEPTORS

Table E.2-1 provides a summary of nuclear and industrial safety related consequences from CP-TF-1 (T Tank and Waste Farms EU) to humans and impacts to important physical Hanford Site resources. Receptors are described in Section E.1.6 (Appendix E.1).

[25] "For groundwater discharging to the Columbia River…, potential long-term impacts on aquatic and riparian receptors would be unlikely for all COPCs and receptors except for chromium and aquatic biota..." (DOE/EIS-0391 2012, p. 2–235). For the COPC (i.e., hexavalent chromium) with the highest risk indices for aquatic biota, Hazard Quotients exceeded 40 (versus a limit of 1). However, the TC&WM EIS states "… Only estimated exposures of aquatic biota to hexavalent chromium in nearshore surface water under all Tank Closure … exceeded the Hazard Quotient criterion of 1 at the Columbia River. Based on the conservative nature of the exposure assumptions, the estimated Hazard Indices and Hazard Quotients for the representative receptors indicated that no adverse effects of radioactive or chemical COPCs in … groundwater releases to the Columbia River..." (DOE/EIS-0391 2012, Appendix P, pp. P–53-54). "The potential impact on aquatic biota in the Hanford Reach of nitrate in groundwater discharge is uncertain." (DOE/EIS-0391 2012, Appendix P, pp. P–54).

Table E.2-1. CP-TF-1 (T Tank Farm) impact Rating Summary for Human Health (unmitigated basis with mitigated basis provided in parentheses (e.g., "High (Low)").

Population or Resource		Evaluation Time Period[a]: Active Cleanup (to 2064)	
		Current Condition: Maintenance & Monitoring (M&M)	**From Cleanup Actions:** Retrieval & Closure
Human Health	Facility Worker[b]	***M&M***: Low-High[d] (Low-High)[d] ***Soil***: Not Discernible (ND)-High (ND-Low)	***Preferred method***: High (Low) ***Alternative***: High (Low)
	Co-located Person[b]	***M&M***: Low-Moderate (Low) ***Soil***: ND (ND)	***Preferred method***: Low-Moderate (Low) ***Alternative***: Low-Moderate (Low)
	Public[b]	***M&M***: Low (Low) ***Soil***: ND (ND)	***Preferred method***: Low (Low) ***Alternative***: Low (Low)
Environmental	Groundwater (A&B PCs) from vadose zone[c]	*High* -- Cr(tot) and Cr-VI *Medium* -- I-129 and Tc-99 *Low* -- C-14 *ND* -- Sr-90[f] and U(tot)[f] **Overall**: *High*	*High* -- Cr(tot) and Cr-VI *Medium* -- I-129 and Tc-99 *Low* -- C-14 *ND* -- Sr-90[f] and U(tot)[f] **Overall**: *High*
	Columbia River from vadose zone[c]	Benthic and Riparian: ND Free-flowing: ND **Overall**: ND	Benthic and Riparian: ND Free-flowing: ND **Overall**: ND
	Ecological Resources[e]	ND to Low **Overall**: Low	Low to Medium **Overall**: Medium
Social	Cultural Resources[e]	**Native American:** Direct: Unknown Indirect: Known **Historic Pre-Hanford:** Direct: None Indirect: Unknown **Manhattan/Cold War:** Direct: Known Indirect: Known	**Native American:** Direct: Unknown Indirect: Known **Historic Pre-Hanford:** Direct: None Indirect: Unknown **Manhattan/Cold War:** Direct: Known Indirect: Known

a. A rating for cultural resources is 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.

b. Evaluated in Section E.1.6 (Appendix E.1).

c. Groundwater threat for Group A and B primary contaminants (PCs) remaining in the vadose zone or to the Columbia River for all primary contaminants (CRESP 2015a). Threats from existing plumes associated with the T Tank and Waste Farms EU are described in Section E.2.5 and Appendix D.6 (CP-GW-2) for the 200-ZP Groundwater Interest Area (GWIA). Groundwater in the area is being treated using the 200 West Pump and Treat Facility that has extracted chromium, Tc-99, and small amounts of I-129 (of those PCs in the table related

to the CP-TF-1 vadose zone) (DOE/RL-2016-09, Rev. 0); however, groundwater treatment does not impact the vadose zone source or threat.

d. Industrial safety consequences range from Low to High (based on the evaluation scale used) for both mitigated (with controls) and unmitigated (without controls). Mitigated radiological and toxicological consequences to facility workers are High (unmitigated) and Low (mitigated).

e. 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.

f. The large amount of Sr-90 disposed of in the T Tank and Waste Farms EU would translate to a *Very High* rating; however, there is no current Sr-90 plume in the 200-ZP GWIA and it would likely require more than 150 years to reach groundwater in a sufficient amount to exceed the drinking water standard over an appreciable area (Section E.2.5). The uranium inventory would translate to a *Low* rating, but also is unexpected to reach groundwater in 150 years. Total uranium and Sr-90 are given *Not Discernible* (*ND*) ratings for the Active Cleanup period and *Low* ratings afterwards to account for uncertainties in the evaluation. Thus these primary contaminants are not considered risk drivers for the T Tank and Waste Farms EU during the evaluation period.

SUPPORT FOR RISK AND IMPACT RATINGS FOR EACH POPULATION OR RESOURCE

Human Health

The current and cleanup-related consequences related to work being conducted at the Tank Farms in the 200 Areas (Hanford Central Plateau) was evaluated in Section E.1.6 (Appendix E.1).

Groundwater, Vadose Zone, and Columbia River

Current

T Tank Farm contaminants are currently impacting the vadose zone and groundwater (where CP-TF-1 sources are suspected of being able to contribute mobile contaminants to groundwater (DOE/RL-92-16, Rev. 0)), and treatment is not predicted to decrease concentrations to below thresholds before active cleanup commences. Secondary sources (e.g., chromium) in the vadose zone also threaten to continue to impact groundwater in the future, including the Active Cleanup period[26]. Note that there is also a current plume for chromium in the 200-ZP GWIA (DOE/RL-2016-09, Rev. 0)[27]. As described in the TC&WM EIS (and summarized in Section E.2.5), there appears to be insufficient impact from radioactive decay (since chromium is the risk driver in this case) and recharge rate (due to large amounts of these contaminants already in the groundwater) on peak concentrations in the groundwater and near-shore region of the Columbia River during or after cleanup to modify ratings. Thus the values for these receptors are the same as those shown in Table E.2-8.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

See Section E.1.1.

[26] Note that Sr-90, which has a large vadose zone source, is not considered a significant threat to groundwater due to its limited mobility in the Hanford subsurface. See Section E.2.5 for details.

[27] Only a single plume area is given for "Chromium (Total and Hexavalent)" in Table 12-1 (DOE/RL-2016-09, Rev. 0, p. 12-3).

Ecological Resources

Current
There is little habitat in the T Tank and Waste Farms EU (>1% level 3 resources), but over 10% in buffer area is level 3 resources. Effect in ND in EU, but may be up to Low in buffer due to truck disturbance.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches
Effects to resources are due to increased disturbance and potential for contaminant release, increases in exotic species, and potential loss of some nesting habitat in buffer area, run over lizards and other wildlife during cleanup.

Cultural Resources

Current
Historical evidence of National Register eligible historic trail through the EU, however, extensive disturbance in area indicates low likelihood of remaining archaeological resources. Manhattan Project/Cold War significant resources have already been mitigated. Area is very disturbed and there is no evidence of archaeological sites being recorded within the EU. There is evidence of ethno historic and historic land use within the EU that has been destroyed by the Tank Farms.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches
Due to presence of historic and ethno-historic land use within this EU, consultation will be necessary. Little to no potential for intact surface or subsurface archaeological material to be present due to heavy disturbance throughout EU.

Considerations for Timing of the Cleanup Actions

See Section E.1.1 (Appendix E.1).

Near-Term, Post-Cleanup Risks and Potential Impacts

See Section E.1.1 (Appendix E.1).

E.2.2. ADMINISTRATIVE INFORMATION

OU AND/OR TSDF DESIGNATION(S):

The T Tank and Waste Farms Evaluation Unit (EU), denoted *CP-TF-1 – T Tank Waste and Farms*, consists of 16 waste tanks, ancillary structures, associated liquid waste sites, and soils contamination; much of this EU is contained within Waste Management Area T (WMA T). Waste Management Area (WMA) T is regulated under the Resource Conservation and Recovery Act (RCRA) as modified in 40 CFR Part 265, Subpart F and Washington State's Hazardous Waste Management Act (HWMA, RCW 70.105 and its implementing requirements in the Washington State dangerous waste regulations [WAC 173-303-400]) (Horton 2006).

COMMON NAME(S) FOR EU:

There is no common name for the T Tank and Waste Farms EU because the EU is comprised of elements from other waste management units including Waste Management Area T (WMA T) that includes the 241-T (or T) Tank Farm. The Tank Farm contains 16 waste tanks (T-101 through T-112 and T-201 through T-204). These tanks often are designated as 241-T-101 through 241-T-112 and 241-T-201 through 241-T-204 or 241-T-TK-101 through 241-T-TK-112 and 241-T-TK-201 through 241-T-TK-204. Other components

in the EU (including associated legacy waste sites) are listed below in the *Primary EU Source Components* section.

KEY WORDS:

T Tank Farm, 241-T Tank Farm, waste tanks, tank farm, Waste Management Area T, WMA T

REGULATORY STATUS

Regulatory Basis

DOE is the responsible agency for the closure of all single-shell tank (SST) waste management areas (WMAs) through post closure, in close coordination with other closure and cleanup activities of the Hanford Central Plateau. Washington State has a program that is authorized under RCRA and implemented through the HWMA and its associated regulations; Ecology is the lead regulatory agency responsible for the closure of the SST system. Please refer to Section E.1.2 (Appendix E.1) for more information.

Applicable Regulatory Documentation

The relationship among the tank waste retrieval work plans (TWRWP) and the overall single-shell tank (SST) waste retrieval and closure process is described in Appendix I of the Hanford Federal Facility Agreement and Consent Order (HFFACO), along with requirements for the content of TWRWPs. In 1993 WMA T was placed in assessment monitoring because of elevated specific conductance, which is a RCRA indicator parameter, in a downgradient well (Horton 2006). A groundwater quality assessment plan was written (Caggiano & Chou 1993; Hodges & Chou 2001) describing the monitoring activities used in deciding whether WMA T has affected groundwater.

Applicable Consent Decree or TPA Milestones

Federal Facility Agreement and Consent Order, 1989 and amended through June 16, 2014: Milestone M-045-00; Lead Agency Ecology: *Complete the closure of all Single Shell Tank Farms by 01/31/2043*

RISK REVIEW EVALUATION INFORMATION

Completed: Revised August 25, 2015

Evaluated by: K. G. Brown

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

E.2.3. SUMMARY DESCRIPTION

CURRENT LAND USE

DOE Hanford Site for industrial use. All current land-use activities in the 200-West Area are *industrial* in nature (EPA 2012).

DESIGNATED FUTURE LAND USE

Industrial-Exclusive. All four land-use scenarios listed in the Comprehensive Land Use Plan (CLUP) indicate that the 200-West Area (of which T Tank and Waste Farms EU is a part) is denoted *Industrial-*

Exclusive (DOE/EIS-0222-F). An industrial-exclusive area is "suitable and desirable for treatment, storage, and disposal of hazardous, dangerous, radioactive, and nonradioactive wastes" (DOE/EIS-0222-F).

PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

The legacy source sites associated with the T Tank and Waste Farms EU are described in Attachment Section E.2.8. To summarize, historic liquid waste disposal practices as well as leaks and unplanned release has resulted in contamination near the T Tank Farm (Horton 2006, p. 2.2-2.3) including cribs: 216-T-7 (110×10^6 L of waste), 216-T-32 (29×10^6 L of waste), 216-T-36 (0.5×10^6 L of waste), and 216-T-5 (2.6×10^6 L of waste); specific retention trenches: 216-T-14 through 216-T-17 ($0.8\text{-}1\times10^6$ L of waste each); and unplanned releases of which there were nine in or near WMA T. Seven of the SSTs in WMA T are "assumed leakers" with leaks estimates ranging from not estimated (T-107) to <1,000 gallons (T-103, T-108, and T-109) to 115,000 gallons (T-106 in 1973) (Templeton 2016, p. 22). Additional details are provided In Section E.2.4.

Waste Tanks and Ancillary Equipment

The 16 waste tanks in the T Tank and Waste Farms EU are:

- (241-)T-101 (241-T-TK-101)
- (241-)T-102 (241-T-TK-102)
- (241-)T-103 (241-T-TK-103)
- (241-)T-104 (241-T-TK-104)
- (241-)T-105 (241-T-TK-105)
- (241-)T-106 (241-T-TK-106)
- (241-)T-107 (241-T-TK-107)
- (241-)T-108 (241-T-TK-108)
- (241-)T-109 (241-T-TK-109)
- (241-)T-110 (241-T-TK-110)
- (241-)T-111 (241-T-TK-111)
- (241-)T-112 (241-T-TK-112)
- (241-)T-201 (241-T-TK-201)
- (241-)T-202 (241-T-TK-202)
- (241-)T-203 (241-T-TK-203)
- (241-)T-204 (241-T-TK-204)

The ancillary equipment included in the T Tank and Waste Farms EU is listed in Attachment Section E.2.8 and consists primarily of pipelines, diversion boxes, and catch tanks.

Groundwater Plumes

The T Tank and Waste Farms EU is associated with the 200-ZP GWIA. The current 200-ZP plumes associated with the T Tank and Waste Farms EU sources that exceed water quality standards are chromium (assumed hexavalent chromium because it presents the greatest risk at a given concentration), I-129, and Tc-99 (DOE/RL-2016-09, Rev. 0). Legacy sites within the CP-TF-1 EU are suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-16, Rev. 0). Uranium is not a contaminant of concern in the 200-ZP GWIA; however, it is extracted from wells in the 200-UP GWIA. There are other contaminants of concern (i.e., carbon tetrachloride, nitrate, and trichloroethene) associated with the 200-ZP GWIA that exceed final cleanup levels (EPA 2008; DOE/RL-2016-09, Rev. 0); however, these contaminants do not result from sources associated with the T Tank and Waste Farms EU. An interim pump-and-treat (P&T) system was operated in 200-ZP from 1996 until 2012 when the final P&T system came on line (EPA 2008) to reduce the mass of carbon tetrachloride (as well as secondary contaminants trichloroethene and chloroform) in the groundwater. Soil vapor extraction has also been used to reduce the vadose zone source of carbon tetrachloride.

See Appendix D.6 (CP-GW-2 EU) for additional details.

Operating Facilities

Because of the prohibition on waste additions to the Hanford SSTs,[28] the T Tank and Waste Farms EU components are not considered Operating Facilities for this Review. See Section E.1.4 (Appendix E.1) for details.

D&D of Inactive Facilities

Not Applicable.

LOCATION AND LAYOUT MAPS

A series of maps are used to illustrate the location of the components within the CP-TF-1 EU and the T Tank and Waste Farms EU relative to the Hanford Site. Figure E.2-1 shows the relationship between the 200-W (200 West) Area (where the T Tank Farm and Waste Management Area T are located) and the Hanford Site. Figure E.2-2 illustrates the T Tank and Waste Farms EU boundary. Figure E.2-3 shows a detailed view of the waste tanks, ancillary equipment, and legacy source units in the T Tank and Waste Farms EU.

[28] Berman presentation on July 29, 2009, titled "Hanford Single-Shell Tank Integrity Program." Available at www.em.doe.gov.

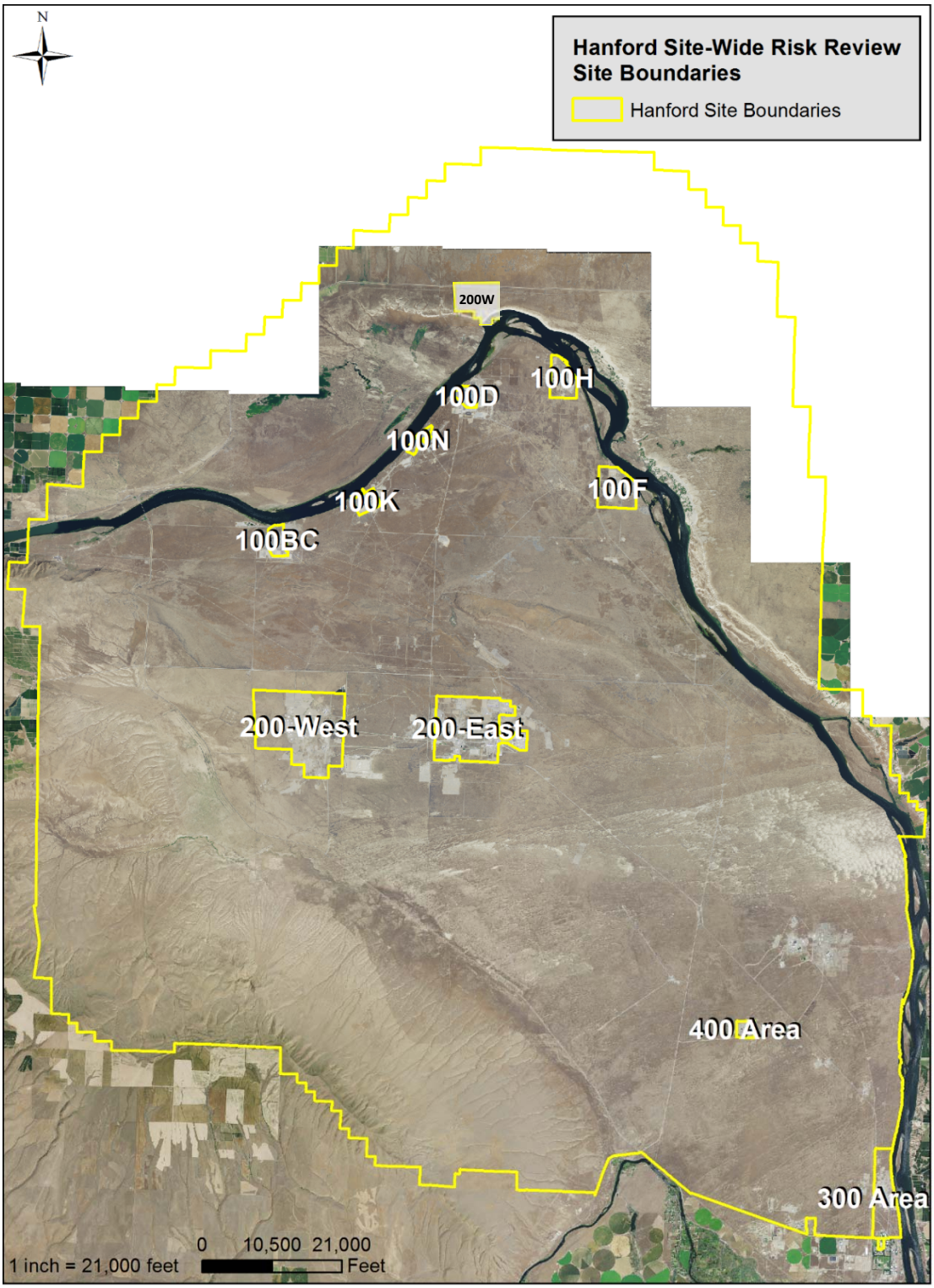

Figure E.2-1. Hanford Site Boundary showing 200-W Area. The T Tank Farm and Waste Management Area T (WMA T) are located in the 200-W Area (http://phoenix.pnnl.gov/).

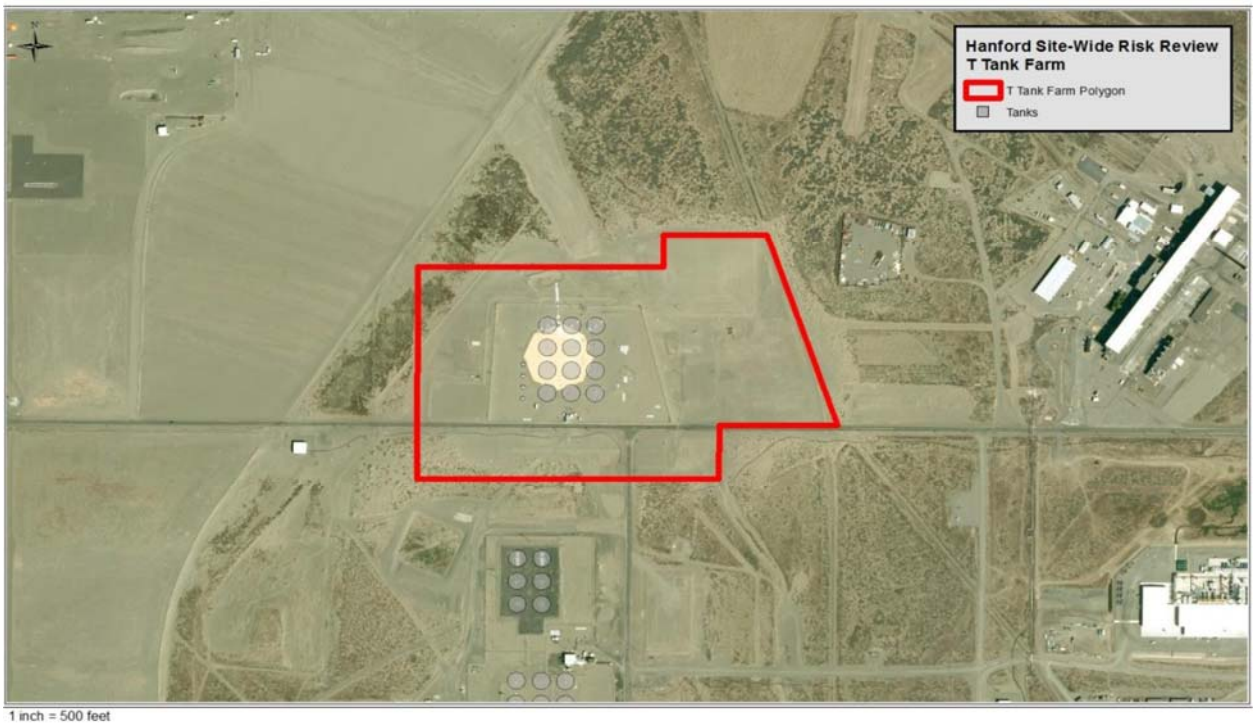

Figure E.2-2. Polygon representing the boundary of the T Tank and Waste Farms Evaluation Unit (see Attachment Section E.2.8).

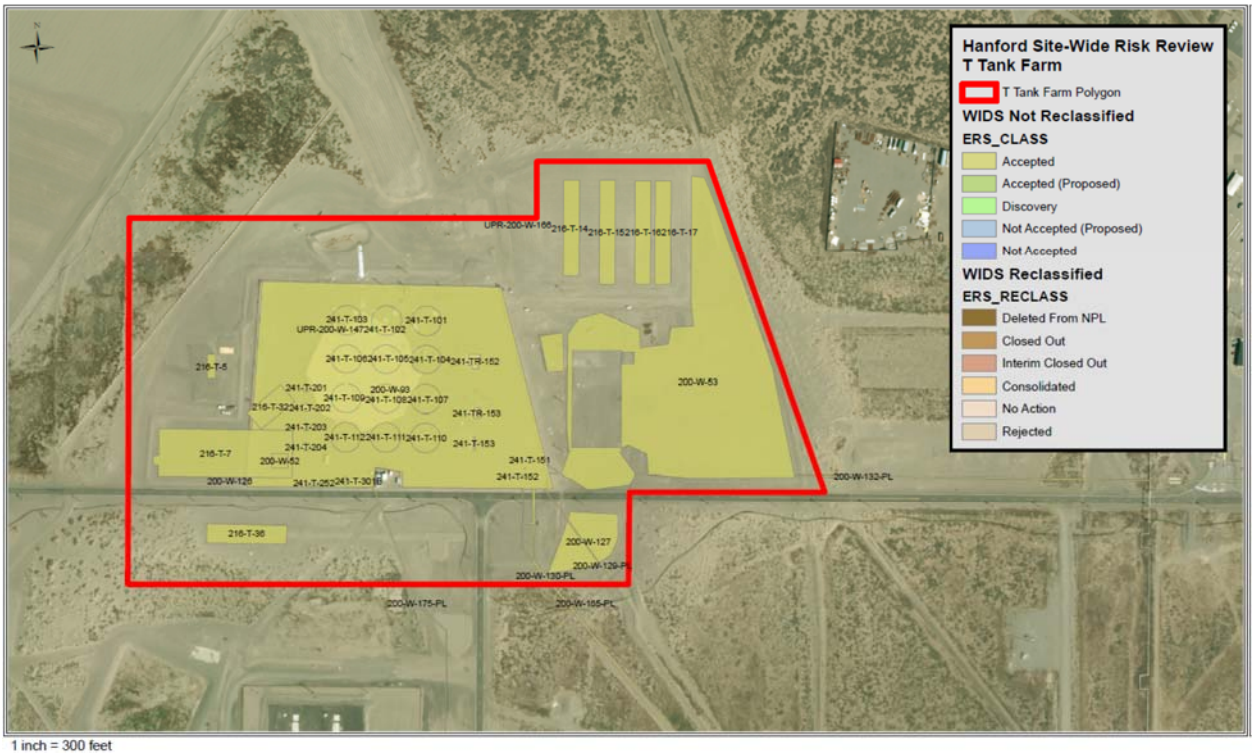

Figure E.2-3. Hanford T Tank and Waste Farms Evaluation Unit including tanks, legacy source units, and ancillary equipment (see Attachment Section E.2.8).

E.2.4. UNIT DESCRIPTION AND HISTORY

EU FORMER / CURRENT USES

Waste Management Area T (WMA T) occupies approximately 32,000 m^2 (7.9 acres) and contains 16 underground single-shell tanks (SSTs) constructed in 1943 and 1944 (Horton 2006, p. 2.1) that constitute the T Tank Farm. The Tank Farm contains 12 carbon steel tanks with capacities of 2×10^6 liters (530 kGal) and four smaller carbon steel tanks with capacities of 2×10^5 liters (55 kGal) in additional to ancillary equipment (e.g., diversion boxes, pumps, valves, and pipes). The SSTs in WMA T began receiving waste in 1944 and were in use until 1980 when the tanks were removed from service. The tanks received primarily high-level metal and first cycle waste from chemical processing (bismuth phosphate process) of uranium-bearing spent fuel rods. When there was a shortage of tank capacity, supernatant from tanks was sent to cribs. Waste management operations created a complex intermingling of tank wastes; natural processes resulted in settling, stratification, and segregation of waste components. Initial corrective actions (including berms, ditches, water line testing and sealing, and a partial cover) have been implemented at WMA T (Horton 2006, p. 2.2; Zhang, et al. 2009). The SSTs in WMA T have been interim stabilized (i.e., liquid transferred to DSTs to <50 kgal drainable interstitial liquid and <5 kgal of supernatant). The T Tank Farm tanks are currently awaiting retrieval and closure.

LEGACY SOURCE SITES

The contamination in the legacy source sites (cribs, trenches, and near-tank soil contaminated by past tank leaks and unplanned releases) associated with the T Tank and Waste Farms EU comes from intentional and unintentional discharges of T Tank Farm wastes (Horton 2006, p. 2.2-2.3):

- The 216-T-7 crib operated from 1948-1955 and received 110×10^6 L of second-cycle, T-Plant cell drainage waste, and plutonium concentrator waste.
- The 216-T-32 crib operated from 1946-1952 and received 29×10^6 L of waste from the 224-T building by way of the 241-T-201 single-shell tank.
- The 216-T-14 through 216-T-17 specific retention trenches each received 785,000 to 1×10^6 L of first-cycle waste in 1954.
- The 216-T-36 crib southwest of the T Tank Farm received about 522,000 L of decontamination waste and condensate in 1967-68.
- The 216-T-5 crib, located just west of the T Tank Farm, received about 2.6×10^6 L of second cycle waste in 1955.
- Seven of the SSTs in WMA T are declared “assumed leakers” [29] with leaks estimates ranging from not estimated (T-107) to < 1,000 gallons (T-103, T-108, and T-109 in 1973) to 115,000 gallons (T-106 in 1973) (Templeton 2016, p. 22).
- Nine unplanned releases (UPRs) have been documented in or near WMA T that are part of the CP-TF-1 EU.

WASTE TANKS

See Section E.2.3 for details.

[29] Tanks that are either known or suspected of leaking at any time (including the present) are denoted “assumed leakers” (Weyns 2014).

GROUNDWATER PLUMES

The 200-ZP groundwater plumes (Tc-99, I-129, and chromium) considered to be associated with the T Tank Farm and co-located liquid waste disposal facilities are described in Section E.2.5 with detailed information in Appendix D.6 for the CP-GW-2 EU (200-ZP GWIA). Sites within the CP-TF-1 EU, including 216-T-5 and 216-T-12 Trenches and 216-T-7 Tile Field are suspected of being able to contribute mobile contaminants to the saturated zone (i.e., representing migration of contaminants from the waste site to the uppermost aquifer) (DOE/RL-92-16, Rev. 0, Table 2-2). Note that no source inventory was provided for carbon tetrachloride (CCl_4) or trichloroethene (TCE) (not tank wastes); the CCl_4 and TCE plumes near the T Tank and Waste Farms EU are not associated with the T Tank and Waste Farms EU legacy sites (DOE/RL-2016-09, Rev. 0). The 200-ZP groundwater is being treated using the 200 West Pump and Treat Facility.

D&D OF INACTIVE FACILITIES – NOT APPLICABLE

OPERATING FACILITIES – NOT APPLICABLE

Because of the prohibition on waste additions to the Hanford SSTs,[30] the T Tank and Waste Farms EU components are not considered Operating Facilities for this Review.

ECOLOGICAL RESOURCES SETTING

Landscape Evaluation and Resource Classification:

The amount and proximity of biological resources to the T Tank and Waste Farms EU was examined within the adjacent landscape buffer area radiating 574 m from the geometric center of the EU (equivalent to 256 acres). Approximately 44% of the adjacent landscape buffer area is classified as level 0 biological resources in the existing resource map (Appendix J, Table 2, p. J-57 and Figure 8, p. J-58). The nearest level 3 resources within the buffer area are located south of the evaluation site (individual occurrences of sensitive plant species) and north and northeast of the evaluation site (Appendix J, Figure 8). Review of historical ECAP data indicates the areas north and northwest of the EU contained shrub-steppe with a native climax big sagebrush (*Artemisia tridentata*) overstory with cheatgrass (*Bromus tectorum*) co-dominant in the understory with native bunchgrasses. These habitats have been degraded over the past 5 years with blowing sand and invasion by Russian thistle (*Salsola tragus*). No level 4 or 5 resources are present within the T Tank Farm adjacent landscape buffer.

Field Survey:

Approximately 90% of the T Tank and Waste Farms EU consists of graveled surfaces and paved areas. No vegetation measurements were taken in the areas adjacent to the actual tank farm. The existing resource level map indicates the presence of level 3 resources in the southwest corner of the EU to the south of the paved road associated with a point occurrence of a sensitive species (*Erigeron piperianus*) that has been observed at this location in past ECAP surveys but was not observed in 2010. No wildlife was observed in the area during a vehicle reconnaissance of the boundary, and in 2010, a previous PNNL ECAP survey of the habitat surrounding the tank farm noted only coyote (*Canis latrans*) tracks in the habitat to the west and northwest of the tank farm.

[30] Berman presentation on July 29, 2009, titled “Hanford Single-Shell Tank Integrity Program.” Available at www.em.doe.gov.

CULTURAL RESOURCES SETTING

Cultural resources known to be recorded within the T Tank and Waste Farms EU are limited to the National Register-eligible 241-T Tank Farm associated with the Manhattan Project and Cold War Era Historic District, with documentation required. All National-Register-eligible Manhattan Project and Cold War Era buildings have been documented as described in the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan* (DOE/RL-97-56). Additionally, the non-contributing/ineligible portion of the National Register-eligible White Bluffs Trail/Road which is associated with both the Native American Precontact and Ethnographic and the Pre-Hanford Early Settlers/Farming Landscapes, passes through the T Tank and Waste Farms EU.

None of the T Tank and Waste Farms EU has been inventoried for archaeological resources and closure and remediation of the tank farms located within the T Tank and Waste Farms EU have been addressed in an NHPA Section 106 review. There is a possibility that intact archaeological material is present in the T Tank and Waste Farms EU because it has not have not been inventoried for archaeological resources (both on the surface and in the subsurface) and particularly if undisturbed soil deposits exist within the T Tank and Waste Farms EU. Given the extensive disturbance this is unlikely. The National Register-eligible Hanford Site Plant Railroad, associated with the Manhattan Project/Cold War era Historic District with documentation required is the closest recorded cultural resource located within 500 meters of the T Tank and Waste Farms EU. All National-Register-eligible Manhattan Project and Cold War Era buildings been documented as described in the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan* (DOE/RL-97-56).

Despite no physical evidence of an historic/ethnohistoric trail/road within the T Tank and Waste Farms EU, historic maps reveal that this trail existed prior to excavation for the T Tank Farm. Given the extensive ground disturbance within the entire EU and the geomorphology in the area, overall the potential for the presence of intact archaeological resources to be present subsurface within the T Tank and Waste Farms EU is unlikely.

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 associated with these landscapes (e.g., East Benton Historical Society, the Franklin County Historical Society, the Prosser Cemetery Association, the Reach and B-Reactor Museum Association) may need to occur. Indirect effects are always possible when TCPs are known to be located in the general vicinity. 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.

E.2.5. WASTE AND CONTAMINATION INVENTORY

Table E.2-2 provides inventory estimates of the various source components associated with the T Tank and Waste Farms EU including tank wastes and ancillary equipment, legacy sources including leaks, cribs, trenches, unplanned releases (UPRs), vadose zone sources, saturated zone (plume) estimates, treatment amounts, and remaining vadose zone estimates (i.e., the difference of the vadose zone

estimates and the saturated zone and treatment estimates)[31]. This information is further summarized in Figure E.2-4 through Figure E.2-12 before and after planned 99% retrieval[32].

For example, the major sources for Tc-99 and I-129 in the EU before retrieval are the T Tank Farm tanks and leaks from these tanks. The maximum groundwater threat metric (GTM) (Figure E.2-13)[33] is dominated by the T Tank Farm wastes before retrieval and by leaks after planned retrieval. The tritium inventory, both pre- and post-retrieval, is dominated by leaks and trenches. After planned retrieval, leaks dominate the T Tank and Waste Farms EU sources for Tc-99 and I-129. For chromium and nitrate, cribs and trenches and the T Tank Farm tanks are major sources before retrieval. After retrieval, the cribs and trenches dominate the source of these primary contaminants. Current uranium, Sr-90, Cs-137, and plutonium isotope inventories tend to be dominated by the tank wastes; the post-retrieval inventories tend to be dominated by legacy sources in the vadose zone.

CONTAMINATION WITHIN PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

The estimated T Tank Farm inventory for the Legacy / Vadose Zone Source Sites (i.e., cribs, trenches, and soil contaminated by tank leaks and unplanned releases) is summarized in Table E.2-2 and further described in Figure E.2-4 through Figure E.2-12 before and after planned 99% retrieval (which will have no impact on the current legacy source site inventories). These values constitute estimates of the initial amounts of contaminants discharged to the vadose zone that are then used to estimate the remaining inventory in the vadose zone as described below (i.e., by difference using the process described in Chapter 6 of the Methodology Report for 2013 groundwater monitoring data (CRESP 2015a) as revised for the 2015 groundwater monitoring results (DOE/RL-2016-09, Rev. 0) as described in Appendix D.1). These estimates necessarily have large associated uncertainties.

Waste Tanks and Ancillary Equipment

The estimated total inventory for all the T TF EU waste tanks and Ancillary Equipment is provided in Table E.2-2 for both the 90% and planned 99% retrieval scenarios. The tank-by-tank inventories are provided in Table E.2-3 through Table E.2-6. Safety-related information (i.e., hydrogen generation rates and times to the lower flammability limit are also provided in Table E.2-3. The inventories for the various contaminant in the T Tank Farm tanks vary over several orders of magnitude as does the GTM. This information is further summarized in Figure E.2-4 through Figure E.2-12 before and after planned 99% retrieval and for the maximum GTM (I-129 and Tc-99) in Figure E.2-13.

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[31] The basis for the saturated and vadose zone estimates are provided in Chapter 6 of the Methodology Report (CRESP 2015a) and examples are provided in the demonstration section for the 200-UP-1 Operable Unit that corresponds to the 200-UP GWIA. These estimates tend to have very high associated uncertainties.

[32] According to the Tri-Party Agreement (Ecology, EPA, and DOE, 1998), retrieval limits for residual wastes are 360 ft^3 and 30 ft^3 for 100-Series and 200-Series tanks, respectively, corresponding to the 99% waste retrieval goal as defined in TPA Milestone M-45-00. For purposes of this Review the 99% and 90% Retrieval Scenarios reflect assumptions described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 and apply only to tank volumes and inventories. They are calculated assuming retrieval of a fully mixed tank of homogeneous composition. For tanks that have been declared "Retrieval Completed" or "Retrieved to Limit of … Technologies" (Templeton, AM 2016, page 9, partially duplicated in Table E.1-7), no further retrieval for either the 99% or 90% retrieval scenario is assumed. This includes tank 241-S-112 and all C Tank Farm tanks except 241-C-105. For tanks that are currently undergoing retrieval (tanks 241-AY-102 and 241-C-105), a retrieval amount equivalent to the 99% and 90% retrieval volumes described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 are calculated.

[33] Maximum of the GTMs for Tc-99 and I-129 only.

Vadose Zone Contamination

The estimated inventories for the vadose zone, saturated zone, and treatment amounts are found in Table E.2-7. These inventories represent the vadose zone contamination *outside* the tanks and ancillary equipment (i.e., that are generally available for transport through the environment). These inventories are used to estimate the inventory remaining in the vadose zone using the process described in Chapter 6 of the Methodology Report (CRESP 2015a) as modified for the 2015 groundwater results (Appendix D.1). The focus in this section will be on the Group A and B primary contaminants in the vadose zone due to their mobility and persistence in the environment and potential threats to groundwater. To summarize:

- *Tc-99, I-129* – There are existing Tc-99 and I-129 plumes in groundwater (200-ZP GWIA) that are associated with T Tank and Waste Farms EU sources. Sources of Tc-99 were leaks from single-shell tanks (SSTs) and pipelines in WMA T and WMA TX-TY and liquid waste disposal from plutonium-processing operations to cribs and trenches adjacent to the WMAs (DOE/RL-2016-09, Rev. 0). Sources of I-129 include past leaks from SSTs containing metal and liquid waste and chemical processing at T Plant (DOE/RL-2016-09, Rev. 0). The reported vadose zone inventory is dominated by past leaks.
- *Sr-90* – There is not currently a Sr-90 plume; measured values in the 200-ZP GWIA have been less than 1 pCi/L over the past few years. The reported vadose zone inventory is dominated by past tank leaks. Thus the majority of the Sr-90 originally discharged into the vadose zone would have had to travel through much of the vadose zone to impact groundwater. The TC&WM EIS screening groundwater transport analysis (Appendix O, DOE/EIS-0391 2012) indicates that Sr-90 (albeit from sources in addition to those in the T TF EU) is not expected to reach the T Barrier (i.e., less than 1×10^{-8} Ci/yr within the 10,000-year TC&WM EIS evaluation period (Appendix O, DOE/EIS-0391 2012, p. O-2))[34], which indicates that Sr-90 is not predicted to be very mobile in the vadose zone near the T Tank and Waste Farms EU. Furthermore, the average water travel time through the vadose zone for a recharge rate of 100 mm/yr is 64 years for the 200-West Area (Table N-52, DOE/EIS-0391 2012), and thus the resulting average Sr-90 travel time accounting for retardation would be more than 300 years (i.e., 64 yr × 4.6 or 10+ half-lives leaving less than 0.10% of the original Sr-90 source) to move through the vadose zone[35]. It would likely require significantly more than 150 years to reach groundwater in a sufficient concentration to exceed the drinking water standard (DWS) over an appreciable area. Thus a Sr-90 plume is not expected in the next 150 years due to retardation in the vadose zone or after due to radioactive decay (+97% reduction in Sr-90 inventory). Thus Sr-90 is not considered a significant threat to the Hanford groundwater.
- *Chromium* – There is currently a chromium plume that is associated with T Tank and Waste Farms EU sources, including past leaks from SSTs containing waste from chemical processing of uranium-bearing, irradiated reactor fuel rods; the bismuth phosphate process; uranium-

[34] The barrier represents the edge of the infiltration barrier to be constructed over disposal areas that are within 100 meters [110 yards] of facility fence lines (DOE/EIS-0391 2012). The T Barrier is the closest to the T Tank and Waste Farms EU. Despite including sources other than those for the T Tank and Waste Farms EU, the analysis in the TC&WM EIS was considered reasonable to assess the rate of movement of contaminants to groundwater through the vadose zone.

[35] The minimum best-estimate K_d for Sr-90 for WMAs T and TX-TY is 1 mL/g (PNNL-17154, p. 3.87), which translates to a retardation factor of ~4.6.

recovery process; and from REDOX and PUREX plant operations (DOE/RL-2016-09, Rev. 0)). The T TF EU reported vadose zone inventory is dominated by past discharges to cribs.

- *Uranium* – Uranium has been measured in the 200-ZP groundwater interest area, but not exceeding the standard (i.e., there is no current plume). The reported vadose zone inventory is distributed among past leaks and discharges to trenches and cribs. Thus at least part of the uranium originally discharged into the vadose may have been driven deeper into the vadose zone (i.e., associated with high volume discharges) and may have less of the vadose zone to travel through until potentially impacting groundwater. The TC&WM EIS groundwater transport analysis (Appendix O, DOE/EIS-0391 2012) indicates that uranium is not expected to reach the T Barrier in a concentration exceeding the DWS (i.e., 9 µg/L for No Action or 1 µg/L for Landfill Closure on or after CY 11,840 versus a DWS of 30 µg/L). Furthermore, the average water travel time through the vadose zone for a recharge rate of 100 mm/yr is 64 years for the 200-West Area (Table N-52, DOE/EIS-0391 2012), or the uranium travel time might be more than 100 years (i.e., 64 yr × 1.7) for an appreciable amount of uranium to move through the vadose zone[36]. It would likely require significantly more than 100 years (from the original discharge) to reach groundwater in a sufficient amount to exceed the DWS over an appreciable area. Thus an appreciable uranium plume would not be expected in the next 150 years but perhaps during the 1,000-year period after cleanup (because of insignificant decay). Thus total uranium is not considered a significant threat to the Hanford groundwater during the Active Cleanup or Near-term, Post Cleanup periods.

Using the process outlined in Chapter 6 of the Methodology Report (CRESP 2015a) as revised for the 2015 groundwater monitoring results (Appendix D.1), the vadose zone inventories in Table E.2-2 are estimated by difference and used to calculate Groundwater Threat Metric (GTM) values for the Group A and B contaminants remaining in the vadose zone as illustrated in Table E.2-7. The resulting current vadose zone (VZ) ratings for threats to groundwater are *Not Discernible* (*ND*) for total uranium and Sr-90[37], *Medium* for Tc-99 and I-129 (where significant amounts of these contaminants are already in the saturated zone near the T Tank and Waste Farms EU), and *High* for chromium (total and hexavalent). The overall rating for current conditions would be *High* (i.e., defined as the maximum of the ratings for an EU) related to the remaining chromium (total and hexavalent) in the vadose zone.

Groundwater Plumes

Legacy waste sites within the CP-TF-1 EU are suspected of be able to contribute mobile contaminants to the saturated zone (DOE/RL-92-16, Rev. 0) and 200-ZP plumes have been linked to CP-TF-1 sources (DOE/RL-2016-09, Rev. 0). In general groundwater plumes are evaluated in separate EUs; however, those portions of groundwater plumes that can be associated with the TF EU (i.e., a plume with sources associated with the TF EU) will be evaluated to provide a better idea of the saturated zone versus remaining vadose zone threats to groundwater. The estimated inventory for the saturated zone contamination is provided in Table E.2-2 where Photoshop was used to estimate the fraction of the plumes considered associated with the T Tank and Waste Farms EU (Attachment 6-4 in the Methodology

[36] The minimum best-estimate K_d for uranium for WMAs T and TX-TY is 0.2 mL/g (PNNL-17154, p. 3.87), which translates to a retardation factor of ~1.7.

[37] The remaining vadose zone inventories for total uranium and Sr-90 would translate to *Low* and *Very High* ratings, respectively. However, no appreciable Sr-90 or uranium plume would be expected in the next 150 years due to transport considerations as described in this section; however, uranium may impact groundwater long after the 150-year period. *Low* ratings are applied to the period after Active Cleanup is completed (i.e., during the Near-term, Post-Cleanup period) to account for uncertainties in the evaluation.

Report (CRESP 2015a) as revised to accommodate the 2015 groundwater monitoring results described in Appendix D.1[38]). This information is also used to estimate amounts treated and remaining in the vadose zone. For the groundwater plumes described in the 200-ZP GWIA (DOE/RL-2016-09, Rev. 0), apportionment of plumes and ratings from the Group A and B primary contaminants to the T Tank and Waste Farms EU would be as follows:

- *Carbon tetrachloride and trichloroethene* – There are plumes for carbon tetrachloride (CCl_4) and trichloroethene (TCE) in the 200-ZP GWIA, but no major sources related to the waste tanks; thus no portion of these plumes are considered associated with the T Tank and Waste Farms EU. The corresponding ratings would be *ND*.
- *Chromium* – There are plumes in the GWIA (assumed to be hexavalent chromium because this represents the highest risk at a given chromium concentration); the single plume near the T TF EU is considered associated with the T Tank and Waste Farms EU and the area of this plume is 69% of the area of the chromium plumes (Appendix D.1). The area is assumed to describe both the total chromium and hexavalent chromium contaminants.
- *I-129* – There are plumes in the GWIA although none of the plumes are considered associated with the T Tank and Waste Farms EU (based on plume history) although some of the contamination could be from the T Tank and Waste Farms EU. Thus the portion of the total 200-ZP plume area is considered <<1%[39] or 0% for this Review (Appendix D.1).
- *Tc-99* – There are plumes in the 200-ZP GWIA; the single plume near the T Tank and Waste Farms EU is considered associated with the T Tank and Waste Farms EU, and the area of this plume is 46% of the total area over the plumes (Appendix D.1).

The Group A and B groundwater plumes (e.g., Tc-99 and chromium) associated with the T TF EU and co-located liquid waste disposal facilities are described in detail in Appendix D.6 for the 200-ZP GWIA within the CP-GW-2 EU. Note that carbon tetrachloride (*Very High*) is the current risk driver for the 200-ZP GWIA; however, there are no T TF EU sources associated with carbon tetrachloride, and the remaining vadose zone sources would drive the risks associated with the T TF EU.

Impact of Recharge Rate and Radioactive Decay on Groundwater Ratings

The TC&WM EIS screening groundwater transport analysis (Appendix O, DOE/EIS-0391 2012) indicates that there is little impact of emplacing an engineered surface barrier (and resulting reduction of infiltrating water) on the predicted peak groundwater concentrations (relative to thresholds) at the T Barrier[40]. This result is likely due to the significant amounts of contaminants already in the groundwater

[38] From the graphic map files provided by PNNL, the Photoshop Magic Wand Tool was used to select areas representing plumes and then the "Record Measurements" Tool was used to provide relative areal extents (CRESP 2015a). A Custom Measurement Scale was set to that of the map.

[39] There are two small plumes in vicinity of the T TF EU. These plume areas (including any possible and likely small contributions from the CP-LS-6 EU waste sites based on the reported inventory in Table G.5.5-2) are evaluated as part of the TX-TY Tank and Waste Farm EU (Appendix E.4). Note that the total reported I-129 inventory (0.0082 Ci) for the CP-LS-6 EU waste sites is almost 30 times lower than the I-129 inventory associated with leaks, cribs, trenches, and UPRs from the TX-TY Tank and Waste Farm EU (Appendix E.4). Furthermore, the history of the plume indicates that the plume appeared to originate from TX-TY sources.

[40] The barrier represents the edge of the infiltration barrier to be constructed over disposal areas that are within 100 meters [110 yards] of facility fence lines (DOE/EIS-0391 2012). The T Barrier is the closest to the T Tank and Waste Farms EU. Despite including sources other than those for the T Tank and Waste Farms EU, the analysis in the TC&WM EIS was considered a reasonable source of information to assess the potential impact of the engineered surface barrier emplacement.

and not due to an ineffective surface barrier. To summarize, the screening groundwater results at the T Barrier (Appendix O, DOE/EIS-0391 2012) include:

- Tc-99 peak concentration is 6,480 pCi/L (CY 2050) for the No Action Alternative versus 6,600 pCi/L (CY 2051) for Landfill Closure where the threshold value is 900 pCi/L.
- I-129 peak concentration is 26.1 pCi/L (CY 4560) for the No Action Alternative versus 12.6 pCi/L (CY 2050) for Landfill Closure where the threshold value of 1 pCi/L.
- Chromium peak concentration is 336 µg/L (CY 2036) for the No Action Alternative versus 353 µg/L (CY 2045) for Landfill Closure where the threshold value is 100 µg/L (total) or 48 µg/L (hexavalent).
- Uranium peak concentration is 9 µg/L (CY 11,840) for the No Action Alternative versus 1 µg/L (CY 11,843) for Landfill Closure where the threshold value is 30 µg/L (total uranium).
- No values are reported at the T Barrier for Sr-90 for either scenario, which indicates that predicted peak fluxes that were less than 1×10^{-8} Ci/yr (Appendix O, DOE/EIS-0391 2012, p. O-2).

Since the predicted peak concentrations remain above thresholds for Tc-99, I-129, and chromium even after surface barrier emplacement, it is decided to not alter the T Tank and Waste Farms EU ratings related to groundwater based on different recharge rate scenarios. This effect is likely not due to an ineffective surface barrier but instead the amount of these contaminants already in the groundwater and possible contributions of sources outside the T Tank and Waste Farms EU (used in the TC&WM EIS analysis[41]).

Columbia River

The process illustrated in Chapter 6 of the Methodology Report (CRESP 2015a) as revised for the 2015 groundwater and Columbia River results (Appendix D.1) is used to evaluate potential impacts to the Columbia River. Note that the evaluation of potential benthic and riparian impacts has a common thread up to the point when the shoreline impact (benthic) or riparian zone impact area is used to define ratings. Thus a common evaluation for the benthic and riparian zone is performed here.

Benthic and Riparian Zone – Current Impacts

Based on the information in the 2015 Hanford Annual Groundwater Report (DOE/RL-2016-09, Rev. 0) and HEIS (http://ehs.hanford.gov/eda/), even though 200-ZP GWIA contaminants are in the saturated zone, no plumes from the 200-ZP GWIA (and thus associated with the T Tank and Waste Farms EU) are currently intersecting the Columbia River at concentrations exceeding the WQS. Thus *current* impacts from the T Tank and Waste Farms EU to the Columbia River benthic and riparian zone ecology are rated as *Not Discernible*.

Benthic and Riparian Zone – Active Cleanup and Near-term, Post Cleanup

Because the 200-ZP GWIA plumes originate from the 200 West Area, it is unlikely that a current or future plume would reach the Columbia River in the next 150 years (at concentrations sufficient to exceed thresholds) since the water travel time is greater than 50 years (and likely significantly more) from 200-West to 200-East and ~10-30 years from 200-East to the Columbia River (Gephart 2003; PNNL-6415 Rev. 18). It is also likely that significantly more time would likely be required to reach the Columbia

[41] Analyses specific to each Tank Farm or Central Plateau EU are not available; thus the aggregate screening analysis provided in the TC&WM EIS was used as an indication.

River in sufficient quantity to exceed the WQS or appropriate aquatic screening values[42]. Any contaminants *predicted* to impact the Columbia River in sufficient amounts from the Central Plateau (e.g., as described in Appendix P in the TC&WM EIS (DOE/EIS-0391 2012)) would thus likely come from 200-East sources[43] and not the 200-ZP-1 OU or those related to the T Tank and Waste Farms EU.

Thus the impacts to the Columbia River benthic and riparian ecology for the Active Cleanup and Near-term, Post Cleanup periods are also rated as *Not Discernible*.

Benthic and Riparian Zone – Long-term

An ecological screening analysis was performed in the TC&WM EIS (Appendix P, DOE/EIS-0391 2012) to evaluate potential long-term impacts of radioactive and chemical contaminants (*under a No Action Alternative for sources including but not limited to those associated with the T Tank and Waste Farms EU*[44]) discharged with groundwater on aquatic and riparian receptors at the Columbia River. The screening results indicate that exposure to radioactive contaminants from peak groundwater discharge was below benchmarks (0.1-rad-per-day for wildlife receptors and 1-rad-per-day for benthic invertebrates and aquatic biota, including salmonids consistent with DOE Technical Standard DOE-STD-1153-2002[45]) (DOE/EIS-0391 2012, Appendix P, p. P-52), indicating there should be no expected adverse effects (and *Not Discernible* ratings) from radionuclides from Central Plateau sources for Columbia River benthic and riparian receptors over the time period evaluated (10,000 years).

The corresponding (No Action) evaluation in the TC&WM EIS for potential long-term impacts of chemical contaminants discharged with groundwater to the near-river ecology (benthic and riparian) indicate that chromium and nitrate would have expected Hazard Quotients exceeding unity for aquatic and riparian receptors over the evaluation period in the TC&WM EIS. The results of the screening evaluation at the near-shore region under the No Action Alternative (DOE/EIS-0391 2012, Appendix O) indicate that the nitrate peak concentration (and discharge) occurred in the past and that future concentrations would appear to not exceed either the drinking water standard or ambient water quality criterion in the next 10,000 years, resulting in a *Not Discernible* rating. Furthermore, the potential impact of increased nitrate levels may depend on other factors (e.g., phosphorus) and is highly uncertain.

The TC&WM EIS results of the screening evaluation at the near-shore region under the No Action Alternative (DOE/EIS-0391 2012, Appendix O) indicate that the concentration could exceed the drinking

[42] Based on current and expected subsurface conditions, the only path currently considered from 200-West to the Columbia River is that from 200-West to 200-East to the Columbia River (Chapter 6, Methodology Report (CRESP 2015a)).

[43] Note that TC&WM EIS predictions indicate possible impacts from chromium to the benthic and riparian zones within the next decade; however, actual well measurements for chromium and other contaminants show no likely impacts in the foreseeable future from 200-West or 200-East sources, including the next 150 years. Note there was a path north from 200-West to the Columbia River that is no longer considered reasonable due to changing hydrologic patterns across the Hanford Site.

[44] Despite including sources other than those for the T Tank and Waste Farms EU, the analysis in the TC&WM EIS was considered a reasonable and consistent information source to assess the potential for potential impacts of contaminants on the benthic and riparian zones. However, because the sources are not limited to the Tank and Waste Farms EUs, the evaluation is not restricted to just the T Tank and Waste Farms EUs sources but instead those for many Central Plateau sources, including other Tank and Waste Farms EUs. Furthermore, the results are divided by the 200-West and 200-East areas based on differences in travel times of water and contaminants to the Columbia River.

[45] The standard also indicates the screening values were used for riparian receptors.

water standard for total chromium (100 µg/L) and the EIS benchmark threshold[46] (as well as the ambient water quality criterion of 10 µg/L) for hexavalent chromium. The predicted concentrations are likely overestimated since all discharge is assumed to occur in a 40-m near-shore region. Furthermore, because of the long travel time of water from 200-West (200-ZP GWIA) to 200-East (then to the Columbia River) relative to that from 200-East to the Columbia River, it is likely that the 200-West sources provide an insignificant contribution of the chromium predicted to reach the Columbia River exceeding screening values (unless this was assumed to occur via the now defunct northern path from 200-West to the Columbia River), which would likely lead to insignificant impacts (and *Not Discernible* ratings) to the benthic and riparian ecology from 200-West sources, including those associated with the T Tank Farm EU.

Threats to the Columbia River Free-flowing Ecology

The threat determination process for the free-flowing River ecology was evaluated in a manner similar to that described above for benthic receptors (Chapter 6, Methodology Report (CRESP 2015a) as revised for the 2015 groundwater monitoring results (Appendix D.1)). However, because of the large dilution effect of the Columbia River on the contamination from the seeps and groundwater upwellings[47], the differences from EU to EU were not found distinguishing and the potential for groundwater contaminant discharges from Hanford to achieve concentrations above relevant thresholds is very remote. Thus the large dilution effect of the Columbia River on the contamination from the seeps and groundwater upwellings results in *Not Discernible* ratings for the Active Cleanup and Near-term, Post Cleanup periods and insignificant long-term impacts to the free-flowing ecology for all contaminants.

Potential Impact of Recharge Rate on Threats to the Columbia River

The No Action Alternative evaluation in the TC&WM EIS suggests that remedial actions (e.g., surface barrier emplacement that would decrease recharge in the areas near the Tank Farms) would appear to not have significant impacts on the long-term peak concentrations in the near-shore area (benthic and riparian receptors) of the Columbia River. Again this result is likely not due to ineffectiveness of the barrier but instead due to large amounts of contaminants already in the groundwater. Thus ratings are not changed based on the remedial actions assumed in the TC&WM EIS.

Facilities for D&D – Not Applicable

Operating Facilities – Not Applicable

Because of the prohibition on waste additions to the Hanford SSTs,[48] the T Tank and Waste Farms EU components are not considered Operating Facilities for this Review.

[46] The benchmark value used for chromium (hexavalent) in the TC&WM EIS was the sensitive-species-test-effect concentration that affects 20 percent of a test population (EC_{20}) despite the fact that the less toxic trivalent form of chromium is more like to be present in oxygenated, aquatic environs (DOE/EIS-0391 2012, Appendix P, pp. P-52 to P-53).

[47] "Groundwater is a potential pathway for contaminants to enter the Columbia River. Groundwater flows into the river from springs located above the water line and through areas of upwelling in the river bed. Hydrologists estimate that groundwater currently flows from the Hanford unconfined aquifer to the Columbia River at a rate of ~ 0.000012 cubic meters per second (Section 4.1 of PNNL-13674). For comparison, the average flow of the Columbia River is ~3,400 cubic meters per second (DOE/RL-2014-32, Rev. 0)." This represents a dilution effect of more than eight orders of magnitude (a dilution factor of greater than 100 million).

[48] Berman presentation on July 29, 2009, titled "Hanford Single-Shell Tank Integrity Program." Available at www.em.doe.gov.

Table E.2-2. Summary Table of Infrastructure and Subsurface Contamination Inventory for the T Tank and Waste Farms Evaluation Unit (CP-TF-1) [a,b]

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[d]	99% Retrieval Scenario[d]
Infrastructure (Tanks and Ancillary Equipment)				
Tank Waste	Waste (kGal)	1810	181	18.1
	Sludge (kGal)	1650	165	16.5
	Saltcake (kGal)	129	12.9	1.29
	Supernatant (kGal)	31	3.1	0.31
Tank Waste (rad)	Am-241 (Ci)	330	33	3.3
	C-14 (Ci)	5.5	0.55	0.055
	Co-60 (Ci)	6.2	0.62	0.062
	Cs-137 (Ci)	47000	4700	470
	Eu-152 (Ci)	0.21	0.021	0.0021
	Eu-154 (Ci)	29	2.9	0.29
	H-3 (Ci)	21	2.1	0.21
	I-129 (Ci)	0.067	0.0067	0.00067
	Ni-59 (Ci)	5.7	0.57	0.057
	Ni-63 (Ci)	490	49	4.9
	Pu (total) (Ci)	2000	200	20
	Sr-90 (Ci)	120000	12000	1200
	Tc-99 (Ci)	140	14	1.4
	U (total) (Ci)	23	2.3	0.23
Tank Waste (non-rad)	Cr (kg)	12000	1200	120
	Hg (kg)	17	1.7	0.17
	NO3 (kg)	590000	59000	5900
	Pb (kg)	8200	820	82
	U (total) (kg)	29000	2900	290
Ancillary Equipment (rad)	C-14 (Ci)	0.2	0.2	0.2
	Cs-137 (Ci)	2200	2200	2200
	H-3 (Ci)	0.46	0.46	0.46
	I-129 (Ci)	0.0015	0.0015	0.0015

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[(d)]	99% Retrieval Scenario[(d)]
	Pu (total) (Ci)	19	19	19
	Sr-90 (Ci)	5000	5000	5000
	Tc-99 (Ci)	2.2	2.2	2.2
	U (total) (Ci)	0.35	0.35	0.35
Ancillary Equipment (non-rad)	Cr (kg)	160	160	160
	Hg (kg)	0.27	0.27	0.27
	NO3 (kg)	10000	10000	10000
	Pb (kg)	58	58	58
	U (total) (kg)	500	500	500
Vadose Zone Source (Leaks and Intentional Discharges into Cribs and Trenches)				
Leaks (rad)	C-14 (Ci)	9.5	9.5	9.5
	Cs-137 (Ci)	25000	25000	25000
	H-3 (Ci)	53	53	53
	I-129 (Ci)	0.13	0.13	0.13
	Pu (total) (Ci)	13	13	13
	Sr-90 (Ci)	24000	24000	24000
	Tc-99 (Ci)	67	67	67
	U (total) (Ci)	0.35	0.35	0.35
Leaks (non-rad)	Cr (kg)	1100	1100	1100
	Hg (kg)	0.24	0.24	0.24
	NO3 (kg)	67000	67000	67000
	Pb (kg)	35	35	35
	U (total) (kg)	380	380	380
Cribs (rad)	Am-241 (Ci)	7.4	7.4	7.4
	C-14 (Ci)	0.38	0.38	0.38
	Co-60 (Ci)	0.32	0.32	0.32
	Cs-137 (Ci)	430	430	430
	Eu-152 (Ci)	0.18	0.18	0.18
	Eu-154 (Ci)	14	14	14
	H-3 (Ci)	0.093	0.093	0.093
	I-129 (Ci)	0.00031	0.00031	0.00031
	Ni-59 (Ci)	0.1	0.1	0.1

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[(d)]	99% Retrieval Scenario[(d)]
	Ni-63 (Ci)	8.8	8.8	8.8
	Pu (total) (Ci)	460	460	460
	Sr-90 (Ci)	370	370	370
	Tc-99 (Ci)	0.19	0.19	0.19
	U (total) (Ci)	1.6	1.6	1.6
Cribs (non-rad)	Cr (kg)	39000	39000	39000
	NO3 (kg)	9100000	9100000	9100000
	U (total) (kg)	510	510	510
Trenches (rad)	Am-241 (Ci)	2.4	2.4	2.4
	C-14 (Ci)	0.34	0.34	0.34
	Co-60 (Ci)	1.3	1.3	1.3
	Cs-137 (Ci)	1800	1800	1800
	Eu-152 (Ci)	0.057	0.057	0.057
	Eu-154 (Ci)	4	4	4
	H-3 (Ci)	100	100	100
	I-129 (Ci)	0.0068	0.0068	0.0068
	Ni-59 (Ci)	0.11	0.11	0.11
	Ni-63 (Ci)	15	15	15
	Pu (total) (Ci)	26	26	26
	Sr-90 (Ci)	310	310	310
	Tc-99 (Ci)	0.8	0.8	0.8
	U (total) (Ci)	0.25	0.25	0.25
Trenches (non-rad)	Cr (kg)	2600	2600	2600
	Hg (kg)	1.4	1.4	1.4
	NO3 (kg)	730000	730000	730000
	U (total) (kg)	370	370	370
UPR (rad)	Am-241 (Ci)	0.0022	0.0022	0.0022
	C-14 (Ci)	0.00032	0.00032	0.00032
	Co-60 (Ci)	0.0012	0.0012	0.0012
	Cs-137 (Ci)	1.8	1.8	1.8
	Eu-152 (Ci)	5.20E-05	5.20E-05	5.20E-05
	Eu-154 (Ci)	0.0036	0.0036	0.0036

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[(d)]	99% Retrieval Scenario[(d)]
	H-3 (Ci)	0.023	0.023	0.023
	I-129 (Ci)	6.70E-06	6.70E-06	6.70E-06
	Ni-59 (Ci)	0.00011	0.00011	0.00011
	Ni-63 (Ci)	0.014	0.014	0.014
	Pu (total) (Ci)	0.014	0.014	0.014
	Sr-90 (Ci)	0.27	0.27	0.27
	Tc-99 (Ci)	0.00078	0.00078	0.00078
	U (total) (Ci)	9.00E-05	9.00E-05	9.00E-05
UPR (non-rad)	Cr (kg)	2.1	2.1	2.1
	Hg (kg)	0.0012	0.0012	0.0012
	NO3 (kg)	560	560	560
	U (total) (kg)	0.13	0.13	0.13
Vadose Zone (from Vadose Zone Sources)				
VZ Remaining (rad)	Am-241 (Ci)	9.9	9.9	9.9
	C-14 (Ci)	10	10	10
	Co-60 (Ci)	1.6	1.6	1.6
	Cs-137 (Ci)	27000	27000	27000
	Eu-152 (Ci)	0.24	0.24	0.24
	Eu-154 (Ci)	18	18	18
	H-3 (Ci)	160	160	160
	I-129 (Ci)	0.14	0.14	0.14
	Ni-59 (Ci)	0.21	0.21	0.21
	Ni-63 (Ci)	24	24	24
	Pu (total) (Ci)	500	500	500
	Sr-90 (Ci)	25000	25000	25000
	Tc-99 (Ci)	65	65	65
	U (total) (Ci)	2.2	2.2	2.2
VZ Remaining (non-rad)	Cr (kg)	42000	42000	42000
	Cr-VI (kg)	42000	42000	42000
	Hg (kg)	1.6	1.6	1.6
	NO3 (kg)	9900000	9900000	9900000
	Pb (kg)	35	35	35

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[(d)]	99% Retrieval Scenario[(d)]
	U (total) (kg)	1300	1300	1300
VZ Treatment (rad)	Tc-99 (Ci)	2.9	2.9	2.9
VZ Treatment (non-rad)	Cr (kg)	250	250	250
	Cr-VI (kg)	250	250	250
Saturated Zone (from Vadose Zone Sources)				
SZ Inventory (rad)	Tc-99 (Ci)	0.93	0.93	0.93
SZ Inventory (non-rad)	Cr (kg)	0	0	0
	Cr-VI (kg)	270	270	270

a. Tanks (SST and DST): Best Basis Inventory (BBI) February 2017; Ancillary Equipment (Anc Eq): Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix D; Unplanned Releases (UPRs): Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0); Ponds: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0); Cribs: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0); Trenches: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0) and Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix S; Leaks: Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix D; MUSTs: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0) and Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix S.

b. All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

c. Differences in inventories for Cr vs Cr-IV are due to differing Water Quality Standards (WQS) and thus plume extents: 100 mg/L for total chromium vs 48 mg/L for chromium (VI). The difference is not distinguishable within the number of significant digits (2) displayed.

d. 99% and 90% Retrieval Scenarios reflect assumptions described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 and apply only to tank volumes and inventories. They are calculated assuming retrieval of a fully mixed tank of homogeneous composition. For tanks that have been declared “Retrieval Completed” or “Retrieved to Limit of … Technologies” (Templeton, AM 2016, page 9, partially duplicated in Table E.1-7), no further retrieval for either the 99% or 90% retrieval scenario is assumed. This includes tank 241-S-112 and all C Tank Farm tanks except 241-C-105. For tanks that are currently undergoing retrieval (tanks 241-AY-102 and 241-C-105), a retrieval amount equivalent to the 99% and 90% retrieval volumes described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 are calculated.

Table E.2-3. Current Bulk Inventory and Steady State Flammability Results (by Tank) for the T Tank Farm (CP-TF-1)

Tank ID	Tank Type	Capacity (kGal)[a]	Sludge (kGal)[a]	Saltcake (kGal)[a]	Supernatant (kGal)[a]	HGR (ft^3/d)[b]	Days to 25% LFL Barometric[c]	Days to 25% LFL Zero Ventilation[d]
T-101	SST	530	37	55	2	0.94	NA	997
T-102	SST	530	19	0	11	0.84	NA	1226
T-103	SST	530	23	0	3	0.82	NA	1273
T-104	SST	530	310	0	0	0.53	NA	1291
T-105	SST	530	92	0	0	0.44	NA	>1826
T-106	SST	530	21	0	0	0.32	NA	>1826
T-107	SST	530	161	0	5	0.61	NA	1368
T-108	SST	530	7	8	0	0.32	NA	>1826
T-109	SST	530	0	66	0	0.85	NA	1165
T-110	SST	530	369	0	1	1.2	NA	475
T-111	SST	530	436	0	0	0.62	NA	830
T-112	SST	530	55	0	7	0.35	NA	>1826
T-201	SST	55	29	0	2	0.21	279	160
T-202	SST	55	19	0	0	0.065	NA	730
T-203	SST	55	36	0	0	0.097	NA	284
T-204	SST	55	36	0	0	0.097	NA	285

a. Volumes from the Waste Tank Summary Report for Month Ending November 30, 2016 (Templeton, AM 2016).

b. Hydrogen generation rate (ft^3/d) (RPP-5926 Rev. 17). Note in 2001 all 24 tanks were removed from the flammable gas watch list (including T-110 in the T Tank and Waste Farms EU) (Johnson, et al. 2001, p. iii).

c. Time (in days) to 25% of the Lower Flammability Limit (LFL) under a barometric (barom) breathing scenario (RPP-5926, Rev. 17). "NA" indicates that the headspace will not reach specified flammability level.

d. Time (in days) to 25% of the LFL under a zero ventilation scenario (RPP-5926, Rev. 17).

Table E.2-4. Current Primary Contaminant Inventory (by Tank) for the T Tank Farm (CP-TF-1) [a]

Tank ID	Baseline Status[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)
T-101	2001	63	0.81	NR	5.3	27000	0.17	8.3	15
T-102	2001	21	4.0	NR	0.25	3300	0.018	7.9	0.48
T-103	2001	0.68	0.15	NR	0.20	310	0.0083	0.40	1.4
T-104	2001	28	0.068	NR	0.017	180	0.0018	0.82	0.19
T-105	2001	32	0.17	NR	0.052	3800	0.00020	11	0.47
T-106	2001	2.2	0.041	NR	0.33	840	0.00018	0.0082	2.8
T-107	2001	49	0.17	NR	0.020	11000	0.0020	0.098	0.27
T-108	2001	0.56	0.014	NR	0.0015	570	0.00021	0.010	0.045
T-109	2001	0.087	0.025	NR	0.0043	610	0.00072	0.036	0.19
T-110	2001	8.7	0.0023	NR	0.00024	20	0.00031	0.016	0.00017
T-111	2001	97	0.0015	NR	0.00044	190	0.00049	0.030	0.00015
T-112	2001	4.5	0.056	NR	0.053	160	0.0078	0.38	0.13
T-201	2001	5.6	0.000019	NR	1.4E-06	4.2	3.5E-06	0.00022	3.8E-09
T-202	2001	2.8	0.000017	NR	2.4E-06	0.45	0.000012	0.00058	1.9E-07
T-203	2001	6.2	0.000032	NR	4.4E-06	0.85	0.000023	0.0011	3.5E-07
T-204	2001	3.7	0.000033	NR	4.5E-06	0.84	0.000023	0.0011	3.5E-07

a. From Best Basis Inventory (BBI) Summary (February 2017). All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

b. This is the "Baseline Status" date as reported in the BBI (February 2017) as "Baselined 2001." It should not be necessarily be considered the decay date for isotope inventories.

c. NR = Not reported for this EU

Table E.2-5. Current Primary Contaminant Inventory[a] and Groundwater Threat Metric (by Tank) for the T Tank Farm (CP-TF-1)

Tank ID	I-129 (Ci)	Ni-59 (Ci)	Ni-63 (Ci)	Pu (total) (Ci)[b]	Sr-90 (Ci)	Tc-99 (Ci)	U (total) (Ci)[c]	GTM (Mm3)[d]
T-101	0.032	3.9	330	400	270	31	3.8	34
T-102	0.019	0.74	65	8.4	13000	6.4	4.1	7.3
T-103	0.014	0.60	52	7.8	530	2.4	2.7	5.3
T-104	0.00050	0.012	1.6	260	2300	0.95	1.1	1.1
T-105	0.000021	0.076	6.7	180	21000	35	0.81	39
T-106	0.000045	0.16	14	31	290	1.5	0.38	1.7
T-107	0.00058	0.014	1.8	360	73000	45	5.0	50
T-108	0.000099	0.014	1.3	7.0	160	1.0	0.080	1.1
T-109	0.00041	0.067	6.2	4.2	75	0.29	0.11	0.32
T-110	2.6E-07	0.00059	0.047	120	36	0.0012	0.025	0.0014
T-111	1.5E-07	0.11	11	330	7700	17	5.0	18
T-112	0.0013	0.011	0.90	71	26	2.1	0.14	2.4
T-201	7.7E-10	5.0E-06	0.00039	100	13	1.7E-06	6.9E-07	1.9E-06
T-202	0.0	4.5E-06	0.00036	19	0.15	1.6E-06	0.0063	1.8E-06
T-203	0.0	8.4E-06	0.00067	47	0.28	3.0E-06	0.00036	3.3E-06
T-204	0.0	8.6E-06	0.00068	39	0.49	3.0E-06	0.00012	3.3E-06

a. From Best Basis Inventory (BBI) Summary (February 2017). All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

b. Sum of plutonium isotopes 238, 239, 240, 241, and 242

c. Sum of uranium isotopes 232, 233, 234, 235, 236, and 238

d. The Groundwater Threat Metric (GTM) shown for tanks is equal to the maximum of the GTM for Tc-99 and I-129.

Table E.2-6. Current Primary Contaminant Inventory (by Tank) for the T Tank Farm (CP-TF-1) [a]

Tank ID	CCl4 (kg)	CN (kg)	Cr (kg)	Cr-VI (kg)	Hg (kg)	NO3 (kg)	Pb (kg)	TBP (kg)	TCE (kg)	U (total) (kg)
T-101	NR[b]	NR	510	NR	0.28	110000	3900	NR	NR	4300
T-102	NR	NR	140	NR	1.2	7500	50	NR	NR	3800
T-103	NR	NR	69	NR	0.34	4500	410	NR	NR	2400
T-104	NR	NR	1400	NR	0.19	88000	75	NR	NR	1400
T-105	NR	NR	800	NR	5.2	12000	390	NR	NR	1100
T-106	NR	NR	71	NR	0.025	8700	320	NR	NR	490
T-107	NR	NR	390	NR	0.12	67000	730	NR	NR	7400
T-108	NR	NR	36	NR	0.25	22000	29	NR	NR	120
T-109	NR	NR	30	NR	1.2	13000	98	NR	NR	160
T-110	NR	NR	2000	NR	4.9	110000	1400	NR	NR	37
T-111	NR	NR	3500	NR	3.0	120000	550	NR	NR	7300
T-112	NR	NR	580	NR	0.50	5300	170	NR	NR	190
T-201	NR	NR	600	NR	0.0	6500	29	NR	NR	0.0010
T-202	NR	NR	280	NR	0.0	5400	8.3	NR	NR	9.3
T-203	NR	NR	590	NR	0.0	9700	3.5	NR	NR	0.54
T-204	NR	NR	740	NR	0.0	9100	51	NR	NR	0.18

a. From Best Basis Inventory (BBI) Summary (February 2017). All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

b. NR = Not reported for this EU

Table E.2-7. Summary of the Evaluation of Current Threats to Groundwater as a Protected Resource from Remaining Vadose Zone (VZ) Contamination associated with the T Tank and Waste Farms Evaluation Unit (CP-TF-1)

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 $M^{Tot\ (d)}$	VZ GTM (Mm^3)	VZ Rating[e]
C-14	A	2000 pCi/L	0.23	0	1.84	1.02E+01 Ci	---	---	1.02E+01 Ci	5.12E+00	*Low*
I-129	A	1 pCi/L	0.23	0.2	1.84	1.37E-01 Ci	---	---	1.37E-01 Ci	5.27E+01	*Medium*
Sr-90	B	8 pCi/L	0.23	22	1.84	2.50E+04 Ci	---	---	2.50E+04 Ci	1.76E+04	*ND*[f]
Tc-99	A	900 pCi/L	0.23	0	1.84	6.84E+01 Ci	9.33E-01 Ci	2.87E+00 Ci	6.46E+01 Ci	7.18E+01	*Medium*
CCl_4	A	5 µg/L	0.23	0	1.84	---	---	---	---	---	*ND*
Cr	B	100 µg/L	0.23	0	1.84	4.23E+04 kg	2.66E+02 kg	2.55E+02 kg	4.17E+04 kg	4.17E+02	*High*
Cr-VI	A	48 µg/L[b]	0.23	0	1.84	4.23E+04 kg	2.66E+02 kg	2.55E+02 kg	4.17E+04 kg	8.70E+02	*High*
TCE	B	5 µg/L	0.23	2	1.84	---	---	---	---	---	*ND*
U(tot)	B	30 µg/L	0.23	0.8	1.84	1.27E+03 kg	---	---	1.27E+03 kg	5.70E+00	*ND*[f]

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

b. "Model Toxics Control Act—Cleanup" (WAC 173-340) Method B groundwater cleanup level for hexavalent chromium. Other WQS values represent drinking water standards.

c. Treatment amounts from the 2015 Hanford Annual Groundwater Report (DOE/RL-2016-09, Rev. 0). The treated amounts are from the 200 West Pump and Treat Facility.

d. The remaining vadose zone inventory is estimated by difference (CRESP 2015a; Appendix D.1) and thus has a high associated uncertainty.

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

f. As discussed in Section E.2.5, no appreciable total uranium or Sr-90 plume would be expected in the next 150 years due to transport and decay (Sr-90) considerations. Thus the *Low* rating would apply to the period *after* the Active Cleanup is complete to account for uncertainties in the evaluation.

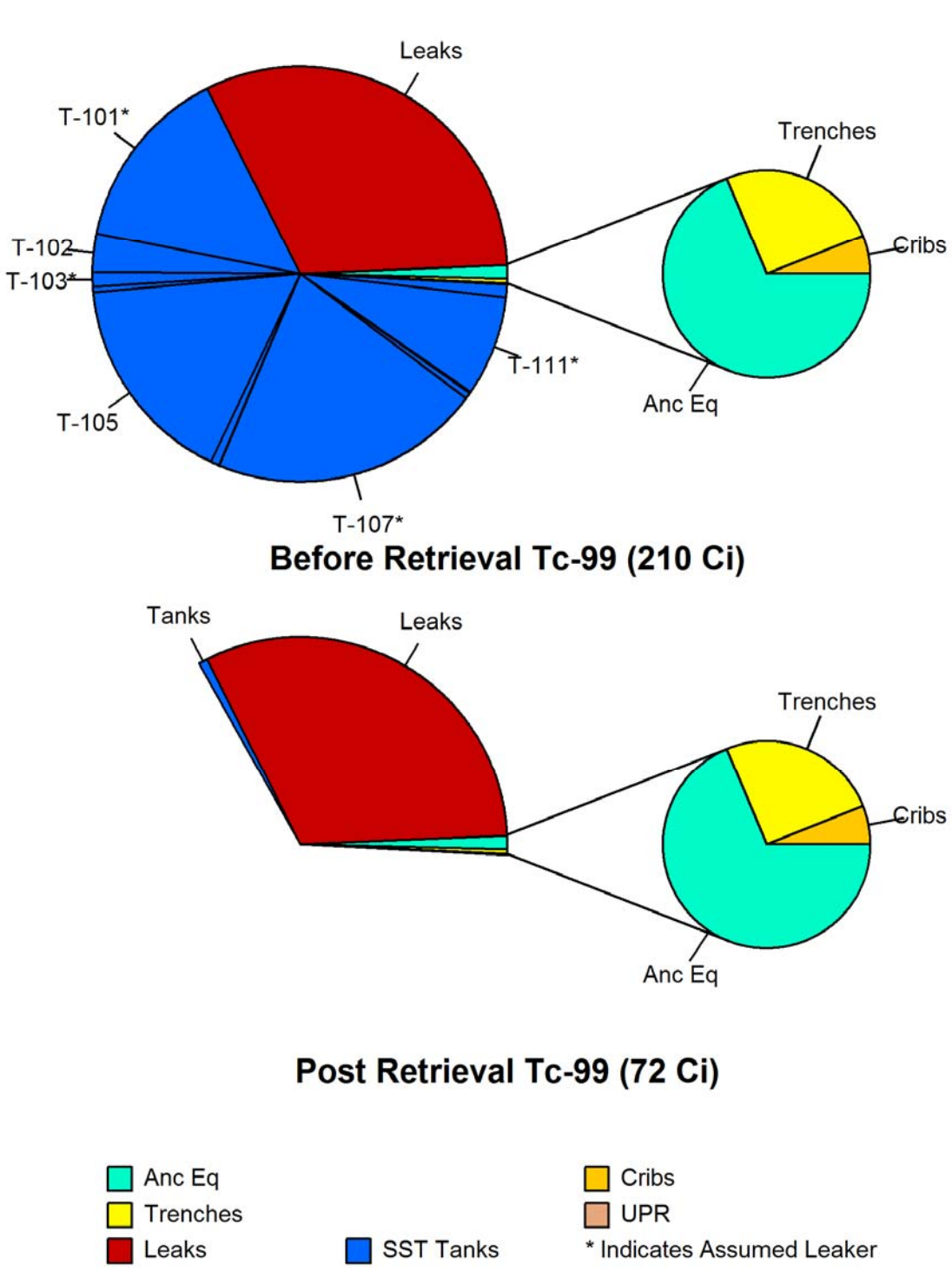


Figure E.2-4. T Tank and Waste Farms Evaluation Unit Inventory Estimates for Tc-99 Before and After 99% Retrieval

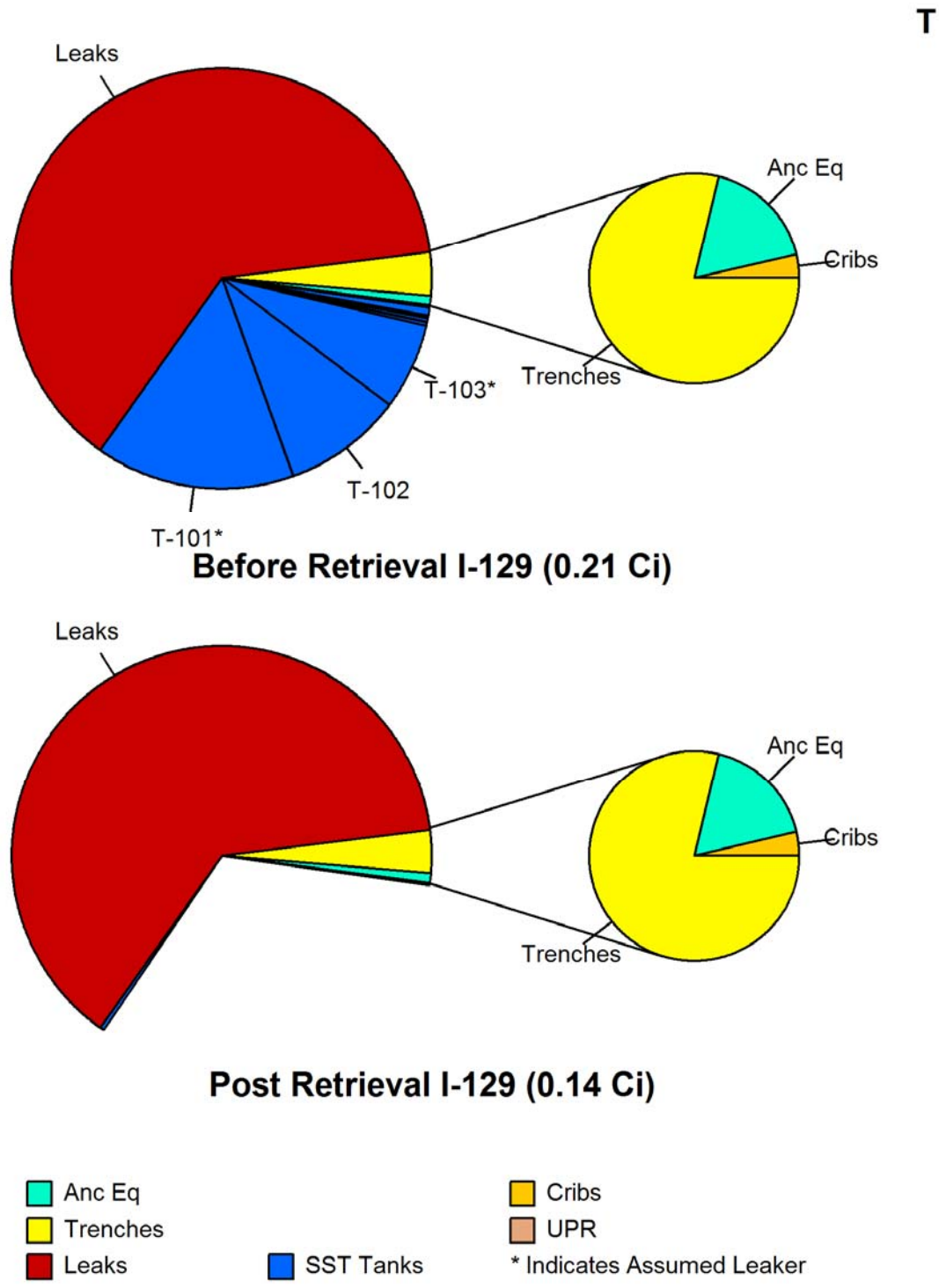


Figure E.2-5. T Tank and Waste Farms Evaluation Unit Inventory Estimates for I-129 Before and After 99% Retrieval

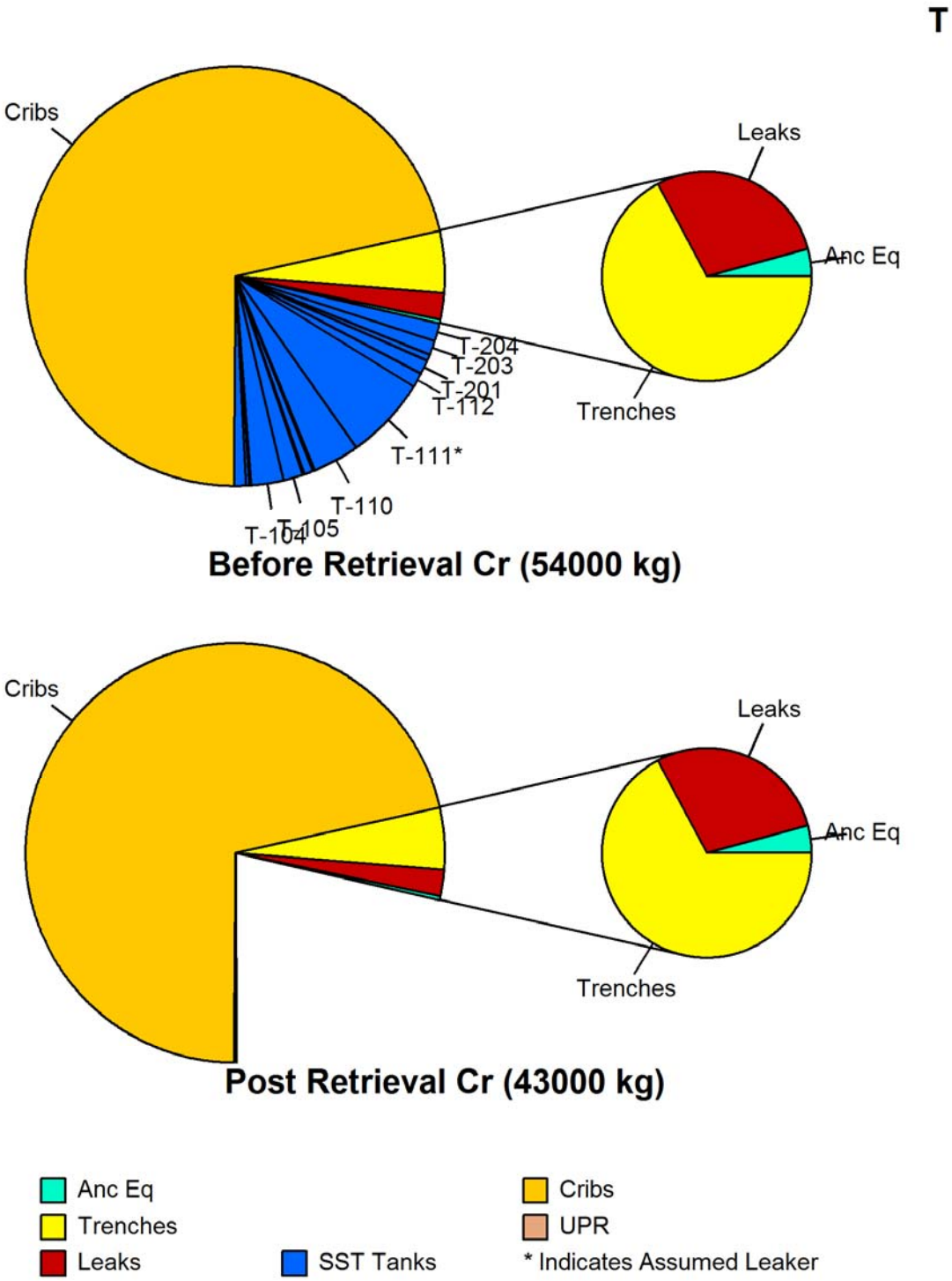


Figure E.2-6. T Tank and Waste Farms Evaluation Unit Inventory Estimates for Chromium Before and After 99% Retrieval

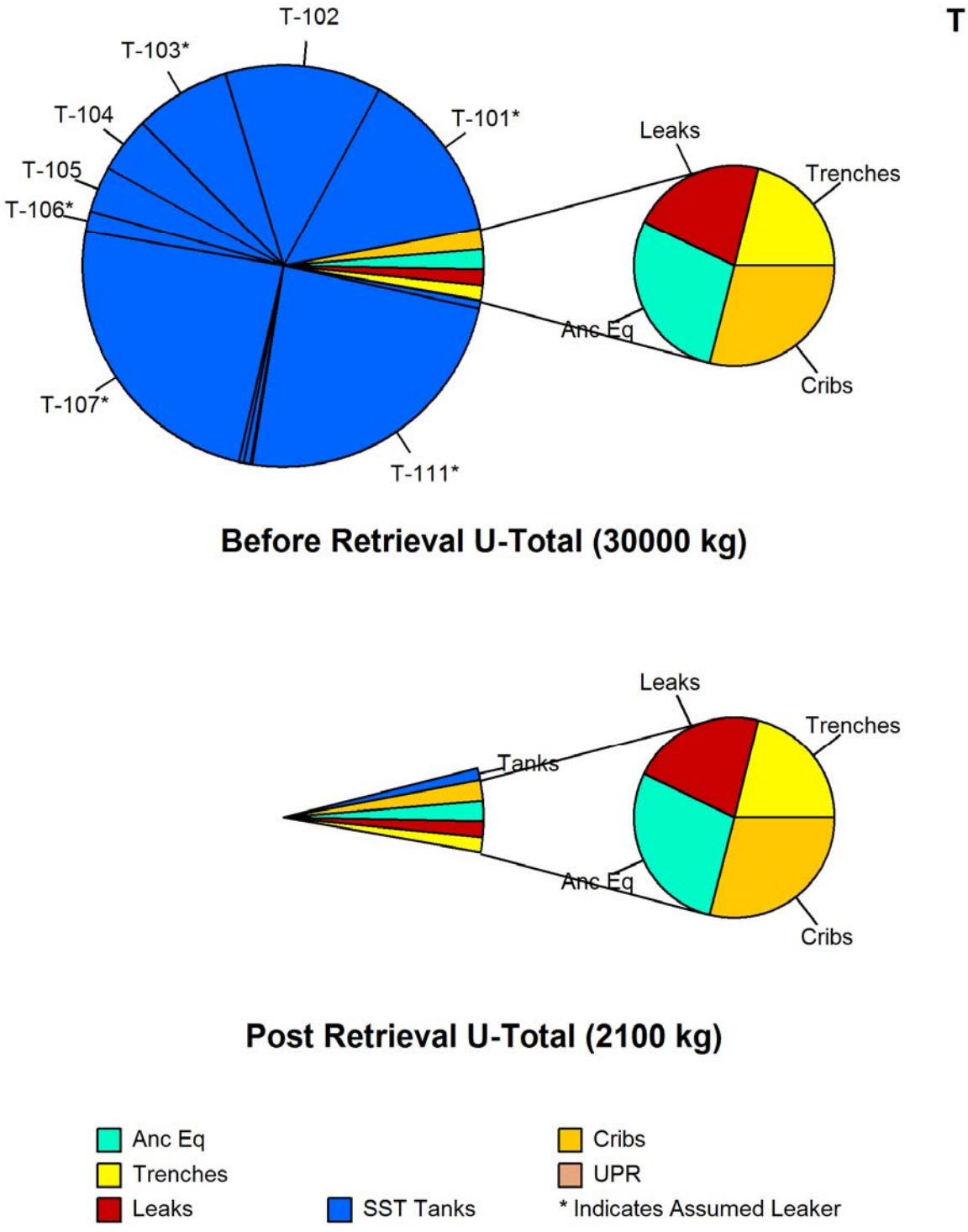


Figure E.2-7. T Tank and Waste Farms Evaluation Unit Inventory Estimates for U(tot) Before and After 99% Retrieval

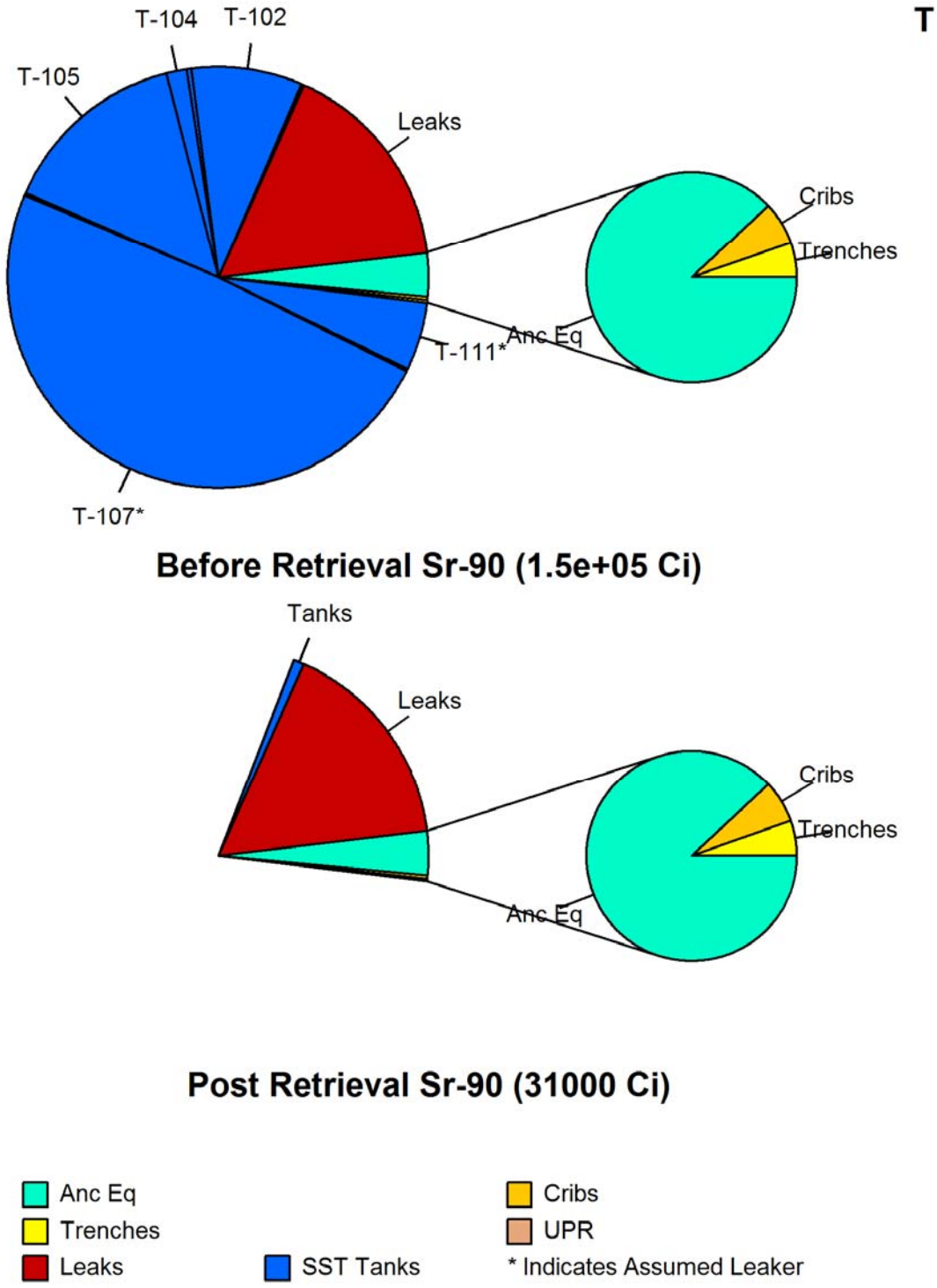


Figure E.2-8. T Tank and Waste Farms Evaluation Unit Inventory Estimates for Sr-90 Before and After 99% Retrieval

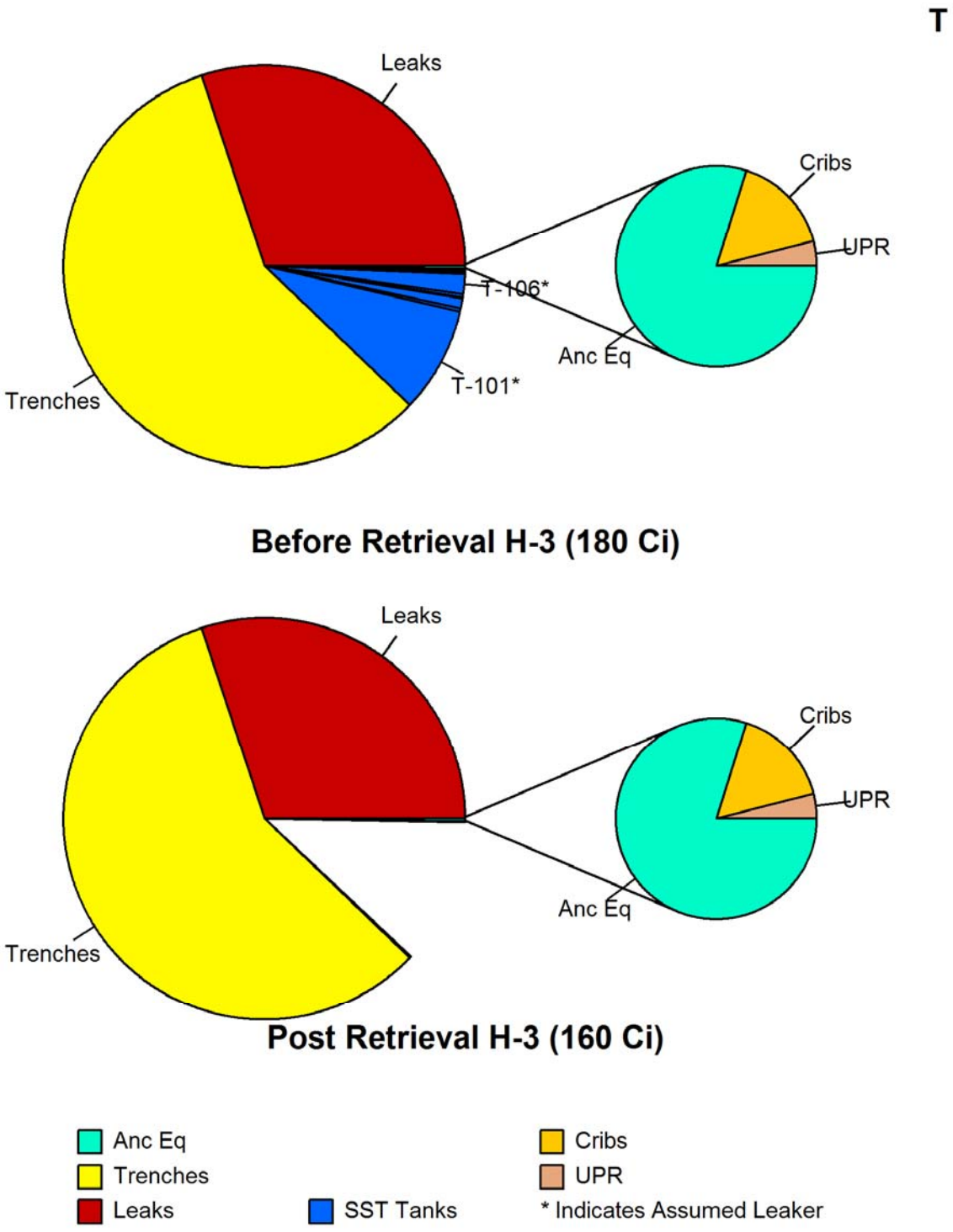


Figure E.2-9. T Tank and Waste Farms Evaluation Unit Inventory Estimates for Tritium (H-3) Before and After 99% Retrieval

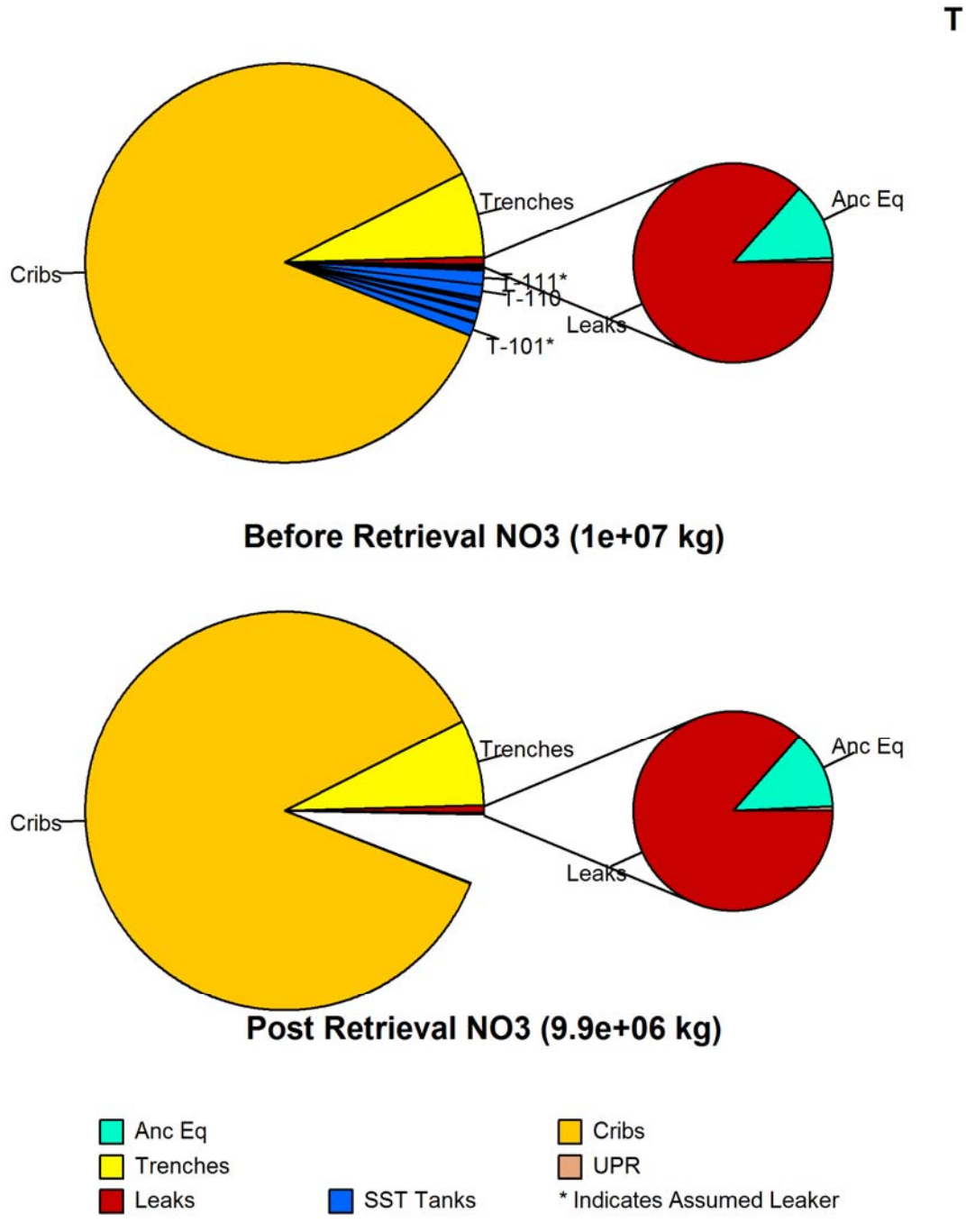


Figure E.2-10. T Tank and Waste Farms Evaluation Unit Inventory Estimates for Nitrate (NO3) Before and After 99% Retrieval

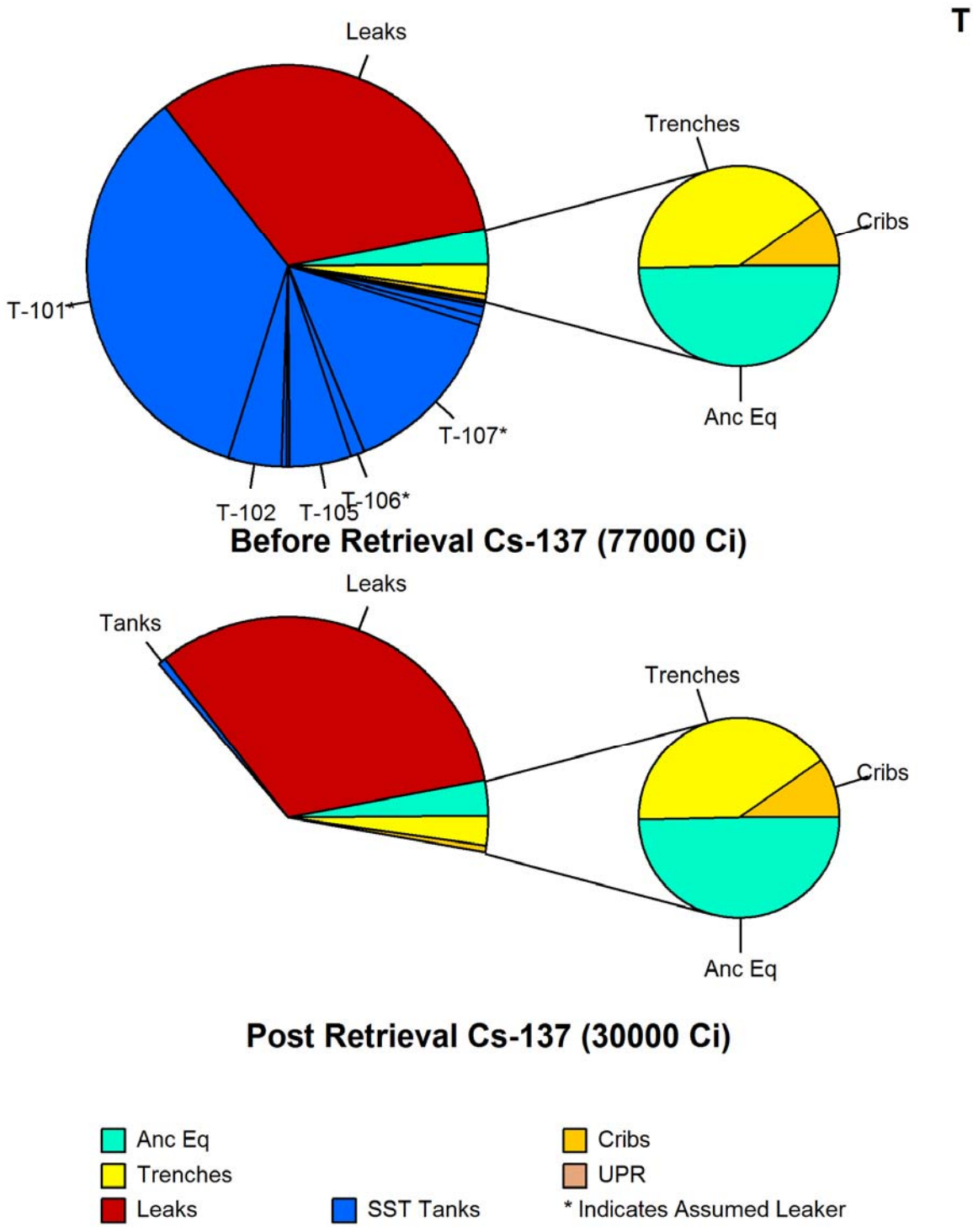


Figure E.2-11. T Tank and Waste Farms Evaluation Unit Inventory Estimates for Cs-137 Before and After 99% Retrieval

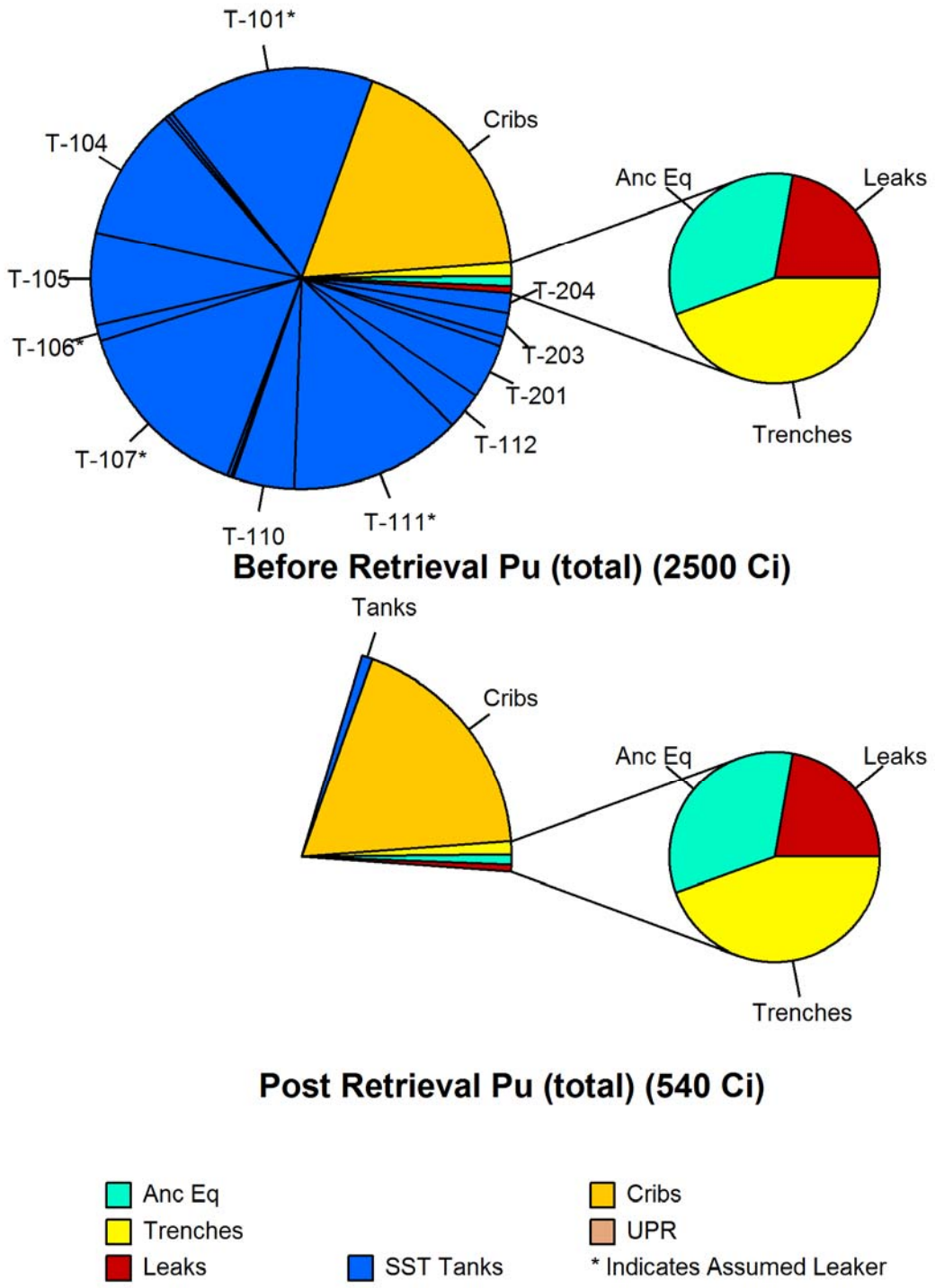


Figure E.2-12. T Tank and Waste Farms Evaluation Unit Inventory Estimates for Plutonium (total) Before and After 99% Retrieval

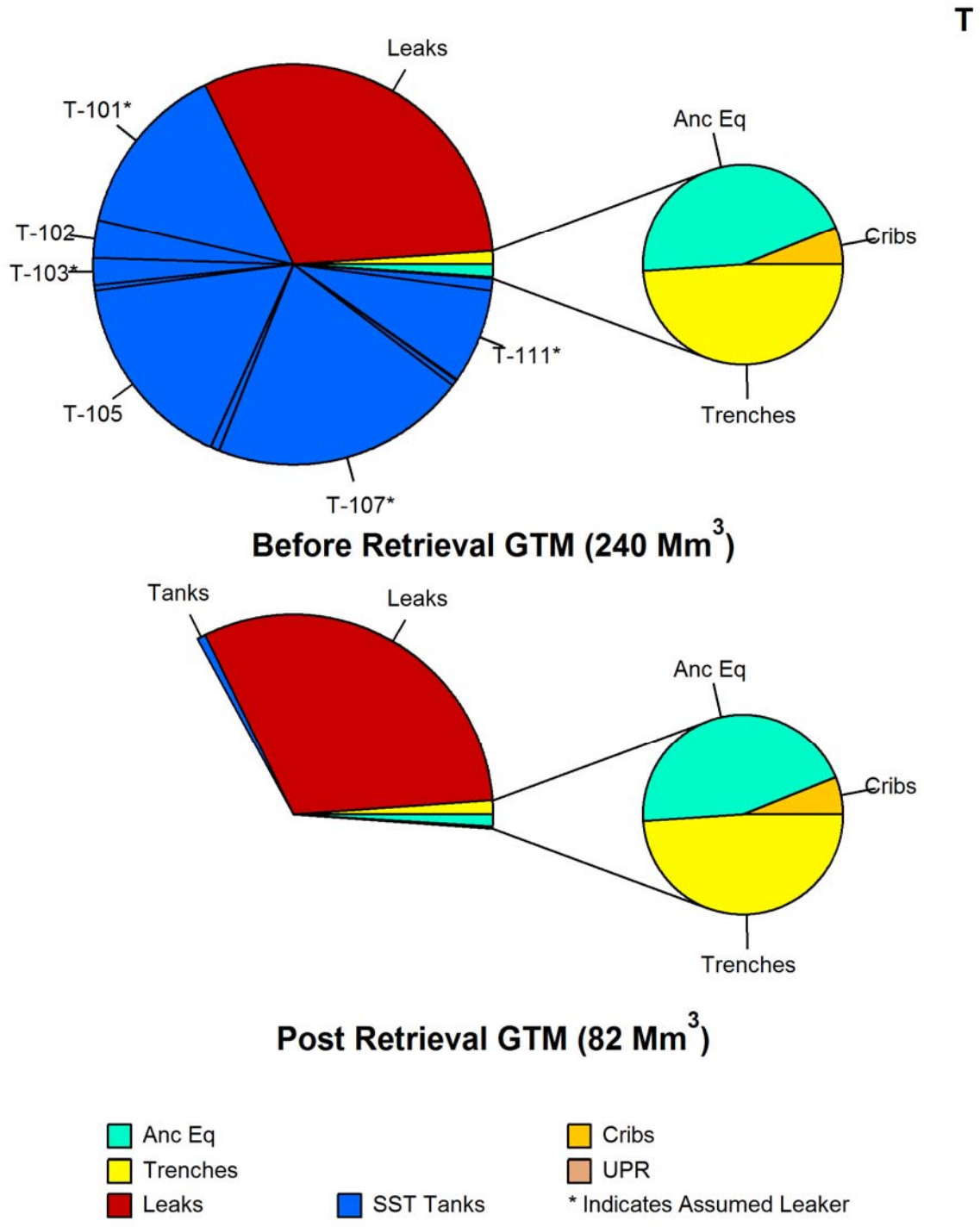


Figure E.2-13. T Tank and Waste Farms Evaluation Unit Maximum Groundwater Threat Metric (GTM) of I-129 and Tc-99 Estimates Before and After 99% Retrieval

E.2.6. POTENTIAL RISK/IMPACT PATHWAYS AND EVENTS

CURRENT CONCEPTUAL MODEL

A common safety analysis was performed for all the single- and double-shell tanks including pathways and barriers (safety scenarios that dominate risk, safety systems and controls, barriers to release, failure mechanisms, pathways and receptors, time frames for exposure). See Section E.1.6 in Appendix E.1 for details.

POPULATIONS AND RESOURCES CURRENTLY AT RISK OR POTENTIALLY IMPACTED

Facility Worker, Co-located Person, and Public

A common analysis was performed for the Facility Worker, Co-located Person, and Public. See Section E.1.6 (Appendix E.1) for details.

Groundwater and Vadose Zone

The current groundwater plumes for Group A and B primary contaminants (Tc-99 and chromium) associated with the T Tank and Waste Farms EU and liquid waste disposal facilities are described in Section E.2.5, and details including ratings are provided in Appendix D.6 for the CP-GW-2 EU (200-ZP GWIA).

As shown in Table E.2-7 (Section E.2.5), the remaining vadose zone (VZ) GTM values for the Group A and B primary contaminants translate into ratings from *Not Discernible* (*ND*) for uranium (with a *Low* rating after the Active Cleanup period as described in Section E.2.5) and Sr-90 (which has an inventory that would translate to a *Very High* rating but appears relatively immobile in the area as described in Section E.2.5) to *High* for chromium (assumed both total and hexavalent) for the T Tank and Waste Farms EU. The overall rating for potential groundwater impacts from vadose zone sources is *High*.

Columbia River

As described in Section E.2.5, no plumes associated with the T Tank and Waste Farms EU currently intersect the Columbia River above benthic or riparian standards, which corresponds to *Not Discernible* ratings. The large dilution effect of the Columbia River results in a rating of *Not Discernible* for the free-flowing ecology.

Additional information concerning potential threats to the Columbia River from Tank Farm and liquid waste disposal facilities in the 200-West Area is provided in Appendix D.6 for the CP-GW-2 EU (especially the 200-ZP GWIA).

Ecological Resources

- Approximately 90% of the T Tank and Waste Farms EU consists of graveled surfaces and paved areas.
- Individual occurrences of level 3 species have been previously documented at the T Tank and Waste Farms EU, however, no level 3 or greater habitat resources occur in patches greater than 0.5 ac within the EU.
- Loss of individual Piper's daisy plants would not be likely to affect the viability of populations of this species in the region.

- No wildlife was observed in the area during a vehicle reconnaissance of the boundary, and in 2010, a previous PNNL ECAP survey of the habitat surrounding the tank farm noted only coyote (*Canis latrans*) tracks in the habitat to the west and northwest of the tank farm.
- Cleanup activities would result in no net change in the amount of level 3 or higher resources within a 0.97 km radius.
- Because the EU is adjacent to paved roadways and multiple industrial areas and waste sites—no significant change in habitat connectivity would be expected if habitat resources within the EU are lost.

Cultural Resources

- Segment C, a non-contributing un-intact segment of the National Register-eligible historic/ethnohistoric Road/Trail runs through the T Tank and Waste Farms EU.
- The 241-T Tank Farm a contributing property within the Manhattan Project and Cold War Era Historic District, with documentation required, that is located within the T Tank and Waste Farms 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 and TCPs located within 500 meters of the EU

- The Hanford Site Plant Railroad, a contributing property within the Manhattan Project and Cold War Era Historic District, with documentation required, is located within 500 meters of the T Tank and Waste Farms 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.

Recorded TCPs Visible from the EU

- There are two recorded TCPs associated with the Native American Precontact and Ethnographic Landscape that are visible from the T Tank and Waste Farms EU.

CLEANUP APPROACHES AND END-STATE CONCEPTUAL MODEL

Selected or Potential Cleanup Approaches

A common analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

Contaminant Inventory Remaining at the Conclusion of Planned Active Cleanup Period

See Section E.2.5 including Table E.2-2 and Figure E.2-4 through Figure E.2-12 for the inventory information after planned 99% retrieval. Furthermore, a more general analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

Risks and Potential Impacts Associated with Cleanup

A general analysis was performed for all the single- and double-shell tanks for workers and the Public. See Section E.1.6 (Appendix E.1) for details.

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

Facility Worker, Co-located Person, and Public

A common analysis was performed for the Facility Worker, Co-located Person, and Public. See Section E.1.6 (Appendix E.1) for details.

Groundwater

As described in Section E.2.5, there will be a continuing threat or impact during this period to groundwater (as a protected resource) from those mobile T Tank Farm primary contaminants (e.g., Tc-99, I-129, chromium, and H-3) currently with plumes that exceed thresholds. These impacts are described in Appendix D.6 for the CP-GW-2 EU (200-ZP GWIA).

Furthermore, there are primary (e.g., tank wastes) and secondary contaminant sources (legacy source sites) in the vadose zone that pose risk to groundwater. The vadose zone (VZ) GTM values for the Group A and B primary contaminants for the T Tank and Waste Farms EU translate to ratings of *Not Discernible* (*ND*) for uranium and Sr-90 (with ratings of *Low* after the Active Cleanup period to address uncertainties), *Medium* for Tc-99 and I-129, and *High* for chromium (total and hexavalent) during this period (because of insufficient impact of recharge rates under treatment likely due to the large amounts of contaminants already in the groundwater and possibly from sources outside the T Tank and Waste Farms EU). These ratings corresponding to an overall rating of *High*.

The 200-West Area P&T system is assumed to be operational during this evaluation period, which will be treating groundwater contamination.

It is considered unlikely that additional groundwater resources would be impacted as a result of either interim remedial actions (e.g., pump and treat) or final closure activities (that are not covered in the Ecological or Cultural Resources results).

Columbia River

As described in Section E.2.5, the impacts to the Columbia River benthic, riparian, and free-flowing ecology for the Active Cleanup and Near-term, Post Cleanup periods are rated as *Not Discernible*. Additional information on groundwater plumes and potential threats associated with the T Tank Farm and liquid waste disposal facilities are described in Appendix D.6 for the CP-GW-2 EU (200-ZP-1 GW OU).

It is considered unlikely that additional benthic or riparian resources would be impacted as a result of either interim remedial actions (e.g., pump and treat) or final closure activities (that are not covered in the Ecological or Cultural Resources results).

Ecological Resources

See Section E.1.6 (Appendix E.1) for details.

Cultural Resources

See Section E.1.6 (Appendix E.1) for details.

ADDITIONAL RISKS AND POTENTIAL IMPACTS IF CLEANUP IS DELAYED

A common analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

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

A common analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

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

Table E.2-8. Summary of Populations and Resources at Risk or Potentially Impacted after Cleanup

Population or Resource		Impact Rating	Comments
Human	Facility Worker	Low	Workers will be low risk from exposure to direct radiation and waste contaminants after waste retrieval, grouting, and capping.
	Co-located Person	Low	These persons will be at low risk from exposure to direct radiation and waste contaminants after waste retrieval, grouting, and capping.
	Public	Not Discernible (ND)	The Tank Farms will be in secure and controlled areas that prevent intentional and inadvertent intruders. No complete groundwater pathway and no impact from air pathway.
Environmental	Groundwater (A&B) from vadose zone[a]	*Low* (C-14, U(tot), Sr-90) *Medium* (I-129 and Tc-99) *High* (Cr(tot) and Cr-VI) **Overall**: *High*	Current GTM values for Group A and B primary contaminants (Table E.2-7): *ND* (U(tot), Sr-90), *Low* (C-14), *Medium* (Tc-99 and I-129), and *High* (total and hexavalent chromium). Uranium and Sr-90 (which would have a *Very High* rating otherwise) are not likely to impact groundwater but are given *Low* ratings here to address uncertainty (Section E.2.5). Insufficient predicted impact from decay (since chromium is risk driver) or changes in recharge rates to modify ratings. Treatment in 200 West P&T Facility does not change vadose zone threats.
	Columbia River from vadose zone[a]	Benthic: Not Discernible Riparian: Not Discernible Free-flowing: Not Discernible **Overall**: Not Discernible	TC&WM EIS screening results indicate that exposure to radioactive and chemical contaminants from peak groundwater discharge below benchmarks for both benthic and riparian receptors (Section E.2.5). Dilution factor of greater than 100

Population or Resource		Impact Rating	Comments
			million between River and upwellings.
	Ecological Resources[a]	ND to Low	Continued monitoring could result in some disturbance to EU, and buffer lands. Remediation may improve habitat through re-vegetation (and increased monitoring may lead to increases in exotic species, and changes in species.
Social	Cultural Resources [a]	**Native American:** Direct: Unknown Indirect: Known **Historic Pre-Hanford:** Direct: None Indirect: Unknown **Manhattan/Cold War**: Direct: None Indirect: None	Indirect effects to trail may be permanent. Permanent indirect effects to viewshed are possible from capping. Permanent effects may be possible due to presence of contamination if capping occurs.

a. Groundwater threat for Group A and B contaminants remaining in the vadose zone or to the Columbia River for all primary contaminants. Threats from existing plumes associated with the T Tank and Waste Farms EU are described in Section E.2.5 and Appendix D.6 (CP-GW-2) for the 200-ZP Groundwater Interest Area (GWIA).

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

As described in Section E.2.5, the TC&WM ecological screening analysis indicate that that exposure to radioactive contaminants from peak groundwater discharge was below screening levels at the Columbia River near-shore region, indicating there should be no expected adverse effects from radionuclides. Furthermore, results of the corresponding TC&WM screening evaluation for chemicals indicated that predicted chromium and nitrate concentrations could exceed screening values (i.e., Hazard Quotient of unity) in the near-shore region. However, the predicted nitrate peak concentration was in the past and would be unlikely to exceed human or aquatic standards in the future. For chromium the long travel time from 200-West to the Columbia River likely indicates that little of the chromium predicted to impact the near-shore region would be from 200-West sources (including the T Tank and Waste Farms EU), which would also likely lead to insignificant impacts from the T Tank and Waste Farms EU.

For more information, see Section E.1.6 (Appendix E.1).

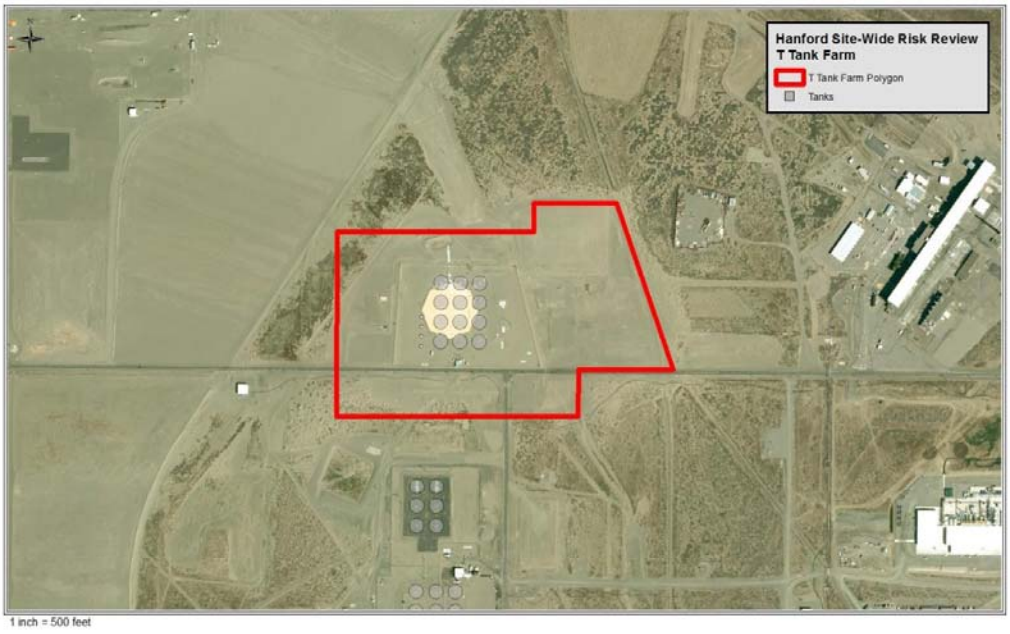
E.2.7. SUPPLEMENTAL INFORMATION AND CONSIDERATIONS

A common analysis was performed for all the single- and double-shell tanks. See Section E.1.7 (Appendix E.1) for details.

E.2.8. ATTACHMENT – T TANK AND WASTE FARMS EVALUATION UNIT WIDS REVIEW

Hanford Site-Wide Risk Review

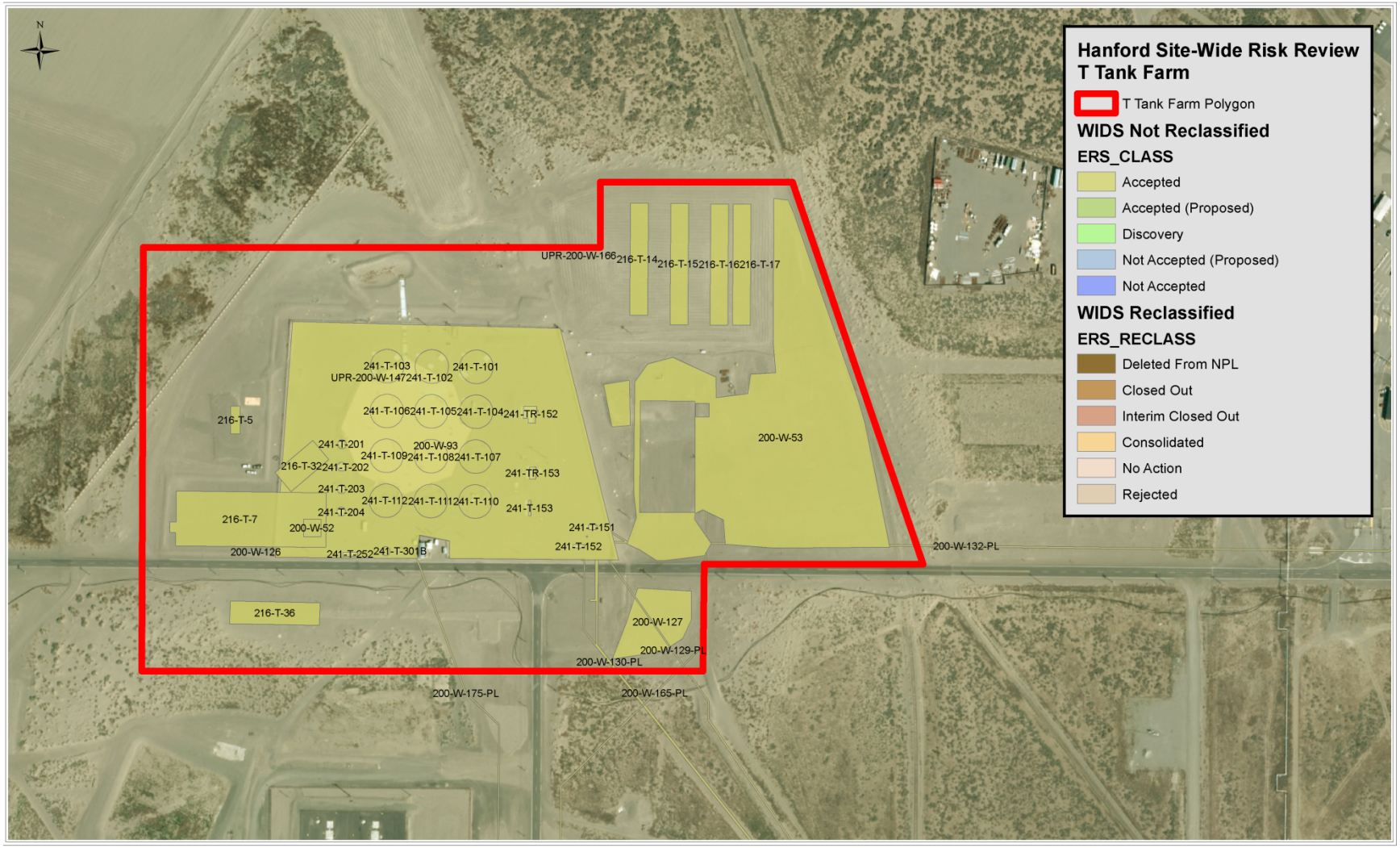
Evaluation Unit:	T Tank Farm
ID:	CP-21
Group:	TF
Operable Unit Cross-Walk:	
Related EU:	
Sites & Facilities:	T Tank Farm
	Ancillary structures
	Associated liquid waste sites
	Associated soils contamination
Key Data Sources Docs:	



Hanford Site-Wide Risk Review

Waste Sites Associated with T Tank Farm	Waste Sites Not Associated with T Tank Farm
200-W-126 (Tank Farm Vertical Storage Units; Vertical Storage Units West of 241-T Tank Farm)	200-W-163-PL (T Plant Process Sewer)
200-W-127 (Surface Stabilized Area East of UPR-200-W-29/UPR-200-W-97 (UN-216-W-5))	200-W-164-PL (Pipeline from 207-T Retention Basin to the 216-T-4 Ditch)
200-W-129-PL (Encased Pipeline from 241-T-151 and 241-T-152 to 241-TX-155 Diversion Box; Lines V399, V405 and V411)	200-W-166-PL (Pipeline from 242-T Evaporator Building to the 207-T Retention Basin)
200-W-130-PL (Pipelines from 241-T-151 and 241-T-152 Diversion Boxes to 241-U-151 Diversion Box)	200-W-167-PL (Pipeline from 242-T Evaporator to 207-T Retention Basin)
200-W-132-PL (Pipelines from 221-T to 241-T-151 and 241-T-152)	200-W-226-PL (Pipeline from 224-T (Plutonium Concentration Facility) to 241-T-361 Settling Tank and 216-T-3 Reverse Well)
200-W-165-PL (Pipeline from Tank 241-TX-112 to 207-T Retention Basin)	200-W-231 (Temporary Facilities Construction Trailer Septic Tank and Tile Field)
200-W-175-PL; (Pipeline to Route Waste from 241-T-112 to 216-TY-201 Flush Tank and 216-T-26, 216-T-27 and 216-T-28 Cribs)	200-W-88-PL (221-T Process Sewer)
200-W-52 (216-T-7 Crib; 241-T-3 Crib)	207-T (T Plant Retention Basin)
200-W-53 (UN-216-W-31; UPR-200-W-166)	200-W-90 (Underground Radioactive Material Areas Posted Along 23rd Street in 200 West Area)
200-W-78-PL (Pipeline Between 241-TX/TY and 241-T Tank Farms)	216-T-12 (207-T Sludge Grave)
200-W-79-PL (216-T-36 Crib Pipeline)	UPR-200-W-29 (23rd and Camden Line Break; Transfer Line Leak; UN-200-W-27; UN-200-W-29; UN-216-W-5; UPR-200-W-27)
200-W-93 (Contaminated Soil at 241-T Tank Farm)	UPR-200-W-63 (Road Contamination Along the South Shoulder of 23rd Street; UN-200-W-63)
216-T-14 (241-T-1 Trench; 216-T-1 Grave)	UPR-200-W-64 (Road Contamination at 23rd and Camden; UN-200-W-64)
216-T-15 (216-T-15 Crib; 241-T-2 Grave; 241-T-2 Trench)	UPR-200-W-97 (Transfer Line Leak; UN-200-W-97; UN-216-W-5)
216-T-16 (216-T-16 Crib; 241-T-3 Grave; 241-T-3 Trench)	
216-T-17 (216-T-4 Grave; 241-T-4 Trench)	
216-T-32 (216-T-6; 241-T #1 & 2 Cribs)	
216-T-36 (216-T-36 Crib)	
216-T-5 (216-T-5 Grave; 216-T-5 Trench; 241-T-5 Trench)	
216-T-7 (216-T-7 Tile Field; 216-T-7TF; 241-T-3 Tile Field)	
241-T-101 (241-T-TK-101)	
241-T-102 (241-T-TK-102)	
241-T-103 (241-T-TK-103)	

241-T-104 (241-T-TK-104)	
241-T-105 (241-T-TK-105)	
241-T-106 (241-T-TK-106)	
241-T-107 (241-T-TK-107)	
241-T-108 (241-T-TK-108)	
241-T-109 (241-T-TK-109)	
241-T-110 (241-T-TK-110)	
241-T-111 (241-T-TK-111)	
241-T-112 (241-T-TK-112)	
241-T-151 (241-T-151 Diversion Box)	
241-T-152 (241-T-152 Diversion Box)	
241-T-153 (241-T-153 Diversion Box)	
241-T-201 (241-T-TK-201)	
241-T-202 (241-T-TK-202)	
241-T-203 (241-T-TK-203)	
241-T-204 (241-T-TK-204)	
241-T-252 (241-T-252 Diversion Box)	
241-T-301B (241-T-301-B; IMUST; Inactive Miscellaneous Underground Storage Tank; Lines V664 and V727; 241-T-0301; 241-T-301 Catch Tank)	
241-T-302 (241-T-302 Catch Tank)	
241-TR-152 (241-TR-152 Diversion Box)	
241-TR-153 (241-TR-153 Booster Pump Pit; 241-TR-153 Diversion Box)	
UPR-200-W-147 (241-T-103 Leak)	
UPR-200-W-148 (241-T-106 Leak)	
UPR-200-W-166 (Contamination Migration from 241-T Tank Farm; UN-216-W-31)	
UPR-200-W-7 (Contamination Spread from the 241-T-151 and 241-T-152 Diversion Boxes; UN-200-W-7)	



1 inch = 300 feet

Hanford Site-Wide Risk Review
T Tank Farm
WIDS Export from PHOENIX

No.	Name	Site Code	Site ID	Class Status	Reclass Status	Site Status	Site Type	Hanford Area	Operable Unit
1	200-W-126; Tank Farm Vertical Storage Units; Vertical Storage Units West of 241 T Tank Farm	200 W 126	2939	Accepted	None	Inactive	Storage	200W	TBD
2	200-W-127; Surface Stabilized Area East of UPR-200-W-29/UPR-200-W-97 (UN-216-W-5)	200-W-127	2940	Accepted	None	Inactive	Unplanned Release	200W	TBD
3	200 W 129 PL; Encased Pipeline from 241 T 151 and 241 T 152 to 241-TX-155 Diversion Box; Lines V399, V405 and V411	200-W-129-PL	2938	Accepted	None	Inactive	Encased Tank Farm Pipeline	200W	TBD
4	200-W-130-PL; Lines V445, V663, V601 and V416 and Spare Lines V662, V663, V682 and V683; Pipelines from 241-T-151 and 241-T-152 Diversion Boxes to 241-U-151 Diversion Box	200-W-130-PL	2935	Accepted	None	Inactive	Direct Buried Tank Farm Pipeline	200W	TBD
5	200-W-132-PL; Pipelines from 221-T to 241-T-151 and 241-T-152; V653, V654, V667, V668, V669, V706, and V707	200 W 132 PL	2937	Accepted	None	Inactive	Direct Buried Tank Farm Pipeline	200W	TBD
6	200-W-163-PL; T Plant Process Sewer; 18-Inch 221-T Process Sewer Pipeline	200-W-163-PL	2893	Accepted	None	Inactive	Radioactive Process Sewer	200W	TBD
7	200-W-164-PL; Pipeline from 207-T Retention Basin to the 216-T-4 Ditch	200 W 164 PL	2901	Accepted	None	Inactive	Radioactive Process Sewer	200W	TBD
8	200-W-165-PL; Pipeline from Tank 241-TX-112 to 207-T Retention Basin	200 W 165 PL	2898	Accepted	None	Inactive	Radioactive Process Sewer	200W	TBD
9	200-W-166-PL; Pipeline from 242-T Evaporator Building to the 207-T Retention Basin	200-W-166-PL	2899	Accepted	None	Inactive	Radioactive Process Sewer	200W	TBD
10	200-W-167-PL; Pipeline from 242-T Evaporator to 207-T Retention Basin	200 W 167 PL	2900	Accepted	None	Inactive	Radioactive Process Sewer	200W	TBD
11	200 W 175 PL; Line V681; Pipeline to Route Waste from 241 T 112 to 216 TY 201 Flush Tank and 216 T 26, 216 T 27 and 216-T-28 Cribs	200 W 175 PL	2964	Accepted	None	Inactive	Radioactive Process Sewer	200W	TBD
12	200 W 226 PL; Lines V326, V671 and V706; Pipeline from 224 T (Plutonium Concentration Facility) to 241 T 361 Settling Tank and 216 T 3 Reverse Well	200 W 226 PL	2975	Accepted	None	Inactive	Radioactive Process Sewer	200W	TBD
13	200-W-231; Temporary Facilities Construction Trailer Septic Tank and Tile Field	200 W 231	3013	Accepted	None	Inactive	Septic Tank	200W	TBD
14	200-W-52; 216-T-7 Crib; 241-T-3 Crib	200-W-52	3202	Accepted	None	Inactive	Crib	200W	WMA T
15	200 W 53; UN 216 W 31; UPR 200 W 166	200 W 53	3203	Accepted	None	Inactive	Unplanned Release	200W	200 WA 1
16	200-W-78-PL: 6025; 7624 and 7630; Lines 6012; Pipeline Between 241-TX/TY and 241-T Tank Farms	200 W 78 PL	3236	Accepted	None	Inactive	Encased Tank Farm Pipeline	200W	TBD
17	200 W 79 PL; 216 T 36 Crib Pipeline; V663	200 W 79 PL	3237	Accepted	None	Inactive	Radioactive Process Sewer	200W	TBD
18	200-W-88-PL: 221-T Process Sewer; 24 Inch Process Sewer; T Plant Process Sewer Pipeline; 200-W-88	200 W 88 PL	3241	Accepted	None	Inactive	Radioactive Process Sewer	200W	TBD
19	200 W 90; Underground Radioactive Material Areas Posted Along 23rd Street in 200 West Area	200 W 90	2931	Accepted	None	Inactive	Unplanned Release	200W	200 WA 1
20	200-W-93; Contaminated Soil at 241-T Tank Farm	200-W-93	2930	Accepted	None	Inactive	Unplanned Release	200W	WMA T
21	207-T; 207-T Retention Basin; T Plant Retention Basin	207-T	622	Accepted	None	Inactive	Retention Basin	200W	200-WA-1
22	216 T 12; 207 T Sludge Grave; 207 T Sludge Pit; 216 T 11	216 T 12	607	Accepted	None	Inactive	Trench	200W	200 WA 1

Hanford Site-Wide Risk Review
T Tank Farm
WIDS Export from PHOENIX

No.	Name	Site Code	Site ID	Class Status	Reclass Status	Site Status	Site Type	Hanford Area	Operable Unit
23	216-T-14; 241-T-1 Trench; 216-T-1 Grave; 216-T-13	216-T-14	601	Accepted	None	Inactive	Trench	200W	200-DV-1
24	216 T 15; 216 T 15 Crib; 241 T 2 Grave; 241 T 2 Trench; 216-T-14	216-T-15	602	Accepted	None	Inactive	Trench	200W	200-DV-1
25	216-T-16; 216-T-16 Crib; 241-T-3 Grave; 241-T-3 Trench; 216-T-15	216 T 16	603	Accepted	None	Inactive	Trench	200W	200 DV 1
26	216 T 17; 216 T 4 Grave; 241 T 4 Trench; 216 T 16	216 T 17	623	Accepted	None	Inactive	Trench	200W	200 DV 1
27	216 T 32; 216 T 6; 241 T #1 & 2 Cribs	216 T 32	648	Accepted	None	Inactive	Crib	200W	200 DV 1
28	216 T 36; 216 T 36 Crib	216 T 36	630	Accepted	None	Inactive	Crib	200W	200 WA 1
29	216-T-5; 216-T-5 Grave; 216-T-5 Trench; 241-T-5 Trench; 216 T 12	216-T-5	600	Accepted	None	Inactive	Trench	200W	200-DV-1
30	216-T-7; 216-T-7 Tile Field; 216-T-7TF; 241-T-3 Tile Field	216-T-7	594	Accepted	None	Inactive	Drain/Tile Field	200W	200-DV-1
31	241-T-101; 241-T-TK-101	241-T-101	631	Accepted	None	Inactive	Single-Shell Tank	200W	WMA T
32	241-T-102; 241-T-TK-102	241-T-102	632	Accepted	None	Inactive	Single-Shell Tank	200W	WMA T
33	241-T-103; 241-T-TK-103	241-T-103	633	Accepted	None	Inactive	Single-Shell Tank	200W	WMA T
34	241-T-104; 241-T-TK-104	241-T-104	1897	Accepted	None	Inactive	Single-Shell Tank	200W	WMA T
35	241-T-105; 241-T-TK-105	241-T-105	3161	Accepted	None	Inactive	Single-Shell Tank	200W	WMA T
36	241 T 106; 241 T TK 106	241 T 106	3162	Accepted	None	Inactive	Single Shell Tank	200W	WMA T
37	241-T-107; 241-T-TK-107	241-T-107	3163	Accepted	None	Inactive	Single-Shell Tank	200W	WMA T
38	241 T 108; 241 T TK 108	241 T 108	3160	Accepted	None	Inactive	Single Shell Tank	200W	WMA T
39	241 T 109; 241 T TK 109	241 T 109	3157	Accepted	None	Inactive	Single Shell Tank	200W	WMA T
40	241 T 110; 241 T TK 110	241 T 110	3158	Accepted	None	Inactive	Single Shell Tank	200W	WMA T
41	241 T 111; 241 T TK 111	241 T 111	3159	Accepted	None	Inactive	Single Shell Tank	200W	WMA T
42	241 T 112; 241 T TK 112	241 T 112	3168	Accepted	None	Inactive	Single Shell Tank	200W	WMA T
43	241 T 151; 241 T 151 Diversion Box	241 T 151	3169	Accepted	None	Inactive	Diversion Box	200W	WMA T
44	241-T-152; 241-T-152 Diversion Box	241-T-152	3170	Accepted	None	Inactive	Diversion Box	200W	WMA T
45	241 T 153; 241 T 153 Diversion Box	241 T 153	3167	Accepted	None	Inactive	Diversion Box	200W	WMA T
46	241-T-201; 241-T-TK-201	241-T-201	3164	Accepted	None	Inactive	Single-Shell Tank	200W	WMA T
47	241-T-202; 241-T-TK-202	241-T-202	3165	Accepted	None	Inactive	Single-Shell Tank	200W	WMA T
48	241-T-203; 241-T-TK-203	241-T-203	3166	Accepted	None	Inactive	Single-Shell Tank	200W	WMA T
49	241-T-204; 241-T-TK-204	241-T-204	3156	Accepted	None	Inactive	Single-Shell Tank	200W	WMA T
50	241-T-252; 241-T-252 Diversion Box	241-T-252	3146	Accepted	None	Inactive	Diversion Box	200W	WMA T
51	241-T-301B; 241-T-301-B; IMUST; Inactive Miscellaneous Underground Storage Tank; Lines V664 and V727; 241-T-0301; 241 T 301 Catch Tank	241-T-301B	3147	Accepted	None	Inactive	Catch Tank	200W	WMA T
52	241-T-302; 241-T-302 Catch Tank	241-T-302	3148	Accepted	Rejected	Inactive	Catch Tank	200W	Not Applic
53	241 TR 152; 241 TR 152 Diversion Box; Line 6053	241 TR 152	3154	Accepted	None	Inactive	Diversion Box	200W	WMA T
54	241-TR-153; 241-TR-153 Booster Pump Pit; 241-TR-153 Diversion Box; Line 6172	241-TR-153	3155	Accepted	None	Inactive	Diversion Box	200W	WMA T
55	UPR 200 W 147; 241 T 103 Leak	UPR 200 W 147	2563	Accepted	Consolidated	Inactive	Unplanned Release	200W	Not Applic
56	UPR-200-W-148; 241-T-106 Leak	UPR-200-W-148	2560	Accepted	Consolidated	Inactive	Unplanned Release	200W	Not Applic
57	UPR-200-W-166; Contamination Migration from 241-T Tank Farm; UN 216 W 31	UPR-200-W-166	2603	Accepted	None	Inactive	Unplanned Release	200W	200-WA-1

Hanford Site-Wide Risk Review
T Tank Farm
WIDS Export from PHOENIX

No.	Name	Site Code	Site ID	Class Status	Reclass Status	Site Status	Site Type	Hanford Area	Operable Unit
58	UPR-200-W-29; 23rd and Camden Line Break; Transfer Line Leak; UN-200-W-27; UN-200-W-29; UN-216-W-5; UPR-200 W 27	UPR-200-W-29	2187	Accepted	None	Inactive	Unplanned Release	200W	200-IS-1
59	UPR-200-W-63; Road Contamination Along the South Shoulder of 23rd Street; UN-200-W-63	UPR 200 W 63	2397	Accepted	None	Inactive	Unplanned Release	200W	200 WA 1
60	UPR-200-W-64; Road Contamination at 23rd and Camden; UN-200-W-64	UPR-200-W-64	2394	Accepted	None	Inactive	Unplanned Release	200W	200-IS-1
61	UPR-200-W-7; Contamination Spread from the 241-T-151 and 241-T-152 Diversion Boxes; UN-200-W-7	UPR-200-W-7	2434	Accepted	Consolidated	Inactive	Unplanned Release	200W	Not Applic
62	UPR-200-W-97; Transfer Line Leak; UN-200-W-97; UN-216 W 5	UPR-200-W-97	2427	Accepted	None	Inactive	Unplanned Release	200W	200-IS-1

Hanford Site-Wide Risk Review
T Tank Farm
WIDS Export from PHOENIX

No.	Name	Contractor	Responsible Project	Unit Category	Photos	Map Authority
1	200-W-126; Tank Farm Vertical Storage Units; Vertical Storage Units West of 241-T Tank Farm	Washington River Protection Solutions	Not Specified	Waste Management Area (WMA) Related	Yes	CHPRC
2	200-W-127; Surface Stabilized Area East of UPR-200-W-29/UPR-200-W-97 (UN-216-W-5)	CH2M HILL Plateau Remediation Company	Central Plateau Surveillance and Maintenance	To Be Determined (TBD)	Yes	CHPRC
3	200 W 129 PL; Encased Pipeline from 241 T 151 and 241 T 152 to 241 TX 155 Diversion Box; Lines V399, V405 and V411	CH2M HILL Plateau Remediation Company	Not Specified	Treatment, Storage and Disposal (TSD)	0	CHPRC
4	200-W-130-PL; Lines V445, V663, V601 and V416 and Spare Lines V662, V663, V682 and V683; Pipelines from 241 T 151 and 241 T 152 Diversion Boxes to 241 U 151 Diversion Box	CH2M HILL Plateau Remediation Company	Not Specified	Treatment, Storage and Disposal (TSD)	0	CHPRC
5	200 W 132 PL; Pipelines from 221 T to 241 T 151 and 241 T 152; V653, V654, V667, V668, V669, V706, and V707	CH2M HILL Plateau Remediation Company	Not Specified	Treatment, Storage and Disposal (TSD)	0	CHPRC
6	200 W 163 PL; T Plant Process Sewer; 18 Inch 221 T Process Sewer Pipeline	None	Not Specified	To Be Determined (TBD)	0	CHPRC
7	200 W 164 PL; Pipeline from 207 T Retention Basin to the 216-T-4 Ditch	None	Not Specified	To Be Determined (TBD)	0	CHPRC
8	200-W-165-PL; Pipeline from Tank 241-TX-112 to 207-T Retention Basin	None	Not Specified	To Be Determined (TBD)	0	CHPRC
9	200-W-166-PL; Pipeline from 242-T Evaporator Building to the 207-T Retention Basin	None	Not Specified	To Be Determined (TBD)	0	CHPRC
10	200-W-167-PL; Pipeline from 242-T Evaporator to 207-T Retention Basin	None	Not Specified	Treatment, Storage and Disposal (TSD)	0	CHPRC
11	200 W 175 PL; Line V681; Pipeline to Route Waste from 241-T-112 to 216-TY-201 Flush Tank and 216-T-26, 216-T-27 and 216-T-28 Cribs	None	Not Specified	To Be Determined (TBD)	0	CHPRC
12	200-W-226-PL; Lines V326, V671 and V706; Pipeline from 224-T (Plutonium Concentration Facility) to 241-T-361 Settling Tank and 216-T-3 Reverse Well	None	Not Specified	To Be Determined (TBD)	0	CHPRC
13	200 W 231; Temporary Facilities Construction Trailer Septic Tank and Tile Field	None	Not Specified	To Be Determined (TBD)	0	CHPRC
14	200-W-52; 216-T-7 Crib; 241-T-3 Crib	Washington River Protection Solutions	Not Specified	RCRA Past Practice (RPP)	Yes	CHPRC
15	200-W-53; UN-216-W-31; UPR-200-W-166	CH2M HILL Plateau Remediation Company	Not Specified	CERCLA Past Practice (CPP)	Yes	CHPRC
16	200-W-78-PL; 6025; 7624 and 7630; Lines 6012; Pipeline Between 241-TX/TY and 241-T Tank Farms	CH2M HILL Plateau Remediation Company	Not Specified	Treatment, Storage and Disposal (TSD)	Yes	CHPRC
17	200 W 79 PL; 216 T 36 Crib Pipeline; V663	CH2M HILL Plateau Remediation Company	Central Plateau Surveillance and Maintenance	Treatment, Storage and Disposal (TSD)	Yes	CHPRC
18	200-W-88-PL; 221-T Process Sewer; 24 Inch Process Sewer; T Plant Process Sewer Pipeline; 200-W-88	CH2M HILL Plateau Remediation Company	Central Plateau - Surveillance and Maintenance	To Be Determined (TBD)	Yes	CHPRC
19	200-W-90; Underground Radioactive Material Areas Posted Along 23rd Street in 200 West Area	CH2M HILL Plateau Remediation Company	Central Plateau - Surveillance and Maintenance	CERCLA Past Practice (CPP)	Yes	CHPRC
20	200 W 93; Contaminated Soil at 241 T Tank Farm	Washington River Protection Solutions	Not Specified	Waste Management Area (WMA) Related	Yes	CHPRC
21	207-T; 207-T Retention Basin; T Plant Retention Basin	CH2M HILL Plateau Remediation Company	Central Plateau - Surveillance and Maintenance	CERCLA Past Practice (CPP)	Yes	CHPRC
22	216-T-12; 207-T Sludge Grave; 207-T Sludge Pit; 216-T-11	CH2M HILL Plateau Remediation Company	Central Plateau - Surveillance and Maintenance	CERCLA Past Practice (CPP)	0	CHPRC

Hanford Site-Wide Risk Review
T Tank Farm
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No.	Name	Contractor	Responsible Project	Unit Category	Photos	Map Authority
23	216-T-14; 241-T-1 Trench; 216-T-1 Grave; 216-T-13	CH2M HILL Plateau Remediation Company	Central Plateau - Surveillance and Maintenance	RCRA-CERCLA Past Practice (R-CPP)	Yes	CHPRC
24	216 T 15; 216 T 15 Crib; 241 T 2 Grave; 241 T 2 Trench; 216-T-14	CH2M HILL Plateau Remediation Company	Central Plateau - Surveillance and Maintenance	RCRA-CERCLA Past Practice (R-CPP)	0	CHPRC
25	216-T-16; 216-T-16 Crib; 241-T-3 Grave; 241-T-3 Trench; 216-T-15	CH2M HILL Plateau Remediation Company	Central Plateau - Surveillance and Maintenance	RCRA-CERCLA Past Practice (R-CPP)	0	CHPRC
26	216 T 17; 216 T 4 Grave; 241 T 4 Trench; 216 T 16	CH2M HILL Plateau Remediation Company	Central Plateau - Surveillance and Maintenance	RCRA-CERCLA Past Practice (R-CPP)	0	CHPRC
27	216 T 32; 216 T 6; 241 T #1 & 2 Cribs	CH2M HILL Plateau Remediation Company	Not Specified	RCRA-CERCLA Past Practice (R-CPP)	Yes	CHPRC
28	216 T 36; 216 T 36 Crib	CH2M HILL Plateau Remediation Company	Central Plateau - Surveillance and Maintenance	CERCLA Past Practice (CPP)	0	CHPRC
29	216-T-5; 216-T-5 Grave; 216-T-5 Trench; 241-T-5 Trench; 216 T 12	CH2M HILL Plateau Remediation Company	Central Plateau - Surveillance and Maintenance	RCRA-CERCLA Past Practice (R-CPP)	Yes	CHPRC
30	216-T-7; 216-T-7 Tile Field; 216-T-7TF; 241-T-3 Tile Field	CH2M HILL Plateau Remediation Company	Central Plateau - Surveillance and Maintenance	RCRA-CERCLA Past Practice (R-CPP)	Yes	CHPRC
31	241-T-101; 241-T-TK-101	Washington River Protection Solutions	Not Specified	Treatment, Storage and Disposal (TSD)	Yes	CHPRC
32	241-T-102; 241-T-TK-102	Washington River Protection Solutions	Not Specified	Treatment, Storage and Disposal (TSD)	Yes	CHPRC
33	241-T-103; 241-T-TK-103	Washington River Protection Solutions	Not Specified	Treatment, Storage and Disposal (TSD)	Yes	CHPRC
34	241-T-104; 241-T-TK-104	Washington River Protection Solutions	Not Specified	Treatment, Storage and Disposal (TSD)	Yes	CHPRC
35	241-T-105; 241-T-TK-105	Washington River Protection Solutions	Not Specified	Treatment, Storage and Disposal (TSD)	Yes	CHPRC
36	241 T 106; 241 T TK 106	Washington River Protection Solutions	Not Specified	Treatment, Storage and Disposal (TSD)	Yes	CHPRC
37	241-T-107; 241-T-TK-107	Washington River Protection Solutions	Not Specified	Treatment, Storage and Disposal (TSD)	Yes	CHPRC
38	241 T 108; 241 T TK 108	Washington River Protection Solutions	Not Specified	Treatment, Storage and Disposal (TSD)	Yes	CHPRC
39	241 T 109; 241 T TK 109	Washington River Protection Solutions	Not Specified	Treatment, Storage and Disposal (TSD)	Yes	CHPRC
40	241 T 110; 241 T TK 110	Washington River Protection Solutions	Not Specified	Treatment, Storage and Disposal (TSD)	Yes	CHPRC
41	241 T 111; 241 T TK 111	Washington River Protection Solutions	Not Specified	Treatment, Storage and Disposal (TSD)	Yes	CHPRC
42	241 T 112; 241 T TK 112	Washington River Protection Solutions	Not Specified	Treatment, Storage and Disposal (TSD)	Yes	CHPRC
43	241 T 151; 241 T 151 Diversion Box	Washington River Protection Solutions	Not Specified	Treatment, Storage and Disposal (TSD)	Yes	CHPRC
44	241-T-152; 241-T-152 Diversion Box	Washington River Protection Solutions	Not Specified	Treatment, Storage and Disposal (TSD)	Yes	CHPRC
45	241 T 153; 241 T 153 Diversion Box	Washington River Protection Solutions	Not Specified	Treatment, Storage and Disposal (TSD)	Yes	CHPRC
46	241-T-201; 241-T-TK-201	Washington River Protection Solutions	Not Specified	Treatment, Storage and Disposal (TSD)	Yes	CHPRC
47	241-T-202; 241-T-TK-202	Washington River Protection Solutions	Not Specified	Treatment, Storage and Disposal (TSD)	Yes	CHPRC
48	241-T-203; 241-T-TK-203	Washington River Protection Solutions	Not Specified	Treatment, Storage and Disposal (TSD)	Yes	CHPRC
49	241-T-204; 241-T-TK-204	Washington River Protection Solutions	Not Specified	Treatment, Storage and Disposal (TSD)	Yes	CHPRC
50	241-T-252; 241-T-252 Diversion Box	Washington River Protection Solutions	Not Specified	Treatment, Storage and Disposal (TSD)	Yes	CHPRC
51	241-T-301B; 241-T-301-B; IMUST; Inactive Miscellaneous Underground Storage Tank; Lines V664 and V727; 241-T-0301; 241 T 301 Catch Tank	Washington River Protection Solutions	Not Specified	Waste Management Area (WMA) Related	Yes	CHPRC
52	241-T-302; 241-T-302 Catch Tank	Washington River Protection Solutions	Not Specified	To Be Determined (TBD)	0	CHPRC
53	241 TR 152; 241 TR 152 Diversion Box; Line 6053	Washington River Protection Solutions	Not Specified	Treatment, Storage and Disposal (TSD)	Yes	CHPRC
54	241-TR-153; 241-TR-153 Booster Pump Pit; 241-TR-153 Diversion Box; Line 6172	Washington River Protection Solutions	Not Specified	Treatment, Storage and Disposal (TSD)	Yes	CHPRC
55	UPR 200 W 147; 241 T 103 Leak	Washington River Protection Solutions	Not Specified	To Be Determined (TBD)	Yes	CHPRC
56	UPR-200-W-148; 241-T-106 Leak	Washington River Protection Solutions	Not Specified	To Be Determined (TBD)	0	CHPRC
57	UPR-200-W-166; Contamination Migration from 241-T Tank Farm; UN 216 W 31	CH2M HILL Plateau Remediation Company	Central Plateau - Surveillance and Maintenance	CERCLA Past Practice (CPP)	Yes	CHPRC

Hanford Site-Wide Risk Review
T Tank Farm
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No.	Name	Contractor	Responsible Project	Unit Category	Photos	Map Authority
58	UPR-200-W-29; 23rd and Camden Line Break; Transfer Line Leak; UN-200-W-27; UN-200-W-29; UN-216-W-5; UPR-200 W 27	CH2M HILL Plateau Remediation Company	Not Specified	RCRA-CERCLA Past Practice (R-CPP)	Yes	CHPRC
59	UPR-200-W-63; Road Contamination Along the South Shoulder of 23rd Street; UN-200-W-63	CH2M HILL Plateau Remediation Company	Central Plateau - Surveillance and Maintenance	CERCLA Past Practice (CPP)	0	CHPRC
60	UPR-200-W-64; Road Contamination at 23rd and Camden; UN-200-W-64	CH2M HILL Plateau Remediation Company	Not Specified	RCRA-CERCLA Past Practice (R-CPP)	Yes	CHPRC
61	UPR-200-W-7; Contamination Spread from the 241-T-151 and 241-T-152 Diversion Boxes; UN-200-W-7	Washington River Protection Solutions	Not Specified	To Be Determined (TBD)	0	CHPRC
62	UPR-200-W-97; Transfer Line Leak; UN-200-W-97; UN-216-W 5	CH2M HILL Plateau Remediation Company	Not Specified	RCRA-CERCLA Past Practice (R-CPP)	Yes	CHPRC

Hanford Site-Wide Risk Review
T Tank Farm
WIDS Export from PHOENIX

No.	Name	ERS_OP_DES	SWMUFLAG
1	200-W-126; Tank Farm Vertical Storage Units; Vertical Storage Units West of 241-T Tank Farm	0	Yes
2	200-W-127; Surface Stabilized Area East of UPR-200-W-29/UPR-200-W-97 (UN-216-W-5)	0	No
3	200 W 129 PL; Encased Pipeline from 241 T 151 and 241 T 152 to 241 TX 155 Diversion Box; Lines V399, V405 and V411	0	Yes
4	200-W-130-PL; Lines V445, V663, V601 and V416 and Spare Lines V662, V663, V682 and V683; Pipelines from 241 T 151 and 241 T 152 Diversion Boxes to 241 U 151 Diversion Box	0	Yes
5	200 W 132 PL; Pipelines from 221 T to 241 T 151 and 241 T 152; V653, V654, V667, V668, V669, V706, and V707	0	Yes
6	200 W 163 PL; T Plant Process Sewer; 18 Inch 221 T Process Sewer Pipeline	0	Yes
7	200 W 164 PL; Pipeline from 207 T Retention Basin to the 216-T-4 Ditch	0	Yes
8	200-W-165-PL; Pipeline from Tank 241-TX-112 to 207-T Retention Basin	0	Yes
9	200-W-166-PL; Pipeline from 242-T Evaporator Building to the 207-T Retention Basin	0	Yes
10	200-W-167-PL; Pipeline from 242-T Evaporator to 207-T Retention Basin	0	Yes
11	200 W 175 PL; Line V681; Pipeline to Route Waste from 241-T-112 to 216-TY-201 Flush Tank and 216-T-26, 216-T-27 and 216-T-28 Cribs	0	Yes
12	200-W-226-PL; Lines V326, V671 and V706; Pipeline from 224-T (Plutonium Concentration Facility) to 241-T-361 Settling Tank and 216-T-3 Reverse Well	0	Yes
13	200 W 231; Temporary Facilities Construction Trailer Septic Tank and Tile Field	0	Yes
14	200-W-52; 216-T-7 Crib; 241-T-3 Crib	0	Yes
15	200-W-53; UN-216-W-31; UPR-200-W-166	0	No
16	200-W-78-PL; 6025; 7624 and 7630; Lines 6012; Pipeline Between 241-TX/TY and 241-T Tank Farms	0	Yes
17	200 W 79 PL; 216 T 36 Crib Pipeline; V663	0	Yes
18	200-W-88-PL; 221-T Process Sewer; 24 Inch Process Sewer; T Plant Process Sewer Pipeline; 200-W-88	0	No
19	200-W-90; Underground Radioactive Material Areas Posted Along 23rd Street in 200 West Area	0	No
20	200 W 93; Contaminated Soil at 241 T Tank Farm	0	No
21	207-T; 207-T Retention Basin; T Plant Retention Basin	0	Yes
22	216-T-12; 207-T Sludge Grave; 207-T Sludge Pit; 216-T-11	0	Yes

Hanford Site-Wide Risk Review
T Tank Farm
WIDS Export from PHOENIX

No.	Name	ERS_OP_DES	SWMUFLAG
23	216-T-14; 241-T-1 Trench; 216-T-1 Grave; 216-T-13	0	Yes
24	216 T 15; 216 T 15 Crib; 241 T 2 Grave; 241 T 2 Trench; 216-T-14	0	Yes
25	216-T-16; 216-T-16 Crib; 241-T-3 Grave; 241-T-3 Trench; 216-T-15	0	Yes
26	216 T 17; 216 T 4 Grave; 241 T 4 Trench; 216 T 16	0	Yes
27	216 T 32; 216 T 6; 241 T #1 & 2 Cribs	0	Yes
28	216 T 36; 216 T 36 Crib	0	Yes
29	216-T-5; 216-T-5 Grave; 216-T-5 Trench; 241-T-5 Trench; 216 T 12	0	Yes
30	216-T-7; 216-T-7 Tile Field; 216-T-7TF; 241-T-3 Tile Field	0	Yes
31	241-T-101; 241-T-TK-101	0	Yes
32	241-T-102; 241-T-TK-102	0	Yes
33	241-T-103; 241-T-TK-103	0	Yes
34	241-T-104; 241-T-TK-104	0	Yes
35	241-T-105; 241-T-TK-105	0	Yes
36	241 T 106; 241 T TK 106	0	Yes
37	241-T-107; 241-T-TK-107	0	Yes
38	241 T 108; 241 T TK 108	0	Yes
39	241 T 109; 241 T TK 109	0	Yes
40	241 T 110; 241 T TK 110	0	Yes
41	241 T 111; 241 T TK 111	0	Yes
42	241 T 112; 241 T TK 112	0	Yes
43	241 T 151; 241 T 151 Diversion Box	0	Yes
44	241-T-152; 241-T-152 Diversion Box	0	Yes
45	241 T 153; 241 T 153 Diversion Box	0	Yes
46	241-T-201; 241-T-TK-201	0	Yes
47	241-T-202; 241-T-TK-202	0	Yes
48	241-T-203; 241-T-TK-203	0	Yes
49	241-T-204; 241-T-TK-204	0	Yes
50	241-T-252; 241-T-252 Diversion Box	0	Yes
51	241-T-301B; 241-T-301-B; IMUST; Inactive Miscellaneous Underground Storage Tank; Lines V664 and V727; 241-T-0301; 241 T 301 Catch Tank	0	Yes
52	241-T-302; 241-T-302 Catch Tank	0	Yes
53	241 TR 152; 241 TR 152 Diversion Box; Line 6053	0	Yes
54	241-TR-153; 241-TR-153 Booster Pump Pit; 241-TR-153 Diversion Box; Line 6172	0	Yes
55	UPR 200 W 147; 241 T 103 Leak	0	No
56	UPR-200-W-148; 241-T-106 Leak	0	No
57	UPR-200-W-166; Contamination Migration from 241-T Tank Farm; UN 216 W 31	0	No

Hanford Site-Wide Risk Review
T Tank Farm
WIDS Export from PHOENIX

No.	Name	ERS_OP_DES	SWMUFLAG
58	UPR-200-W-29; 23rd and Camden Line Break; Transfer Line Leak; UN-200-W-27; UN-200-W-29; UN-216-W-5; UPR-200 W 27	Infrastructure	No
59	UPR-200-W-63; Road Contamination Along the South Shoulder of 23rd Street; UN-200-W-63	0	No
60	UPR-200-W-64; Road Contamination at 23rd and Camden; UN-200-W-64	Infrastructure	No
61	UPR-200-W-7; Contamination Spread from the 241-T-151 and 241-T-152 Diversion Boxes; UN-200-W-7	0	No
62	UPR-200-W-97; Transfer Line Leak; UN-200-W-97; UN-216 W 5	Infrastructure	No

APPENDIX E.3

Tank Waste and Farms

CP-TF-2 (S-SX Tank Waste and Farms)
Evaluation Unit Summary Template

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PART E.3. CP-TF-2 S-SX SINGLE-SHELL TANK WASTE AND FARMS (200-W)

E.3.1. EXECUTIVE SUMMARY

Much of the information related to the S-SX Tank and Waste Farms Evaluation Unit (EU) is organized around the corresponding Waste Management Area (namely WMA S-SX) that is regulated under the Resource Conservation and Recovery Act (RCRA) and Washington's Hazardous Waste Management Act (HWMA, RCW 70.105) and its implementing requirements (Washington's Dangerous Waste Regulations, WAC 173-303) (Johnson&Chou 1999).

EU LOCATION:

South-Central part of 200-West on the Hanford Reservation; Central Plateau

RELATED EUS:

T Tank Waste and Farms (CP-TF-1), TX-TY Tank Waste and Farms (CP-TF-3), U Tank Waste and Farms (CP-TF-4), A-AX Tank Waste and Farms (CP-TF-5), B-BX-BY Tank Waste and Farms (CP-TF-6), C Tank Waste and Farms (CP-TF-7), 200-East DST Waste and Farms (CP-TF-8), 200-West DST Waste and Farms (CP-TF-9), 200-E Groundwater Plumes (CP-GW-1), 200-W Groundwater Plumes (CP-GW-2), and 200 Area Waste Transfer Pipeline (CP-LS-7)

PRIMARY CONTAMINANTS, CONTAMINATED MEDIA AND WASTES:

The TC&WM EIS describes tank wastes as including radioactive (tritium or H-3, C-14, Sr-90, Tc-99, I-129, Cs-137, U-233, U-234, U-235, U-238, Np-237, Pu-239, and Pu-240)[49] and non-radioactive contaminants (chromium, mercury, nitrate, lead, total uranium, and PCBs) of potential concern (DOE/EIS-0391 2012, Appendix D). The tank wastes contain saltcake, sludge, and supernatant phases. Contaminated media related to the S-SX Tank Farms include ancillary equipment and surrounding vadose zone (including cribs and trenches) down to the saturated zone (for some mobile contaminants) from past and current discharges. The Interim Record of Decision for the 200-UP-1 Operable Unit (OU) (EPA 2012) associated with WMA S-SX identifies I-129, Tc-99, tritium, uranium, nitrate, and chromium as tank waste constituents that must be addressed in cleanup; carbon tetrachloride (CCl_4) is also listed but is not a tank waste. The 2015 Groundwater Monitoring Report (DOE/RL-2016-09, Rev. 0) lists tank wastes including chromium, nitrate, I-129, Tc-99, H-3, and uranium as well as carbon tetrachloride (non-tank) waste for the 200-UP groundwater interest area (GWIA) that is used to geographically represent contaminant migration from the 200-UP-1 OU for monitoring purposes (DOE/RL-2016-09, Rev. 0).

After evaluating the contaminants associated with S-SX Tank Farm tanks, ancillary equipment, legacy sources, and contaminated vadose zone, the primary contaminants from the tank wastes that drive human health risk to groundwater for the S-SX Tank and Waste Farms Evaluation Unit are: Tc-99, chromium, and nitrate. Those primary contaminants that may drive risk from groundwater discharge to the Columbia River are nitrate and chromium; however, any impacts are highly uncertain (see Section

[49] Other isotopes considered include U-232 and U-236 and Pu-238, Pu-241, and Pu-242 to be consistent with other EUs. These additional uranium and plutonium isotopes are included in the totals presented but are not used for rating because 1) uranium toxicity impacts (represented by total uranium drives corresponding risks and 2) plutonium has been found relatively immobile in the Hanford subsurface and has not been identified as a risk driver for groundwater impacts.

E.2.1). Cs-137 and Sr-90 are important from a safety standpoint and uranium isotopes, plutonium isotopes, and tritium are iconic constituents; these contaminants are included in the inventory summary even though they are not considered risk drivers for impacts to or from groundwater in this review. Carbon tetrachloride is not a tank waste and is captured in Appendix D.6 for the CP-GW-2 EU (200-UP GWIA).

BRIEF NARRATIVE DESCRIPTION:

Waste Management Area S-SX (WMA S-SX) occupies approximately 15 acres and contains 12 underground single-shell tanks (SSTs) in S Tank Farm and 15 SSTs in SX Tank Farm in additional to ancillary equipment (e.g., diversion boxes, pumps, valves, and pipes). The S Tank Farm was constructed in 1950-1951 and the SX Tank Farm in 1953-1955 (ORP-11242, Rev. 6, p. 3-2). The S-SX Tank Farm tanks received primarily redox wastes and salt and slurry cake from evaporator campaigns (Agnew 1997; Remund et al. 1995).

The S Tank Farm contains 12 carbon steel tanks with capacities of 758 kGal and began receiving REDOX wastes in 1951. Some S Tank Farm tanks began to boil because of the high radioactive decay heat load in the REDOX wastes (Wood et al. 1999). A condenser was added to remove excess liquid from the S Tank Farm tanks, and collected liquids were discharged to cribs. The S Tank Farm tanks received 242-S Evaporator solids after the REDOX Plant was decommissioned. Only one S Tank Farm tank (241-S-104) is classified an assumed leaker (Templeton 2016). The S Tank Farms tanks were removed from service beginning in the late 1970s with completion in the early 1980s.

The SX Tank Farm contains 15 carbon steel tanks with capacities of 1,000 Kgal in additional to ancillary equipment (e.g., diversion boxes, pumps, valves, and pipes). The first six SX Tank Farm tanks began receiving REDOX Plant wastes in 1954 (and are currently at least half full of mostly saltcake and some sludge solids); the remaining nine tanks began receiving REDOX Plant wastes in 1955. Ten SX Tank Farm tanks (241-SX-105 and 241-SX-107 through 241-SX-115) were designed to manage high-boiling REDOX wastes by allowing collecting and returning condensates from evaporated supernate to the tanks; this process helped reduce high heat loads in the tanks (Wood et al. 1999). Eight of the ten SX Tank Farm tanks that operated as “boiling waste tanks” are currently considered assumed leakers (Weyn 2014; Templeton 2016). The SX Tank Farms tanks were removed from service by 1980.

There are various cribs in the area around the S-SX Tank Farms that received large volumes of slightly contaminated waste from Tank Farms and other waste streams (although it appears that tank wastes were not directly cascaded from the S-SX Tank Farm tanks to the cribs). Nine of the SSTs in WMA S-SX are declared “assumed leakers,” and there have been 25 unplanned releases documented in or near WMA S-SX. This information is summarized in Section E.3.3.

The SSTs in WMA S-SX have been interim stabilized (i.e., liquid transferred to DSTs to <50 kgal drainable interstitial liquid and <5 kgal of supernatant), and a groundwater extraction system has been in operation since 2012 to extract Tc-99 and other contaminants.

SUMMARY TABLES OF RISKS AND POTENTIAL IMPACTS TO RECEPTORS

Table E.3-1 provides a summary of nuclear and industrial safety related consequences from CP-TF-2 (S-SX Tank and Waste Farms EU) to humans and impacts to important physical Hanford Site resources. Receptors are described in Section E.1.6 (Appendix E.1).

Table E.3-1. CP-TF-2 (S-SX Tank Farms) impact Rating Summary for Human Health (unmitigated basis with mitigated basis provided in parentheses (e.g., "High (Low)").

Population or Resource		Evaluation Time Period[a] Active Cleanup (to 2064) **Current Condition:** Maintenance & Monitoring (M&M)	 **From Cleanup Actions:** Retrieval & Closure
Human Health	Facility Worker[b]	***M&M***: Low-High[d] (Low-High)[d] ***Soil***: Not Discernible (ND)-High (ND-Low)	***Preferred method***: High (Low) ***Alternative***: High (Low)
	Co-located Person[b]	***M&M***: Low-Moderate (Low) ***Soil***: ND (ND)	***Preferred method***: Low-Moderate (Low) ***Alternative***: Low-Moderate (Low)
	Public[b]	***M&M***: Low (Low) ***Soil***: ND (ND)	***Preferred method***: Low (Low) ***Alternative***: Low (Low)
Environmental	Groundwater (A&B) from vadose zone[c]	*High* -- Cr(tot), Cr-VI *Medium* -- I-129 and Tc-99 *Low* -- C-14 ND -- Sr-90[f] and U(tot)[f] **Overall**: *High*	*High* -- Cr(tot), Cr-VI *Medium* -- I-129 and Tc-99 *Low* -- C-14 ND -- Sr-90[f] and U(tot)[f] **Overall**: *High*
	Columbia River from vadose zone[c]	Benthic: ND Riparian: ND Free-flowing: ND **Overall**: Not Discernible	Benthic: ND Riparian: ND Free-flowing: ND **Overall**: Not Discernible
	Ecological Resources[e]	ND to Low	Low to Medium
Social	Cultural Resources[e]	**Native American:** Direct: Unknown Indirect: Known **Historic Pre-Hanford:** Direct: Known Indirect: Unknown **Manhattan/Cold War:** Direct: Known Indirect: Unknown	**Native American:** Direct: Unknown Indirect: Known **Historic Pre-Hanford:** Direct: Known Indirect: Unknown **Manhattan/Cold War:** Direct: Known Indirect: Unknown

a. A rating for cultural resources is 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.

b. Evaluated in Section E.1.6 (Appendix E.1).

c. Groundwater threat for Group A and B contaminants remaining in the vadose zone or to the Columbia River for all primary contaminants. Threats from existing plumes associated with the S-SX Tank and Waste Farms EU are described in Section E.3.5 and Appendix D.6 (CP-GW-2) for the 200-UP Groundwater Interest Area. Groundwater in the area is being treated using the WMA S-SX groundwater extraction system that has

extracted chromium and Tc-99 (of those PCs in the table related to the CP-TF-2 vadose zone) (DOE/RL-2016-09, Rev. 0); however, groundwater treatment does not impact the vadose zone source or threat.

d. Industrial safety consequences range from low to high (based on the evaluation scale used) for both mitigated (with controls) and unmitigated (without controls). Mitigated radiological and toxicological consequences to facility workers are high (unmitigated) and low (mitigated).

e. 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.

f. The large amount of Sr-90 disposed of in the S-SX Tank and Waste Farms EU would translate to a *Very High* rating; however, there is no current Sr-90 plume in the 200-UP GWIA and it would likely require more than 150 years to reach groundwater in a sufficient amount to exceed the drinking water standard over an appreciable area (Section E.3.5). The total uranium inventory would translate to a *Medium* rating, but also is unexpected to reach groundwater in 150 years. Total uranium and Sr-90 are given *Not Discernible* (*ND*) ratings for the Active Cleanup period and *Low* ratings afterwards to account for uncertainties in the evaluation. Thus total uranium and Sr-90 are not considered risk drivers for the evaluation period.

SUPPORT FOR RISK AND IMPACT RATINGS FOR EACH POPULATION OR RESOURCE

Human Health

The current and cleanup-related consequences related to work being conducted at the Tank Farms in the 200 Areas (Hanford Central Plateau) was evaluated in Section E.1.6 (Appendix E.1).

Groundwater, Vadose Zone, and Columbia River

Current

S-SX Tank Farm contaminants are currently impacting the vadose zone and groundwater (where CP-TF-2 sources are suspected of being able to contribute mobile contaminants to groundwater (DOE/RL-92-16, Rev. 0)) and treatment is not predicted to decrease concentrations to below thresholds before active cleanup commences. Secondary sources (e.g., total and hexavalent chromium) in the vadose also threaten to continue to impact groundwater in the future, including the Active Cleanup period[50]. Note that there are current plumes for total and hexavalent chromium in the 200-UP groundwater interest area (GWIA) (CP-GW-2, Appendix D.6). As described in the TC&WM EIS (and summarized in Section E.3.5), there appears to be insufficient expected impact from radioactive decay (since chromium is risk driver) or recharge rate (due to large amounts of these contaminants already in the groundwater) on peak concentrations in the groundwater or near-shore region of the Columbia River during or after cleanup to modify ratings. Thus the ratings for these receptors are the same as those shown in Table E.3-8.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

See Section E.1.1.

Ecological Resources

Current

There is little habitat in EU (level 2 only), but over 10% in buffer is level 3 resources. Effect is ND in EU, but may be up to Low in buffer due to current truck disturbance.

[50] Note that Sr-90, which has a large vadose zone source, is not considered a significant threat to groundwater due to its limited mobility in the Hanford subsurface. See Section E.3.5 for details.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

Effects due to increased disturbance and potential for contaminant release, increases in exotic species, and could lose some nesting habitat, run over lizards and other wildlife during cleanup.

Cultural Resources

Current

Manhattan Project/Cold War significant resources have already been mitigated. Area is very disturbed and there are no known recorded archaeological resources within the EU. There is evidence of ethno historic and historic land use.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

Because area has not been investigated either on the surface or subsurface, archaeological investigations may need to occur within pockets of undisturbed land if any prior to remediation. Potential for intact archaeological material to be present is very low.

Considerations for Timing of the Cleanup Actions

See Section E.1.1 (Appendix E.1).

Near-Term, Post-Cleanup Risks and Potential Impacts

See Section E.1.1 (Appendix E.1).

E.3.2. ADMINISTRATIVE INFORMATION

OU AND/OR TSDF DESIGNATION(S):

The S-SX Tank and Waste Farms Evaluation Unit (EU), denoted *CP-TF-2 – S-SX Tank Waste and Farms*, consists of 27 waste tanks, ancillary structures, associated liquid waste sites, and soils contamination; much of this EU is contained within Waste Management Area S-SX (WMA S-SX). Waste Management Area (WMA) S-SX is regulated under the Resource Conservation and Recovery Act (RCRA) as modified in 40 CFR Part 265, Subpart F and Washington State's Hazardous Waste Management Act (HWMA, RCW 70.105 and its implementing requirements in the Washington State dangerous waste regulations [WAC 173-303-400]) (Johnson&Chou 1999).

COMMON NAME(S) FOR EU:

There is no common name for the S-SX Tank and Waste Farms EU because the EU is comprised of elements from other waste management units including Waste Management Area S-SX (WMA S-SX) that includes the 241-S (or S) and 241-SX (or SX) Tank Farms.

The S Tank Farm contains 12 waste tanks (S-101 through S-112); these tanks often are designated as 241-S-101 through 241-S-112. The SX Tank Farm contains 15 waste tanks (SX-101 through SX-115); these tanks often are designated as 241-SX-101 through 241-SX-115. Other components in the EU are listed below in the *Primary EU Source Components* section.

KEY WORDS:

S Tank Farm, SX Tank Farm, 241-S Tank Farm, 241-SX Tank Farm, waste tanks, tank farm, Waste Management Area S-SX, WMA S-SX

REGULATORY STATUS

Regulatory Basis

DOE is the responsible agency for the closure of all single-shell tank (SST) waste management areas (WMAs) through post closure, in close coordination with other closure and cleanup activities of the Hanford Central Plateau. Washington State has a program that is authorized under RCRA and implemented through the HWMA and its associated regulations; Ecology is the lead regulatory agency responsible for the closure of the SST system. Please refer to Section E.1.2 (Appendix E.1) for more information.

Applicable Regulatory Documentation

The relationship among the tank waste retrieval work plans (TWRWP) and the overall single-shell tank (SST) waste retrieval and closure process is described in Appendix I of the Hanford Federal Facility Agreement and Consent Order (HFFACO), along with requirements for the content of TWRWPs. WMA S-SX was placed in assessment monitoring (40 CFR 265.93[d][4]) after elevated waste constituents and indicator parameter measurements (specific conductance, chromium, and Tc-99) in downgradient monitoring wells were observed and confirmed (Johnson & Chou 1999). A groundwater quality assessment plan was written (Caggiano 1996) describing the monitoring activities used in deciding whether WMA S-SX has affected groundwater.

Applicable Consent Decree or TPA Milestones

Federal Facility Agreement and Consent Order, 1989 and amended through June 16, 2014: Milestone M-045-00; Lead Agency Ecology: *Complete the closure of all Single Shell Tank Farms by 01/31/2043*

RISK REVIEW EVALUATION INFORMATION

Completed: Revised August 25, 2015

Evaluated by: K. G. Brown

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

E.3.3. SUMMARY DESCRIPTION

CURRENT LAND USE

DOE Hanford Site for industrial use. All current land-use activities in the 200-West Area are *industrial* in nature (EPA 2012).

DESIGNATED FUTURE LAND USE

Industrial-Exclusive. All four land-use scenarios listed in the Comprehensive Land Use Plan (CLUP) indicate that the 200-West Area (of which the S-SX Tank and Waste Farms EU is a part) is denoted *Industrial-Exclusive* (DOE/EIS-0222-F). An industrial-exclusive area is “suitable and desirable for treatment, storage, and disposal of hazardous, dangerous, radioactive, and nonradioactive wastes” (DOE/EIS-0222-F).

PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

The legacy source sites associated with the S-SX Tank and Waste Farms EU are described in Attachment Section E.3.8. The contamination in the legacy source sites (cribs, trenches, and near-tank soil) associated with the S-SX Tank and Waste Farms EU comes from intentional and unintentional discharges of S-SX Tank Farm and other wastes. There are various trenches and cribs in the area around the S-SX Tank Farms; these sources received large volumes of slightly contaminated waste and other waste streams in trenches: 216-S-8 (2.6×10^6 gallons of REDOX waste) and 216-S-23 trench (76×10^6 gallons of evaporator condensate) and cribs: ranging from 216-S-3 (1.1×10^6 gallons of stream condensate) to 216-S-6 ($1{,}200\times10^6$ gallons condenser waste) (Wood et al. 1999). From historic monitoring activities, there is one "assumed leaker" (S-104) in the S Tank Farm and eight (SX-107 through SX-109 and SX-111 through SX-115) "assumed leakers" in the SX Tank Farm (Templeton 2016). Estimates of leaks for the S-SX Tank Farm range from not estimated (SX-114 in 1972) to 500-2000 gallons (SX-111 in 1974) to 24,000 (S-104 in 1968) to 50,000 gallons (SX-115 in 1965). There are also 25 documented unplanned releases in or near WMA S-SX.

Waste Tanks and Ancillary Equipment

The 12 waste tanks in the S Tank and Waste Farms EU are:

- (241-)S-101 (241-S-TK-101)
- (241-)S-102 (241-S-TK-102)
- (241-)S-103 (241-S-TK-103)
- (241-)S-104 (241-S-TK-104)
- (241-)S-105 (241-S-TK-105)
- (241-)S-106 (241-S-TK-106)
- (241-)S-107 (241-S-TK-107)
- (241-)S-108 (241-S-TK-108)
- (241-)T-109 (241-S-TK-109)
- (241-)T-110 (241-S-TK-110)
- (241-)T-111 (241-S-TK-111)
- (241-)T-112 (241-S-TK-112)

The 15 waste tanks in the SX Tank and Waste Farms EU are:

- (241-)SX-101 (241-SX-TK-101)
- (241-)SX-102 (241-SX-TK-102)
- (241-)SX-103 (241-SX-TK-103)
- (241-)SX-104 (241-SX-TK-104)
- (241-)SX-105 (241-SX-TK-105)
- (241-)SX-106 (241-SX-TK-106)
- (241-)SX-107 (241-SX-TK-107)
- (241-)SX-108 (241-SX-TK-108)
- (241-)SX-109 (241-SX-TK-109)
- (241-)SX-110 (241-SX-TK-110)
- (241-)SX-111 (241-SX-TK-111)
- (241-)SX-112 (241-SX-TK-112)
- (241-)SX-113 (241-SX-TK-113)
- (241-)SX-114 (241-SX-TK-114)
- (241-)SX-115 (241-SX-TK-115)

The ancillary equipment included in the S-SX Tank and Waste Farms EU is listed in the Attachment in Section E.3.8 and primarily consists of pipelines, diversion boxes, and catch tanks.

Groundwater Plumes

The S-SX Tank and Waste Farms EU is associated with the 200-UP groundwater interest area (GWIA). The current 200-UP GWIA plumes that exceed water quality standards are carbon tetrachloride (CCl_4), total and hexavalent chromium, nitrate, I-129, Tc-99, tritium, and total uranium (DOE/RL-2016-09, Rev. 0). However, carbon tetrachloride (CCl_4) does not result from tank wastes and is being managed as part of the 200-ZP-1 Operable Unit and 200-ZP GWIA. An interim action pump-and-treat system was in

operation from 1997 until 2012 (when the 200-West P&T Facility started operations). In the 200-UP GWIA, the WMA S-SX groundwater extraction system has been in operation since 2012 to extract Tc-99, nitrate, chromium, and carbon tetrachloride (DOE/RL-97-36); the U Plant P&T System was designed primarily to remediate the uranium plume from the 216-U-1/2 Cribs near U Plant, but the system also removes Tc-99, nitrate, and carbon tetrachloride; and the I-129 Plume Hydraulic Control is containing the I-129 plume while treatment technologies are evaluated (DOE/RL-2016-09, Rev. 0). The final ROD for the 200-UP-1 OU will be pursued when future groundwater impacts are adequately understood and potential technologies to treat I-129 are completed (EPA 2012).

See Appendix D.6 for the CP-GW-2 EU (200-UP GWIA) for additional details.

Operating Facilities

Because of the prohibition on waste additions to the Hanford SSTs,[51] the S-SX Tank and Waste Farms EU components are not considered Operating Facilities for this review. See Section E.1.4 (Appendix E.1) for details.

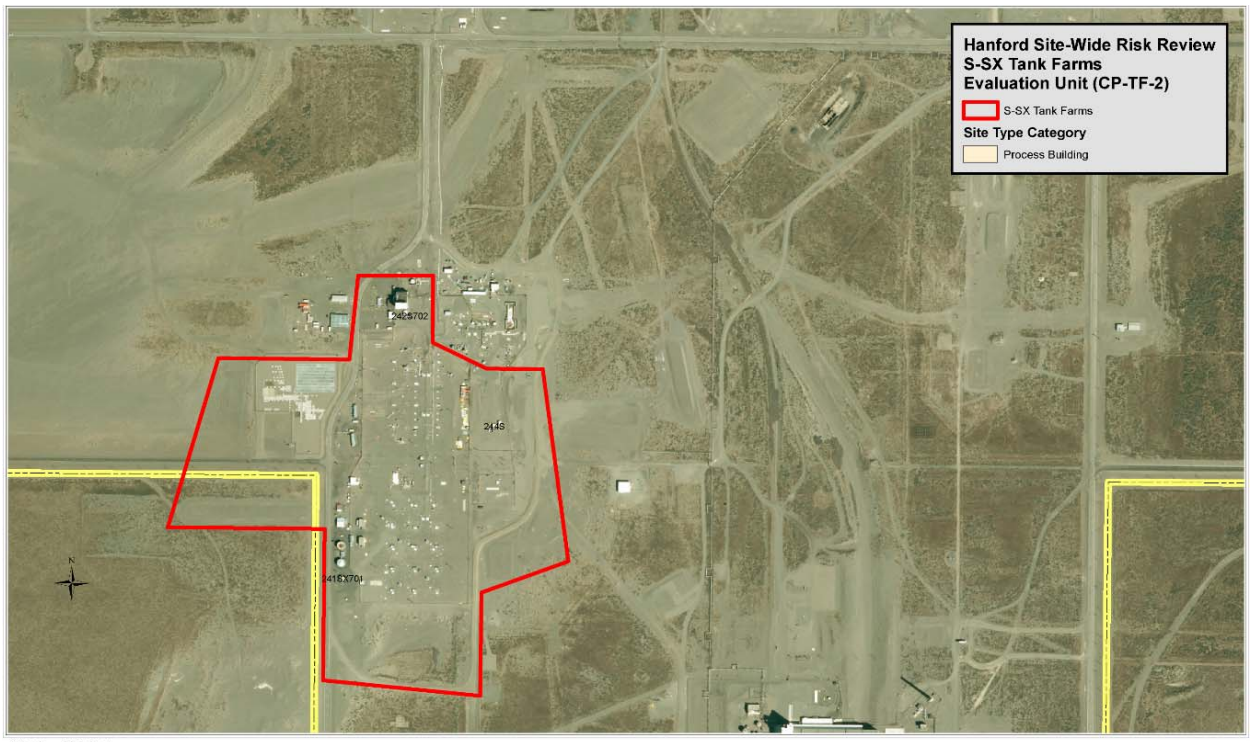
D&D of Inactive Facilities

Not Applicable.

LOCATION AND LAYOUT MAPS

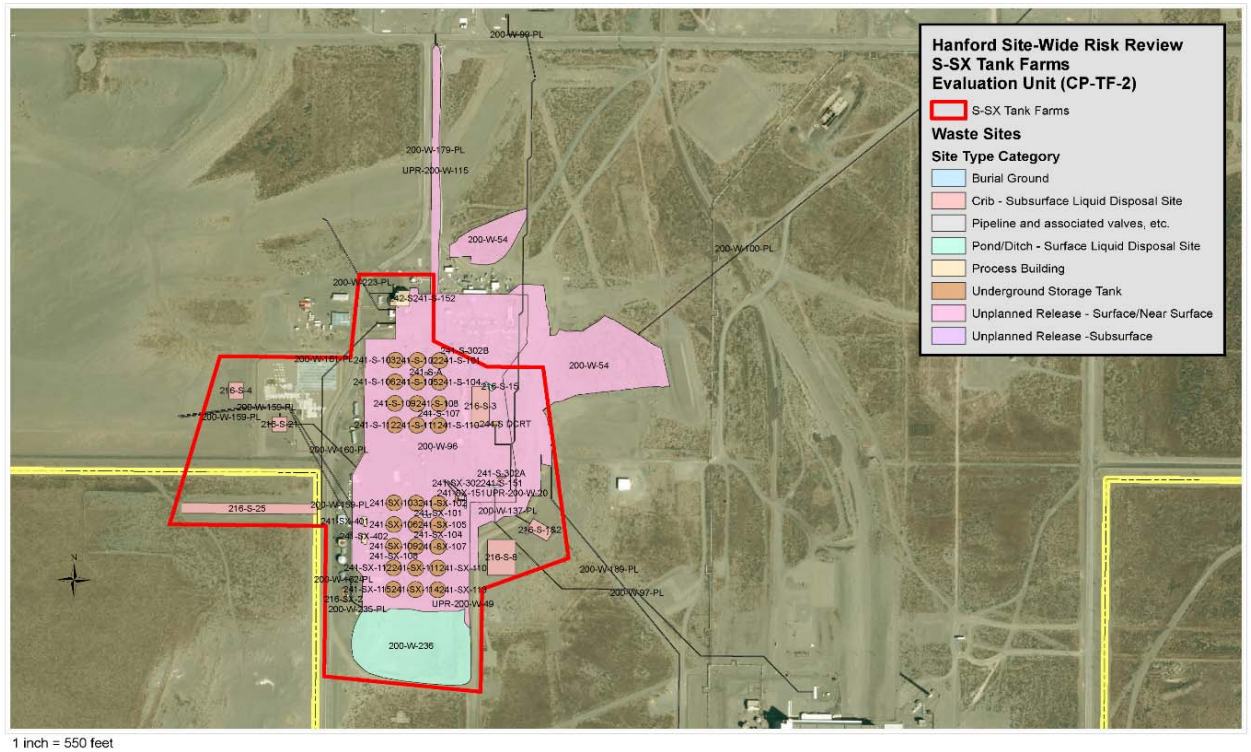
A series of maps are used to illustrate the location of the components within the CP-TF-2 EU and the S-SX Tank and Waste Farms EU relative to the Hanford Site. Figure E.2-1 shows the relationship between the 200-W (200 West) Area (where the S-SX Tank Farms and Waste management Area S-SX are located) and the Hanford Site. Figure E.3-1 illustrates the S-SX Tank and Waste Farms EU boundary. Figure E.3-2 shows a detailed view of the waste tanks, ancillary equipment, and legacy source units in the S-SX Tank and Waste Farms EU.

[51] Berman presentation on July 29, 2009, titled “Hanford Single-Shell Tank Integrity Program.” Available at www.em.doe.gov.



1 inch = 550 feet

Figure E.3-1. Polygon representing the boundary of the S-SX Tank and Waste Farms Evaluation Unit (Attachment Section E.3.8).



1 inch = 550 feet

Figure E.3-2. Hanford S-SX Tank and Waste Farms Evaluation Unit including tanks, legacy source units, and ancillary equipment (Attachment Section E.3.8).

E.3.4. UNIT DESCRIPTION AND HISTORY

EU FORMER / CURRENT USES

Waste Management Area S-SX (WMA S-SX) occupies approximately 15 acres and contains 12 underground single-shell tanks (SSTs) in S Tank Farm and 15 SSTs in SX Tank Farm in additional to ancillary equipment (e.g., diversion boxes, pumps, valves, and pipes). The S Tank Farm was constructed in 1950-1951 and the SX Tank Farm in 1953-1955 (ORP-11242, Rev. 6, p. 3-2). The S-SX Tank Farm tanks received primarily redox wastes and salt and slurry cake from evaporator campaigns (Agnew 1997; Remund et al. 1995). The S Tank Farm began receiving REDOX wastes in 1951 and received 242-S Evaporator solids after the REDOX Plant was decommissioned. The first six SX Tank Farm tanks began receiving REDOX Plant wastes in 1954; the remaining nine tanks began receiving REDOX Plant wastes in 1955. The S and SX Tank Farms tanks were removed from service by 1980. The SSTs in WMA S-SX have been interim stabilized (i.e., liquid transferred to DSTs to <50 kgal drainable interstitial liquid and <5 kgal of supernatant). The S-SX Tank Farm tanks are currently awaiting retrieval and closure.

LEGACY SOURCE SITES

The contamination in the legacy source sites (cribs, trenches, and near-tank soil) associated with the S-SX Tank and Waste Farms EU comes from intentional and unintentional discharges of S-SX Tank Farm and other wastes. There are various trenches and cribs in the area around the S-SX Tank Farms; these legacy source received large volumes of slightly contaminated waste and other waste streams (where the largest include) (Wood et al. 1999):

- 216-S-8 trench (east of WMA SX) received 2.6×10^6 gallons of REDOX waste (including unirradiated uranium) in 1951-52.
- 216-S-23 trench (northeast of S TF) received 76×10^6 gallons of evaporator condensate in 1973-95.
- 216-S-1 crib (east of WMA SX) received 42×10^6 gallons of process condensate in 1952-56.
- 216-S-3 crib (east of WMA SX) received 1.1×10^6 gallons of stream condensate in 1953-56.
- 216-S-5 crib (southwest of WMA SX) received $1{,}100\times10^6$ gallons of stream condensate in 1954-57.
- 216-S-6 crib (southwest of WMA SX) received $1{,}200\times10^6$ gallons condenser waste (REDOX) in 1954-57.
- 216-S-7 crib (east of WMA SX) received 82×10^6 gallons of stream condensate in 1956-65.
- 216-S-9 crib (east of S TF) received 13×10^6 gallons of redistilled process condensate in 1965-75 (replacing 216-S-7 crib).
- 216-S-21 crib (west of S TF) received 23×10^6 gallons of stream condensate in 1954-70.
- 216-S-25 crib (west of S TF) received 76×10^6 gallons of evaporator condensate in 1973-95.
- Nine of the SSTs in WMA S-SX are declared “assumed leakers” with leaks estimates ranging from <5,000 gallons (SX-114 and SX-107) to 50,000 gallons (SX-115 in 1965) (Weyns 2014, pp. 18-22).
- 25 unplanned releases have been documented in or near WMA S-SX.

It appears that tank wastes were not directly cascaded from the S-SX Tank Farm tanks to the cribs.

WASTE TANKS

See Section E.3.3 for details.

GROUNDWATER PLUMES

The 200-UP GWIA Group A and B primary contaminant plumes (Tc-99, I-129, and chromium) considered to be associated with the S-SX Tank Farm and co-located liquid waste disposal facilities are described in detail in Section E.3.5 with additional information in Appendix D.6 for the CP-GW-2 EU (200-UP GWIA). Sites within the CP-TF-2 EU, including 216-S-1/2 and 216-S-25 Cribs, 216-S-3 French drain, and 216-S-8 Trench are suspected of being able to contribute mobile contaminants to the saturated zone (i.e., representing migration of contaminants from the waste site to the uppermost aquifer) (DOE/RL-92-16, Rev. 0, Table 2-2). Note that no source inventory was provided for carbon tetrachloride (CCl_4) (not a tank waste); the CCl_4 plumes near the S-SX Tank and Waste Farms EU are not associated with the S-SX Tank and Waste Farms EU legacy sites (DOE/RL-2016-09, Rev. 0).

D&D OF INACTIVE FACILITIES – NOT APPLICABLE

OPERATING FACILITIES – NOT APPLICABLE

Because of the prohibition on waste additions to the Hanford SSTs,[52] the S-SX Tank and Waste Farms EU components are not considered Operating Facilities for this Review.

ECOLOGICAL RESOURCES SETTING

Landscape Evaluation and Resource Classification:

The amount of each category of biological resources at and near the S-SX Tank and Waste Farms EU was examined within a circular area radiating 623 m from the geometric center of the unit (equivalent to 300.9 acres). The majority of the area within the 47.7 acres of the EU is classified as level 0 (41.2 ac) biological resources, with the remainder classified as level 1 and 2. The adjacent landscape buffer consists primarily of level 0, 1, and 2. Small patches of level 3 resources are located to the north and south of the EU, including several point occurrences of sensitive species (Appendix J, Figure 2, p. J-65). Overall, approximately 5.3 percent of the total combined area currently consists of level 3 or higher biological resources (Appendix J, Table 2, p. J-66 and Figure 2, p. J-65).

Field Survey:

PNNL biologists conducted a reconnaissance and visual survey of the S-SX Tank and Waste Farms EU in October 2014. The major portion of the unit consists of graveled surfaces, buildings, parking areas, and infrastructure related to the tanks. Small areas of remnant shrub-steppe vegetation occur within the EU near the west and south boundaries. The canopy cover was visually evaluated in the field for these patches. In the overstory successional shrub (gray rabbitbrush, *Ericameria nauseosa*) cover was approximately 5%, with mixed native and alien grasses and forbs in the understory (Appendix J, Table 1, p. J-64).

No wildlife were observed within the EU during the October reconnaissance, however, PNNL ECAP surveys conducted in 2009 and 2010 noted the following wildlife: an American kestrel (*Falco sparverius*) apparently nesting in a building at the north end of the EU, loggerhead shrike (*Lanius ludovicianus*),

[52] Berman presentation on July 29, 2009, titled "Hanford Single-Shell Tank Integrity Program." Available at www.em.doe.gov.

Say's phoebe (*Sayornis saya*), barn swallow (*Hirundo rustica*), white-crowned sparrow (*Zonotrichia leucophrys*), western meadowlark (*Sturnella neglecta*), and black-tailed jackrabbit (*Lepus californicus*). All the bird species noted are protected by the Migratory Bird Treaty Act and, additionally, the loggerhead shrike is listed as a Washington State Species of Concern. The black-tailed jackrabbit is listed as a Washington State Candidate Species.

CULTURAL RESOURCES SETTING

Cultural resources known to be recorded within the S-SX Tank Farms EU are limited to one National Register-eligible building; the 242S Evaporator Facility, associated with the Manhattan Project/Cold War Era Landscape with no documentation required. All have been documented as described in the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan* (DOE/RL-97-56).

Much of the S-SX Tank and Waste Farms EU has not been inventoried for archaeological resources with the exception of a very small area with negative findings. Closure and remediation of the tank farms located within the S-SX Tank and Waste Farms EU has been addressed in an NHPA Section 106 review completed. There are no archaeological sites or TCPs known to have been recorded or identified within the S-SX Tank and Waste Farms EU. Although unlikely given the presence of heavy disturbance, there is a possibility 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), particularly if undisturbed soil deposits exist within the S-SX Tank and Waste Farms EU.

One isolated archaeological find associated with the Pre-Hanford Early Settlers/Farming Landscape has been identified within 500 meters of the S-SX Tank and Waste Farms EU. Additionally, the National Register-eligible Hanford Site Plant Railroad and the 272S Maintenance Shop both of which are associated with the Manhattan Project and Cold War Era landscape with documentation required are located within 500 meters of the S-SX Tank and Waste Farms EU. Both have been documented as described in the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan* (DOE/RL-97-56).

Historic maps indicate that there is no evidence of historic settlement in or near the S-SX Tank and Waste Farms EU. Geomorphology and extensive ground disturbance further indicates a low potential for the presence of intact archaeological sites associated with all three landscapes to be present subsurface within the S-SX Tank and Waste Farms EU. Because none of the S-SX Tank and Waste Farms EU has been investigated for archaeological sites and pockets of undisturbed soil may exist, it may be appropriate to conduct 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 associated with these landscapes (e.g. East Benton Historical Society, the Franklin County Historical Society, Prosser Cemetery Association, the Reach and B-Reactor Museum Association) may need to occur. Indirect effects are always possible when TCPs are known to be located in the general vicinity. 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.

E.3.5. WASTE AND CONTAMINATION INVENTORY

Table E.3-2 provides inventory estimates of the various source components associated with the S-SX Tank and Waste Farms EU including tank wastes and ancillary equipment, legacy sources including leaks, cribs, trenches, unplanned releases (UPRs), vadose zone sources, saturated zone (plume) estimates,

treatment amounts, and remaining vadose zone estimates (i.e., the difference of the vadose zone estimates and the saturated zone and treatment estimates)[53]. This information is further summarized in Figure E.3-3 through Figure E.3-11 before and after planned 99% retrieval[54].

For example, the major sources for Tc-99 and I-129 before retrieval are the S-SX Tank Farm tanks with leaks from these tanks being a distant second. The maximum groundwater threat metric (GTM) (Figure E.3-12)[55] is dominated by the S-SX Tank Farm wastes before retrieval and by tank wastes, leaks and cribs after planned retrieval. After planned retrieval, leaks and ancillary equipment dominate the S-SX Tank and Waste Farms EU legacy sources for Tc-99. After planned retrieval, cribs and leaks dominate the S-SX Tank and Waste Farms EU legacy sources for I-129. The tritium inventory, both pre- and post-retrieval, is dominated by cribs with a minor contribution from historic leaks. For chromium and nitrate, tank wastes and trenches are major sources before retrieval. After retrieval, trenches and past leaks dominate the chromium legacy sources whereas trenches and cribs dominate the legacy sources for nitrate. Current uranium, Sr-90, Cs-137, and plutonium isotope inventories in the S-SX Tank and Waste Farms EU tend to be dominated by the tank wastes; whereas post-retrieval legacy zone inventories are dominated by cribs and past leaks (uranium), ancillary equipment and past leaks (Sr-90), past leaks and ancillary equipment (Cs-137), and cribs and ancillary equipment (plutonium isotopes).

CONTAMINATION WITHIN PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

The estimated S-SX Tank Farm inventory for the Legacy / Vadose Zone Source Sites (i.e., cribs, trenches, and soil contaminated by tank leaks and unplanned releases) is summarized in Table E.3-2 and further described in Figure E.3-3 through Figure E.3-11 before and after planned 99% retrieval (which will have no impact on the legacy source site inventories). These values constitute estimates of the initial amounts of contaminants discharged to the vadose zone that are then used to estimate the remaining inventory in the vadose zone as described below (i.e., by difference using the process described in Chapter 6 of the Methodology Report (CRESP 2015a) as revised for the 2015 groundwater monitoring results (DOE/RL-2016-09, Rev. 0) as described in Appendix D.1). These estimates necessarily have large associated uncertainties.

Waste Tanks and Ancillary Equipment

The estimated total inventory for all the S-SX Tank Farm High Level Waste Tanks and Ancillary Equipment is provided in Table E.3-2 for both the 90% and planned 99% retrieval scenarios. The tank-by-

[53] The basis for the saturated and vadose zone estimates are provided in Chapter 6 of the Methodology Report (CRESP 2015a) and examples are provided in the demonstration section for the 200-UP-1 Operable Unit. These estimates tend to have very high associated uncertainties.

[54] According to the Tri-Party Agreement (Ecology, EPA, and DOE, 1998), retrieval limits for residual wastes are 360 ft^3 and 30 ft^3 for 100-Series and 200-Series tanks, respectively, corresponding to the 99% waste retrieval goal as defined in TPA Milestone M-45-00. For purposes of this Review the 99% and 90% Retrieval Scenarios reflect assumptions described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 and apply only to tank volumes and inventories. They are calculated assuming retrieval of a fully mixed tank of homogeneous composition. For tanks that have been declared "Retrieval Completed" or "Retrieved to Limit of … Technologies" (Templeton, AM 2016, page 9, partially duplicated in Table E.1-7), no further retrieval for either the 99% or 90% retrieval scenario is assumed. This includes tank 241-S-112 and all C Tank Farm tanks except 241-C-105. For tanks that are currently undergoing retrieval (tanks 241-AY-102 and 241-C-105), a retrieval amount equivalent to the 99% and 90% retrieval volumes described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 are calculated.

[55] Maximum of the GTMs for Tc-99 and I-129 only.

tank inventories are provided in Table E.3-3 through Table E.3-6. Safety-related information (i.e., hydrogen generation rates and times to the lower flammability limit are also provided in Table E.3-3. The inventories for the various contaminant in the S-SX Tank Farm tanks vary over several orders of magnitude as does the GTM. This information is further summarized in Figure E.3-3 through Figure E.3-11 before and after planned 99% retrieval and for the maximum GTM in Figure E.3-12.

Vadose Zone Contamination

The estimated inventories for the vadose zone, saturated zone, and treatment amounts are found in Table E.3-7. These inventories represent the vadose zone contamination *outside* the tanks and ancillary equipment (i.e., that are generally available for transport through the environment). These inventories are used to estimate the inventory remaining in the vadose zone using the process described in Chapter 6 of the Methodology Report (CRESP 2015a) as modified for the 2015 groundwater results (Appendix D.1). The focus in this section will be on the Group A and B contaminants in the vadose zone due to their mobility and persistence and potential threats to groundwater. To summarize (DOE/RL-2016-09, Rev. 0):

- *Uranium* – There is a current uranium plume; however, this plume is not associated with Tank Farm operations. The vadose zone inventory is dominated by past leaks and ancillary equipment. Furthermore, uranium would not be expected to significantly move through the environment in the next 150 years (using an analysis similar to that for uranium in Section E.2.5). Thus uranium is not considered a significant threat to the Hanford groundwater.
- *Tc-99* – There are current Tc-99 plumes in the 200-UP GWIA; some of these are attributed to a past leak from tank SX-115 and an overfill event related to tank S-104. The vadose zone inventory is dominated by leaks and cribs.
- *Sr-90* – There is no current plume for Sr-90. The vadose zone inventory is dominated by past leaks and ancillary equipment. Thus the majority of the Sr-90 originally discharged into the vadose zone would have had to travel through much of the vadose zone to impact groundwater. Using an analysis similar to that in Section E.2.5 for Sr-90 in the WMA T (200-West), a Sr-90 plume is not expected in the next 150 years due to retardation in the vadose zone or after due to radioactive decay (+97% reduction in Sr-90 inventory). Thus Sr-90 is not considered a significant threat to the Hanford groundwater.
- *I-129* – There is a small current plume for I-129 that is associated with the SX Tank Farm. The vadose zone inventory is dominated by cribs and leaks.
- *Chromium* – There are current plumes for chromium near the S-SX Tank and Waste Farms EU that are considered associated with this EU. The vadose zone inventory is dominated by trenches and past leaks.

Using the process outlined in Chapter 6 of the Methodology Report (CRESP 2015a) as revised for the 2015 groundwater monitoring results (Appendix D.1), the remaining vadose zone inventories in Table E.3-2 are estimated by difference and used to calculate Groundwater Threat Metric (GTM) values for the Group A and B contaminants remaining in the vadose zone as illustrated in Table E.3-7. The resulting vadose zone (VZ) ratings are *ND* for total uranium and Sr-90[56], *Low* for C-14, *Medium* for Tc-99 and I-

[56] The remaining vadose zone inventories for uranium and Sr-90 would translate to *Medium* and *Very High* ratings, respectively, if they were considered mobile. However, no appreciable Sr-90 or uranium plume would be expected in the next 150 years due to transport considerations (Section E.2.5); however, uranium may impact groundwater after the 150-year period. Thus *Low* ratings are applied to the period after the Active Cleanup period to account for uncertainties in the evaluation.

129, and *High* for chromium (total and hexavalent). The overall current rating would be *High* related to chromium (total and hexavalent) in the vadose zone.

Groundwater Plumes

Legacy waste sites within the CP-TF-2 EU are suspected of be able to contribute mobile contaminants to the saturated zone (DOE/RL-92-16, Rev. 0) and 200-UP plumes have been linked to CP-TF-2 sources (DOE/RL-2016-09, Rev. 0). In general groundwater plumes are evaluated in separate EUs; however, those portions of groundwater plumes that can be associated with the TF EU (i.e., a plume with sources associated with the TF EU) will be evaluated to provide a better idea of the saturated zone versus remaining vadose zone threats to groundwater. The estimated inventory for the saturated zone contamination is provided in Table E.3-2 where Photoshop was used to estimate the fraction of the plumes considered associated with the S-SX Tank and Waste Farms EU (Attachment 6-4 in the Methodology Report (CRESP 2015a) as revised for the 2015 groundwater results (Appendix D.1))[57]. This information is also used to estimate amounts treated and remaining in the vadose zone. For the groundwater plumes described in the 200-UP GWIA (DOE/RL-2016-09, Rev. 0), apportionment of the Group A and B primary contaminant plumes to the S-SX Tank and Waste Farms EU is as follows:

- *Uranium* -- There is a plume in the OU, but no major sources related to the waste tanks; thus there is no portion of the uranium plume considered associated with the S-SX Tank and Waste Farms EU.
- *Chromium* – There are plumes in the OU; the plumes near the S-SX Tank and Waste Farms EU are considered associated with the EU. Total plume areas in the 200-UP GWIA and those considered associated with the plume near the S-SX Tank and Waste Farms EU for both total chromium (above 100 µg/L) and hexavalent chromium (above 48 µg/L) were estimated . The small area of the plume considered associated with the S-SX Tank and Waste Farms EU was estimated at less than 1% of the total (Appendix D.1) and was assumed to describe both total chromium and hexavalent chromium contributions.
- *Tc-99* – There are plumes in the OU; the single plume near the S-SX Tank and Waste Farms EU is considered associated with the EU, and the area of this plume is 62% of the area (Appendix D.1).
- *I-129* – There are plumes in the OU; the major plumes in the 200-UP-1 OU primarily originated from U Plant and REDOX Plant waste sites. There is a small plume interpreted to occur beneath the SX Tank Farm; the likely source is the SX Tank Farm. The contribution is less than 1% and considered insignificant for this study (Appendix D.1).
- *Carbon tetrachloride* – The carbon tetrachloride plume is managed in the 200-ZP GWIA (Appendix D.6). Furthermore, there are no sources of carbon tetrachloride related to this EU.

The Group A and B groundwater plumes (e.g., Tc-99, I-129, and chromium) associated with the S-SX Tank Farm and co-located liquid waste disposal facilities are described in detail in Appendix D.6 for the CP-GW-2 EU (200-UP GWIA). Note that nitrate, tritium, hexavalent chromium, and I-129 (*Medium*) are the current risk drivers for the 200-UP GWIA; however, there are no *major* S-SX TF EU sources

[57] From the graphic map files provided by PNNL, the Photoshop Magic Wand Tool was used to select areas representing plumes and then the "Record Measurements" Tool was used to provide relative areal extents (CRESP 2015a). A Custom Measurement Scale was set to that of the map.

associated with these plumes (i.e., less than 1% of the total plume areas for the risk drivers[58]), and the remaining vadose zone sources would drive the risks associated with the S-SX TF EU.

Impact of Recharge Rate and Radioactive Decay on Groundwater Ratings

The TC&WM EIS screening groundwater transport analysis (Appendix O, DOE/EIS-0391 2012) indicates that there is an impact of emplacing the engineered surface barrier (and resulting reduction of infiltrating water) on the predicted peak groundwater concentrations at the S Barrier; however, the impact does not result in peak concentrations below thresholds[59]. This result is likely due to the significant amounts of contaminants already in the groundwater and not due to an ineffective surface barrier. To summarize, the results for all Central Plateau sources (Appendix O, DOE/EIS-0391 2012) include:

- Tc-99 peak concentration is 22,800 pCi/L (CY 3072) for the No Action Alternative versus 1,510 pCi/L (CY 2051) for the Landfill Scenarios where the threshold value is 900 pCi/L.
- I-129 peak concentration is 29.1 pCi/L (CY 3136) for the No Action Alternative versus 2.8 pCi/L (CY 2050) for the Landfill Scenarios versus a threshold value of 1 pCi/L.
- Chromium peak concentration is 541 µg/L (CY 3242) for the No Action Alternative versus 156 µg/L (CY 2050) for the Landfill Scenarios versus a threshold value of 100 µg/L (total) or 48 µg/L (hexavalent).
- Uranium peak concentration is 41 µg/L (CY 11,778) for the No Action Alternative versus 0 µg/L (CY 11,850) for the Landfill Scenarios versus a threshold value of 30 µg/L.
- No values are reported at the S Barrier for Sr-90 or carbon tetrachloride (CCl_4) for either scenario, which indicates that the appropriate sources were not considered in the analysis (e.g., for carbon tetrachloride) or peak fluxes that were less than 1×10^{-8} Ci/yr for Sr-90 (Appendix O, DOE/EIS-0391 2012, p. O-2).

Despite the large impacts on the predicted peak concentrations, these peak values at the S Barrier still exceed threshold values within 50 years and thus the saturated and vadose ratings will not be altered even though predicted impacts due to barrier emplacement may be large[60].

Columbia River

The process illustrated in Chapter 6 of the Methodology Report (CRESP 2015a) as revised for the 2015 groundwater and Columbia River monitoring results (Appendix D.1) is used to evaluate potential impacts to the Columbia River. Note that the evaluation of potential benthic and riparian impacts has a common thread up to the point when the shoreline impact (benthic) or riparian zone impact area is used to define ratings. Thus a common evaluation for the benthic and riparian zone is performed here.

[58] S-SX TF EU sources account for over 60% of the Tc-99 plume area (Appendix D.1); however, Tc-99 is not a risk driver for the 200-UP GWIA (Appendix D.6).

[59] The barrier represents the edge of the infiltration barrier to be constructed over disposal areas that are within 100 meters [110 yards] of facility fence lines (DOE/EIS-0391 2012). The S Barrier is the closest to the S-SX Tank and Waste Farms EU. Despite including sources other than those for the S-SX Tank and Waste Farms EU, the analysis in the TC&WM EIS was considered a reasonable source of information to assess the potential impact of the engineered surface barrier emplacement.

[60] Analyses specific to each Tank Farm or Central Plateau EU are not available; thus the aggregate screening analysis provided in the TC&WM EIS was used as an indication.

Benthic and Riparian Zone – Current Impacts

Based on the information in the 2013 Hanford Annual Groundwater Report (DOE/RL-2016-09, Rev. 0) and HEIS (http://ehs.hanford.gov/eda/), even though 200-UP GWIA contaminants are in the saturated zone, no plumes from the 200-UP GWIA are currently intersecting the Columbia River at concentrations exceeding the WQS. Thus current impacts from the S-SX Tank and Waste Farms EU to the Columbia River benthic and riparian ecology would be rated as *Not Discernible*.

Benthic and Riparian Zone – Active Cleanup and Near-term, Post Cleanup

Based on a similar analysis to that in Section E.2.5 for CP-TF-1 (T Tank and Waste Farms EU also in 200-West), the impacts to the Columbia River benthic and riparian ecology for the Active Cleanup and Near-term, Post Cleanup periods are also rated as *Not Discernible*.

Benthic and Riparian Zone – Long-term

As described in Section E.2.5, the ecological screening analysis performed in the TC&WM EIS (Appendix P, DOE/EIS-0391 2012) to evaluate potential long-term impacts of radioactive and chemical contaminants indicated that there should be no expected adverse effects from radionuclides for Columbia River benthic and riparian receptors over the time period evaluated (10,000 years).

The corresponding evaluation in the TC&WM EIS for potential impacts of chemical contaminants discharged with groundwater to the near-river ecology (benthic and riparian) suggest that only chromium and nitrate would be *predicted* to exceed thresholds. However, the screening results indicate that future nitrate peak concentration (and discharge) appear to not exceed either the drinking water standard or ambient water quality criterion in the next 10,000 years. Furthermore, because of the long travel time of water from 200-West (200-UP GWIA) to the River relative to that from 200-East to the Columbia River, it is unlikely that 200-West sources (including the S-SX Tank and Waste Farms EU) would present any threat to the Columbia River, which would likely lead to insignificant impacts to the benthic and riparian ecology from S-SX sources. Additional details are provided in Section E.2.5.

Threats to the Columbia River Free-flowing Ecology

As described in Section E.2.5, the large dilution effect of the Columbia River on the contamination from the seeps and groundwater upwellings results in *Not Discernible* ratings for the Active Cleanup and Near-term, Post Cleanup periods and insignificant long-term impacts to the free-flowing ecology for all contaminants.

Potential Impact of Recharge Rate on Threats to the Columbia River

Finally, the No Action Alternative evaluation in the TC&WM EIS suggests that remedial actions (e.g., surface barrier emplacement that would decrease recharge in the areas near the Tank Farms) appear to not have significant impacts on the long-term peak concentrations in the near-shore area (benthic and riparian receptors) of the Columbia River. This result is likely not due to ineffectiveness of the barrier but instead due to large amounts of contaminant already in the groundwater. Thus ratings are not changed based on the remedial actions assumed in the TC&WM EIS.

Facilities for D&D – Not Applicable

Operating Facilities – Not Applicable

Because of the prohibition on waste additions to the Hanford SSTs,[61] the S-SX Tank and Waste Farms EU components are not considered Operating Facilities for this Review.

[61] Berman presentation on July 29, 2009, titled "Hanford Single-Shell Tank Integrity Program." Available at www.em.doe.gov.

Table E.3-2. Summary Table of Infrastructure and Subsurface Contamination Inventory for the S-SX Tank and Waste Farms Evaluation Unit (CP-TF-2) [a,b]

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[d]	99% Retrieval Scenario[d]
Infrastructure (Tanks and Ancillary Equipment)				
Tank Waste	Waste (kGal)	7394	739.4	73.94
	Sludge (kGal)	1996	199.6	19.96
	Saltcake (kGal)	5395	539.5	53.95
	Supernatant (kGal)	3	0.3	0.03
Tank Waste (rad)	Am-241 (Ci)	10000	1000	100
	C-14 (Ci)	110	11	1.1
	Co-60 (Ci)	190	19	1.9
	Cs-137 (Ci)	3500000	350000	35000
	Eu-152 (Ci)	66	6.6	0.66
	Eu-154 (Ci)	3000	300	30
	H-3 (Ci)	590	59	5.9
	I-129 (Ci)	3.7	0.37	0.037
	Ni-59 (Ci)	180	18	1.9
	Ni-63 (Ci)	16000	1600	160
	Pu (total) (Ci)	15000	1500	150
	Sr-90 (Ci)	12000000	1200000	120000
	Tc-99 (Ci)	3600	360	36
	U (total) (Ci)	66	6.6	0.66
Tank Waste (non-rad)	Cr (kg)	200000	20000	2000
	Hg (kg)	380	38	3.8
	NO3 (kg)	13000000	1300000	130000
	Pb (kg)	3200	320	33
	U (total) (kg)	82000	8200	820
Ancillary Equipment (rad)	C-14 (Ci)	3.7	3.7	3.7
	Cs-137 (Ci)	27000	27000	27000

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[(d)]	99% Retrieval Scenario[(d)]
	H-3 (Ci)	16	16	16
	I-129 (Ci)	0.044	0.044	0.044
	Pu (total) (Ci)	65	65	65
	Sr-90 (Ci)	44000	44000	44000
	Tc-99 (Ci)	22	22	22
	U (total) (Ci)	0.38	0.38	0.38
Ancillary Equipment (non-rad)	Cr (kg)	1100	1100	1100
	Hg (kg)	1.2	1.2	1.2
	NO3 (kg)	84000	84000	84000
	Pb (kg)	20	20	20
	U (total) (kg)	400	400	400
Vadose Zone Source (Leaks and Intentional Discharges into Cribs and Trenches)				
Leaks (rad)	C-14 (Ci)	5.3	5.3	5.3
	Cs-137 (Ci)	140000	140000	140000
	H-3 (Ci)	100	100	100
	I-129 (Ci)	0.078	0.078	0.078
	Pu (total) (Ci)	9.9	9.9	9.9
	Sr-90 (Ci)	27000	27000	27000
	Tc-99 (Ci)	41	41	41
	U (total) (Ci)	0.5	0.5	0.5
Leaks (non-rad)	Cr (kg)	4700	4700	4700
	Hg (kg)	0.1	0.1	0.1
	NO3 (kg)	140000	140000	140000
	Pb (kg)	68	68	68
	U (total) (kg)	670	670	670
Cribs (rad)	Am-241 (Ci)	24	24	24
	C-14 (Ci)	0.0094	0.0094	0.0094
	Co-60 (Ci)	0.056	0.056	0.056
	Cs-137 (Ci)	1500	1500	1500
	Eu-152 (Ci)	0.023	0.023	0.023
	Eu-154 (Ci)	2.9	2.9	2.9
	H-3 (Ci)	8900	8900	8900

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[(d)]	99% Retrieval Scenario[(d)]
	I-129 (Ci)	0.14	0.14	0.14
	Ni-59 (Ci)	0.0016	0.0016	0.0016
	Ni-63 (Ci)	0.15	0.15	0.15
	Pu (total) (Ci)	140	140	140
	Sr-90 (Ci)	970	970	970
	Tc-99 (Ci)	2.8	2.8	2.8
	U (total) (Ci)	1.5	1.5	1.5
Cribs (non-rad)	Cr (kg)	190	190	190
	Hg (kg)	7.4	7.4	7.4
	NO3 (kg)	430000	430000	430000
	Pb (kg)	10	10	10
	U (total) (kg)	2200	2200	2200
Trenches (rad)	U (total) (Ci)	0.21	0.21	0.21
Trenches (non-rad)	Cr (kg)	29000	29000	29000
	Hg (kg)	3.2	3.2	3.2
	NO3 (kg)	1400000	1400000	1400000
	U (total) (kg)	310	310	310
Pond (rad)	Co-60 (Ci)	8.30E-09	8.30E-09	8.30E-09
	Cs-137 (Ci)	4.40E-09	4.40E-09	4.40E-09
	H-3 (Ci)	0.29	0.29	0.29
	Pu (total) (Ci)	1.00E-05	1.00E-05	1.00E-05
	Sr-90 (Ci)	1.80E-09	1.80E-09	1.80E-09
	U (total) (Ci)	2.10E-09	2.10E-09	2.10E-09
Pond (non-rad)	Cr (kg)	0.005	0.005	0.005
	Hg (kg)	0.0002	0.0002	0.0002
	NO3 (kg)	0.0052	0.0052	0.0052
	Pb (kg)	5.30E-05	5.30E-05	5.30E-05
	U (total) (kg)	3.00E-06	3.00E-06	3.00E-06
UPR (rad)	Co-60 (Ci)	9.10E-10	9.10E-10	9.10E-10
	Cs-137 (Ci)	4.90E-10	4.90E-10	4.90E-10
	H-3 (Ci)	0.032	0.032	0.032
	Pu (total) (Ci)	1.80E-06	1.80E-06	1.80E-06

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[(d)]	99% Retrieval Scenario[(d)]
	Sr-90 (Ci)	2.00E-10	2.00E-10	2.00E-10
	U (total) (Ci)	2.80E-10	2.80E-10	2.80E-10
UPR (non-rad)	Cr (kg)	0.00056	0.00056	0.00056
	Hg (kg)	2.20E-05	2.20E-05	2.20E-05
	NO3 (kg)	0.00057	0.00057	0.00057
	Pb (kg)	5.90E-06	5.90E-06	5.90E-06
	U (total) (kg)	3.30E-07	3.30E-07	3.30E-07
Vadose Zone (from Vadose Zone Sources)				
VZ Remaining (rad)	Am-241 (Ci)	24	24	24
	C-14 (Ci)	5.4	5.4	5.4
	Co-60 (Ci)	0.056	0.056	0.056
	Cs-137 (Ci)	140000	140000	140000
	Eu-152 (Ci)	0.023	0.023	0.023
	Eu-154 (Ci)	2.9	2.9	2.9
	H-3 (Ci)	9000	9000	9000
	I-129 (Ci)	0.21	0.21	0.21
	Ni-59 (Ci)	0.0016	0.0016	0.0016
	Ni-63 (Ci)	0.15	0.15	0.15
	Pu (total) (Ci)	150	150	150
	Sr-90 (Ci)	28000	28000	28000
	Tc-99 (Ci)	37	37	37
	U (total) (Ci)	2.2	2.2	2.2
VZ Remaining (non-rad)	Cr (kg)	34000	34000	34000
	Cr-VI (kg)	34000	34000	34000
	Hg (kg)	11	11	11
	NO3 (kg)	1900000	1900000	1900000
	Pb (kg)	79	79	79
	U (total) (kg)	3200	3200	3200
VZ Treatment (rad)	Tc-99 (Ci)	2.8	2.8	2.8
VZ Treatment (non-rad)	Cr (kg)	0.16	0.16	0.16
	Cr-VI (kg)	0.16	0.16	0.16
	NO3 (kg)	2100	2100	2100

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[(d)]	99% Retrieval Scenario[(d)]
Saturated Zone (from Vadose Zone Sources)				
SZ Inventory (rad)	I-129 (Ci)	6.6E-05	6.6E-05	6.6E-05
	Tc-99 (Ci)	4.5	4.5	4.5
SZ Inventory (non-rad)	Cr (kg)	2.6	2.6	2.6
	Cr-VI (kg)	15	15	15
	NO3 (kg)	92000	92000	92000

a. Tanks (SST and DST): Best Basis Inventory (BBI) February 2017; Ancillary Equipment (Anc Eq): Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix D; Unplanned Releases (UPRs): Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0); Ponds: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0); Cribs: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0); Trenches: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0) and Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix S; Leaks: Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix D; MUSTs: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0) and Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix S.

b. All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

c. Differences in inventories for Cr vs Cr-IV are due to differing Water Quality Standards (WQS) and thus plume extents: 100 mg/L for total chromium vs 48 mg/L for chromium (VI). The difference is not distinguishable within the number of significant digits (2) displayed.

d. 99% and 90% Retrieval Scenarios reflect assumptions described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 and apply only to tank volumes and inventories. They are calculated assuming retrieval of a fully mixed tank of homogeneous composition. For tanks that have been declared “Retrieval Completed” or “Retrieved to Limit of … Technologies” (Templeton, AM 2016, page 9, partially duplicated in Table E.1-7), no further retrieval for either the 99% or 90% retrieval scenario is assumed. This includes tank 241-S-112 and all C Tank Farm tanks except 241-C-105. For tanks that are currently undergoing retrieval (tanks 241-AY-102 and 241-C-105), a retrieval amount equivalent to the 99% and 90% retrieval volumes described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 are calculated.

Table E.3-3. Current Bulk Inventory and Steady State Flammability Results (by Tank) for the S-SX Tank Farm (CP-TF-2)

Tank ID	Tank Type	Capacity (kGal)[a]	Sludge (kGal)[a]	Saltcake (kGal)[a]	Supernatant (kGal)[a]	HGR (ft^3/d)[b]	Days to 25% LFL Barometric[c]	Days to 25% LFL Zero Ventilation[d]
S-101	SST	758	235	117	0	1.3	NA	641
S-102	SST	758	22	69	2	0.95	NA	1087
S-103	SST	758	9	227	1	0.9	NA	1090
S-104	SST	758	132	156	0	0.81	NA	1151
S-105	SST	758	2	404	0	0.55	NA	1487
S-106	SST	758	0	455	0	0.74	NA	995
S-107	SST	758	320	39	0	0.98	NA	852
S-108	SST	758	5	536	0	0.6	NA	1056
S-109	SST	758	13	520	0	0.61	NA	1080
S-110	SST	758	96	293	0	0.86	NA	930
S-111	SST	758	72	329	0	0.93	NA	772
S-112	SST	758	2	0	0	0.78	NA	1710
SX-101	SST	1000	144	276	0	0.98	NA	NA
SX-102	SST	1000	55	287	0	1.7	NA	NA
SX-103	SST	1000	78	431	0	6.2	234	NA
SX-104	SST	1000	136	310	0	2.8	NA	NA
SX-105	SST	1000	63	312	0	6.6	273	NA
SX-106	SST	1000	0	399	0	0.87	NA	NA
SX-107	SST	1000	96	0	0	1.9	NA	NA
SX-108	SST	1000	74	0	0	0.69	NA	NA
SX-109	SST	1000	66	175	0	6.1	479	NA
SX-110	SST	1000	49	9	0	2.7	NA	NA
SX-111	SST	1000	97	20	0	3.5	NA	NA
SX-112	SST	1000	77	0	0	1.3	NA	NA
SX-113	SST	1000	22	0	0	0.33	NA	NA
SX-114	SST	1000	127	31	0	3.8	NA	NA

Tank ID	Tank Type	Capacity (kGal)[a]	Sludge (kGal)[a]	Saltcake (kGal)[a]	Supernatant (kGal)[a]	HGR (ft^3/d)[b]	Days to 25% LFL Barometric[c]	Days to 25% LFL Zero Ventilation[d]
SX-115	SST	1000	4	0	0	0.44	NA	NA

a. Volumes from the Waste Tank Summary Report for Month Ending November 30, 2016 (Templeton, AM 2016).

b. Hydrogen generation rate (ft^3/d) (RPP-5926 Rev. 17). Note in 2001 all 24 tanks were removed from the flammable gas watch list (including T-110 in the T Tank and Waste Farms EU) (Johnson, et al. 2001, p. iii).

c. Time (in days) to 25% of the Lower Flammability Limit (LFL) under a barometric (barom) breathing scenario (RPP-5926, Rev. 17). "NA" indicates that the headspace will not reach specified flammability level.

d. Time (in days) to 25% of the LFL under a zero ventilation scenario (RPP-5926, Rev. 17).

Table E.3-4. Current Primary Contaminant Inventory (by Tank) for the S-SX Tank Farm (CP-TF-2) [(a)]

Tank ID	Baseline Status[(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)
S-101	2001	220	3.3	NR[(c)]	6.2	220000	1.5	65	36
S-102	2001	44	1.6	NR	0.41	42000	0.74	5.2	5.4
S-103	2001	140	3.8	NR	7.5	180000	1.6	95	11
S-104	2001	200	1.8	NR	2.7	71000	1.1	59	8.3
S-105	2001	7.8	10	NR	11	79000	1.8	110	29
S-106	2001	58	8.5	NR	15	250000	1.5	90	24
S-107	2001	750	2.5	NR	56	150000	0.31	33	120
S-108	2001	220	8.9	NR	6.0	240000	1.1	52	17
S-109	2001	38	13	NR	15	40000	2.3	91	38
S-110	2001	300	6.9	NR	8.9	160000	1.2	72	29
S-111	2001	27	4.5	NR	2.9	150000	0.55	26	12
S-112	2001	0.013	0.0011	NR	0.0069	2.9	0.0018	0.097	0.0013
SX-101	2001	510	5.1	NR	8.8	240000	2.5	150	43
SX-102	2001	230	4.6	NR	2.9	210000	0.70	34	12
SX-103	2001	720	8.4	NR	15	380000	1.6	96	32
SX-104	2001	360	6.0	NR	10	230000	1.4	80	31
SX-105	2001	600	5.3	NR	9.3	200000	3.3	180	21
SX-106	2001	480	6.5	NR	4.8	220000	2.6	130	12
SX-107	2001	570	0.44	NR	0.27	41000	4.2	180	9.8
SX-108	2001	720	0.43	NR	0.72	75000	6.1	180	15
SX-109	2001	460	2.3	NR	1.8	97000	4.1	180	29
SX-110	2001	710	0.26	NR	0.40	34000	6.4	280	12
SX-111	2001	860	0.56	NR	0.53	53000	7.2	310	16
SX-112	2001	610	0.32	NR	0.29	36000	5.0	210	10
SX-113	2001	10	0.10	NR	0.020	1500	0.0094	0.42	0.81
SX-114	2001	830	0.91	NR	0.68	71000	6.4	280	18

Tank ID	Baseline Status[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)
SX-115	2001	380	0.015	NR	2.4	420	0.60	54	1.0

a. From Best Basis Inventory (BBI) Summary (February 2017). All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

b. This is the "Baseline Status" date as reported in the BBI (February 2017) as "Baselined 2001." It should not be necessarily be considered the decay date for isotope inventories.

C. NR = Not reported for this EU

Table E.3-5. Current Primary Contaminant Inventory[(a)] and Groundwater Threat Metric (by Tank) for the S-SX Tank Farm (CP-TF-2)

Tank ID	I-129 (Ci)	Ni-59 (Ci)	Ni-63 (Ci)	Pu (total) (Ci)[(b)]	Sr-90 (Ci)	Tc-99 (Ci)	U (total) (Ci)[(c)]	GTM (Mm3)[(d)]
S-101	0.12	5.9	530	570	410000	110	7.3	120
S-102	0.046	1.3	120	63	57000	20	3.4	22
S-103	0.16	3.1	280	210	38000	170	0.85	190
S-104	0.084	5.4	480	660	350000	51	3.9	57
S-105	0.33	13	1100	17	5900	350	0.73	390
S-106	0.27	11	950	43	33000	290	0.83	320
S-107	0.036	8.1	720	2600	280000	31	12	34
S-108	0.29	11	960	160	48000	310	2.0	340
S-109	0.40	16	1500	85	45000	420	0.52	460
S-110	0.23	9.8	880	560	210000	240	4.8	260
S-111	0.16	6.6	560	24	260000	170	0.49	190
S-112	0.00034	0.061	0.061	0.038	49	0.14	0.00013	0.15
SX-101	0.20	9.9	880	870	270000	160	4.0	180
SX-102	0.16	7.0	590	210	120000	160	1.2	180
SX-103	0.28	12	1100	500	470000	280	1.8	310
SX-104	0.22	11	950	870	370000	210	4.0	230
SX-105	0.19	8.4	760	1200	530000	200	1.4	220
SX-106	0.23	2.6	230	580	19000	240	1.0	260
SX-107	0.022	4.4	370	600	980000	14	2.3	16
SX-108	0.022	4.3	380	1300	1.2E+06	14	1.9	15
SX-109	0.12	8.9	760	510	680000	78	1.8	86
SX-110	0.025	4.6	390	410	1.3E+06	16	1.3	18
SX-111	0.036	6.3	540	680	1.5E+06	23	2.4	26
SX-112	0.021	4.3	360	510	1.1E+06	13	1.9	15
SX-113	0.0028	0.063	5.2	7.2	2000	1.8	0.0088	2.0
SX-114	0.049	7.0	590	810	1.4E+06	31	3.0	35

Tank ID	I-129 (Ci)	Ni-59 (Ci)	Ni-63 (Ci)	Pu (total) (Ci)[b]	Sr-90 (Ci)	Tc-99 (Ci)	U (total) (Ci)[c]	GTM (Mm3)[d]
SX-115	0.0018	0.41	35	930	270000	1.2	0.12	1.3

a. From Best Basis Inventory (BBI) Summary (February 2017). All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

b. Sum of plutonium isotopes 238, 239, 240, 241, and 242

c. Sum of uranium isotopes 232, 233, 234, 235, 236, and 238

d. The Groundwater Threat Metric (GTM) shown for tanks is equal to the maximum of the GTM for Tc-99 and I-129.

Table E.3-6. Current Primary Contaminant Inventory (by Tank) for the S-SX Tank Farm (CP-TF-2) [(a)]

Tank ID	CCl4 (kg)	CN (kg)	Cr (kg)	Cr-VI (kg)	Hg (kg)	NO3 (kg)	Pb (kg)	TBP (kg)	TCE (kg)	U (total) (kg)
S-101	NR[(b)]	NR	14000	NR	16	310000	120	NR	NR	9800
S-102	NR	NR	1500	NR	3.7	120000	41	NR	NR	4600
S-103	NR	NR	5700	NR	2.4	360000	130	NR	NR	780
S-104	NR	NR	4100	NR	0.23	390000	31	NR	NR	5700
S-105	NR	NR	2400	NR	3.6	1.4E+06	190	NR	NR	600
S-106	NR	NR	16000	NR	2.7	980000	190	NR	NR	650
S-107	NR	NR	9000	NR	19	140000	310	NR	NR	17000
S-108	NR	NR	15000	NR	3.7	900000	270	NR	NR	1600
S-109	NR	NR	5400	NR	6.4	1.7E+06	200	NR	NR	600
S-110	NR	NR	13000	NR	14	910000	110	NR	NR	6400
S-111	NR	NR	9400	NR	10	430000	80	NR	NR	420
S-112	NR	NR	18	NR	0.00069	0.34	1.1	NR	NR	0.19
SX-101	NR	NR	27000	NR	26	780000	160	NR	NR	4100
SX-102	NR	NR	11000	NR	18	430000	130	NR	NR	1000
SX-103	NR	NR	16000	NR	17	990000	290	NR	NR	1700
SX-104	NR	NR	12000	NR	26	710000	210	NR	NR	5200
SX-105	NR	NR	7500	NR	16	480000	190	NR	NR	1500
SX-106	NR	NR	9800	NR	0.81	470000	200	NR	NR	730
SX-107	NR	NR	1900	NR	27	72000	43	NR	NR	3100
SX-108	NR	NR	4500	NR	26	180000	120	NR	NR	2600
SX-109	NR	NR	8500	NR	21	560000	45	NR	NR	2400
SX-110	NR	NR	1400	NR	24	64000	22	NR	NR	1600
SX-111	NR	NR	2500	NR	34	120000	44	NR	NR	3200
SX-112	NR	NR	1500	NR	25	58000	34	NR	NR	2500
SX-113	NR	NR	5.8	NR	0.39	9900	0.63	NR	NR	13
SX-114	NR	NR	3600	NR	37	170000	59	NR	NR	4100

Tank ID	CCl4 (kg)	CN (kg)	Cr (kg)	Cr-VI (kg)	Hg (kg)	NO3 (kg)	Pb (kg)	TBP (kg)	TCE (kg)	U (total) (kg)
SX-115	NR	NR	91	NR	2.2	3500	2.0	NR	NR	150

a. From Best Basis Inventory (BBI) Summary (February 2017). All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

b. NR = Not reported for this EU

Table E.3-7. Summary of the Evaluation of Current Threats to Groundwater as a Protected Resource from Remaining Vadose Zone (VZ) Contamination associated with the S-SX Tank and Waste Farms Evaluation Unit (CP-TF-2)

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 Remain $M^{Tot\ (d)}$	VZ GTM (Mm^3)	VZ Rating[e]
C-14	A	2000 pCi/L	0.23	0	1.84	5.35E+00 Ci	---	---	5.35E+00 Ci	2.68E+00	*Low*
I-129	A	1 pCi/L	0.23	0.2	1.84	2.15E-01 Ci	6.56E-05 Ci	---	2.14E-01 Ci	8.25E+01	*Medium*
Sr-90	B	8 pCi/L	0.23	22	1.84	2.84E+04 Ci	---	---	2.84E+04 Ci	2.00E+04	*ND*[f]
Tc-99	A	900 pCi/L	0.23	0	1.84	4.42E+01 Ci	4.48E+00 Ci	2.84E+00 Ci	3.69E+01 Ci	4.10E+01	*Medium*
CCl_4[g]	A	5 µg/L	0.23	0	1.84	---	---	---	---	---	*ND*
Cr	B	100 µg/L	0.23	0	1.84	3.36E+04 kg	2.60E+00 kg	1.63E-01 kg	3.36E+04 kg	3.36E+02	*High*
Cr-VI	A	48 µg/L[b]	0.23	0	1.84	3.36E+04 kg	1.53E+01 kg	1.63E-01 kg	3.36E+04 kg	7.01E+02	*High*
TCE	B	5 µg/L	0.23	2	1.84	---	---	---	---	---	*ND*
U(tot)	B	30 µg/L	0.23	0.8	1.84	3.20E+03 kg	---	---	3.20E+03 kg	1.44E+01	*ND*[f]

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

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). The WMA S-SX Groundwater Extraction System is treating contaminants in the area, including chromium and Tc-99.

d. The remaining vadose zone inventory is estimated by difference (CRESP 2015a; Appendix D.1) and thus has a high associated uncertainty.

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

f. As discussed in Section E.2.5, no appreciable total uranium or Sr-90 plume would be expected in the next 150 years due to transport and decay (Sr-90) considerations. Thus the *Low* rating would apply to the period *after* the Active Cleanup is complete to account for uncertainties.

g. Carbon tetrachloride is managed in the 200-ZP GWIA (Appendix D.6 for CP-GW-2).

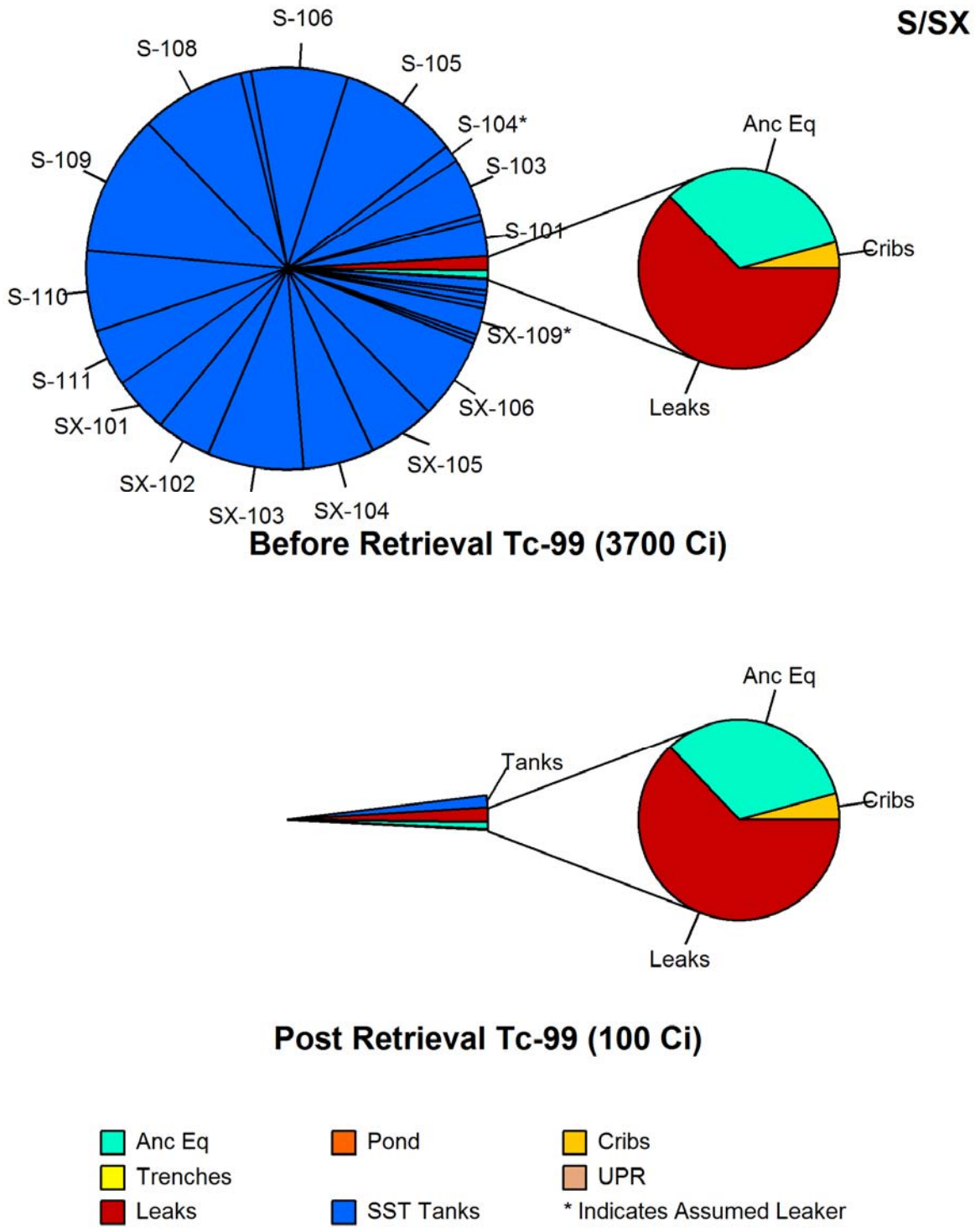


Figure E.3-3. S-SX Tank and Waste Farms Evaluation Unit Inventory Estimates for Tc-99 Before and After 99% Retrieval

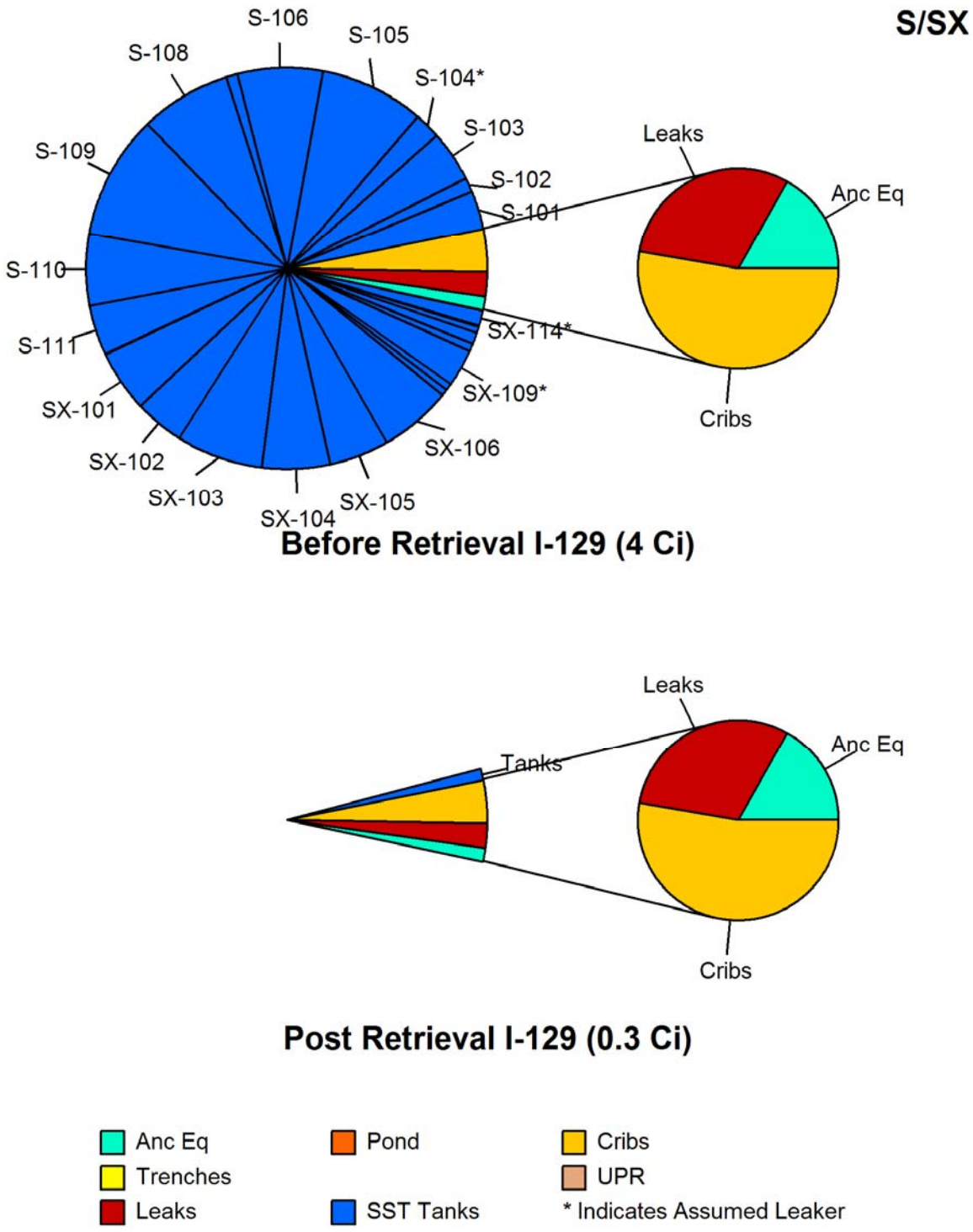


Figure E.3-4. S-SX Tank and Waste Farms Evaluation Unit Inventory Estimates for I-129 Before and After 99% Retrieval

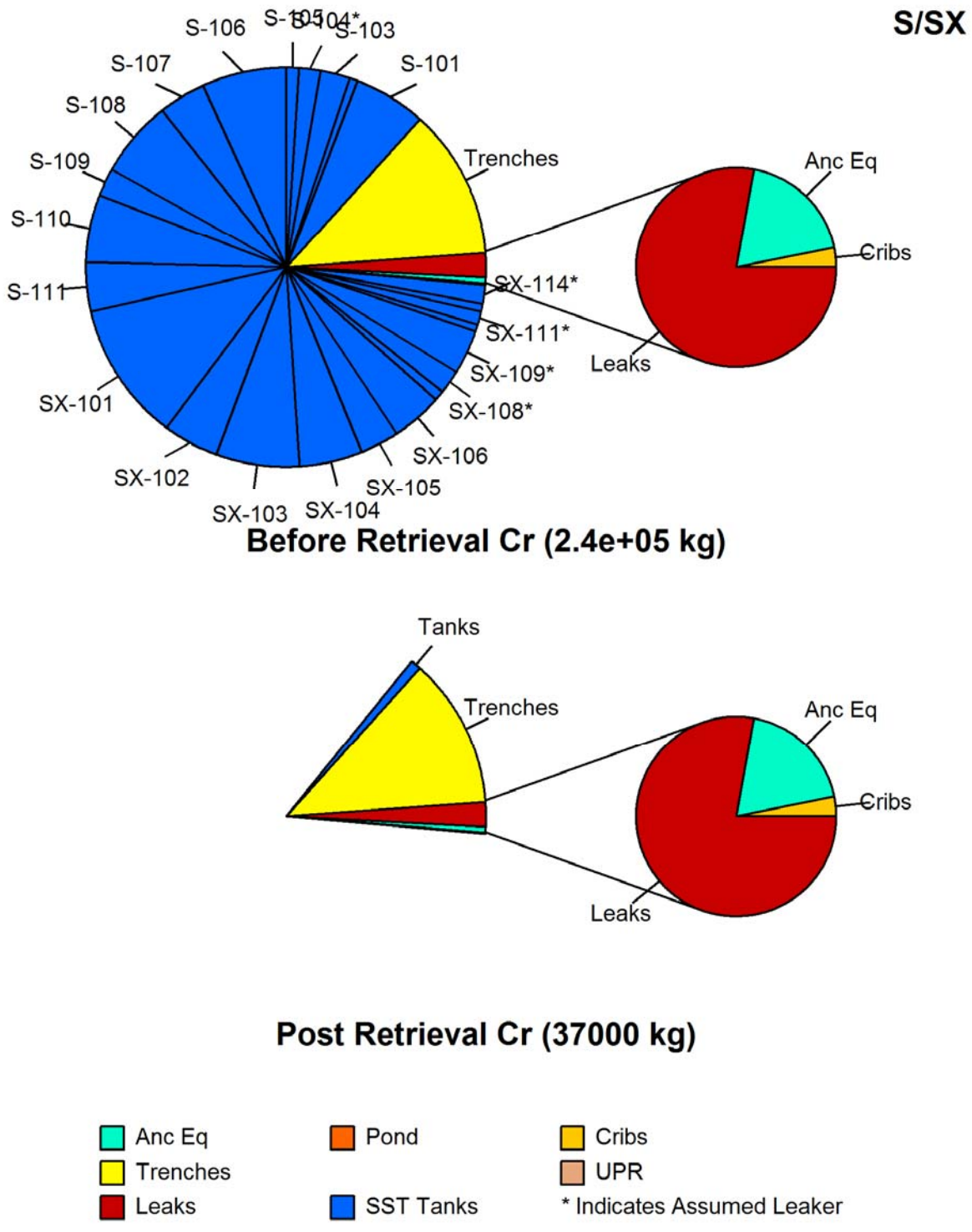


Figure E.3-5. S-SX Tank and Waste Farms Evaluation Unit Inventory Estimates for Chromium Before and After 99% Retrieval

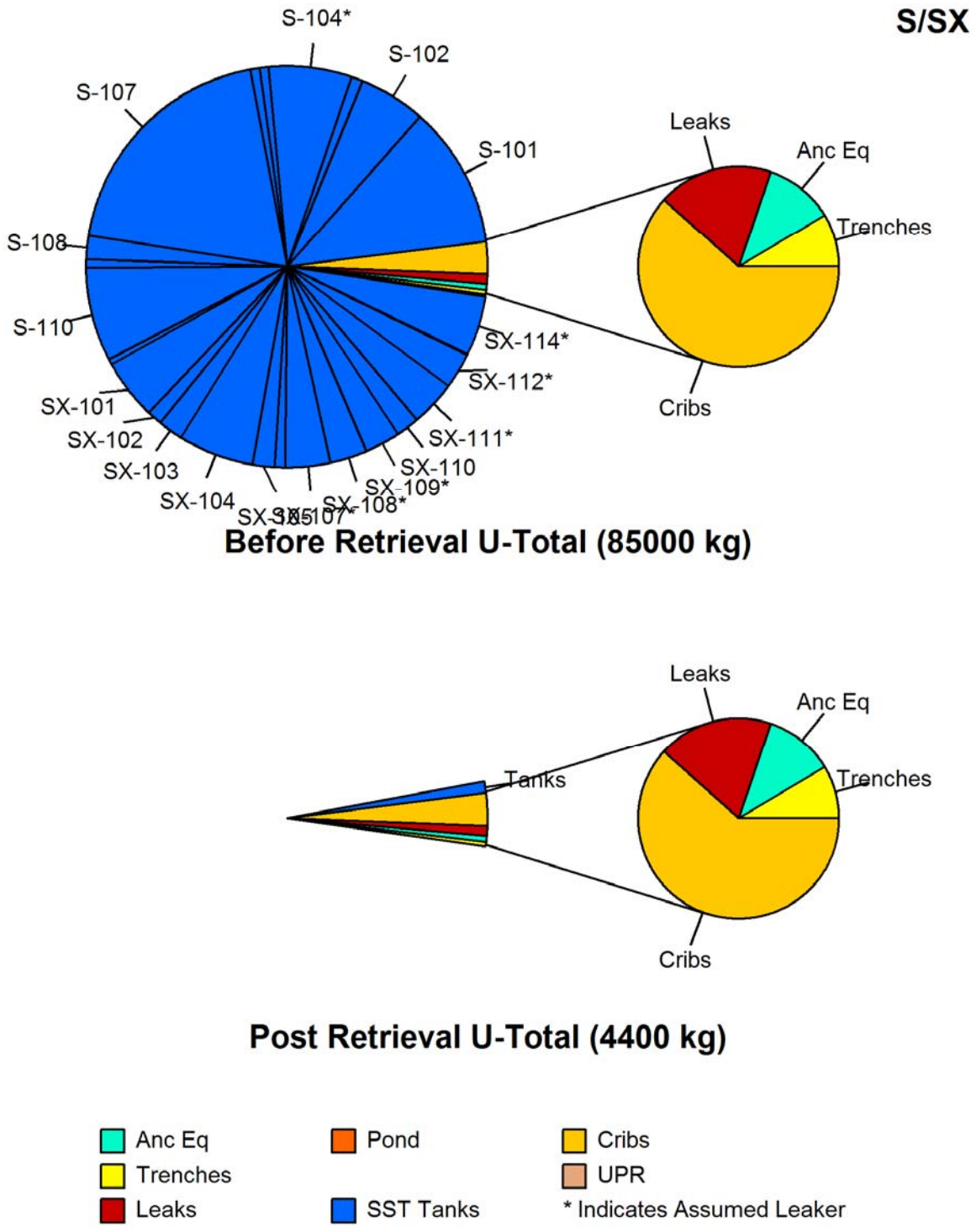


Figure E.3-6. S-SX Tank and Waste Farms Evaluation Unit Inventory Estimates for U(tot) Before and After 99% Retrieval

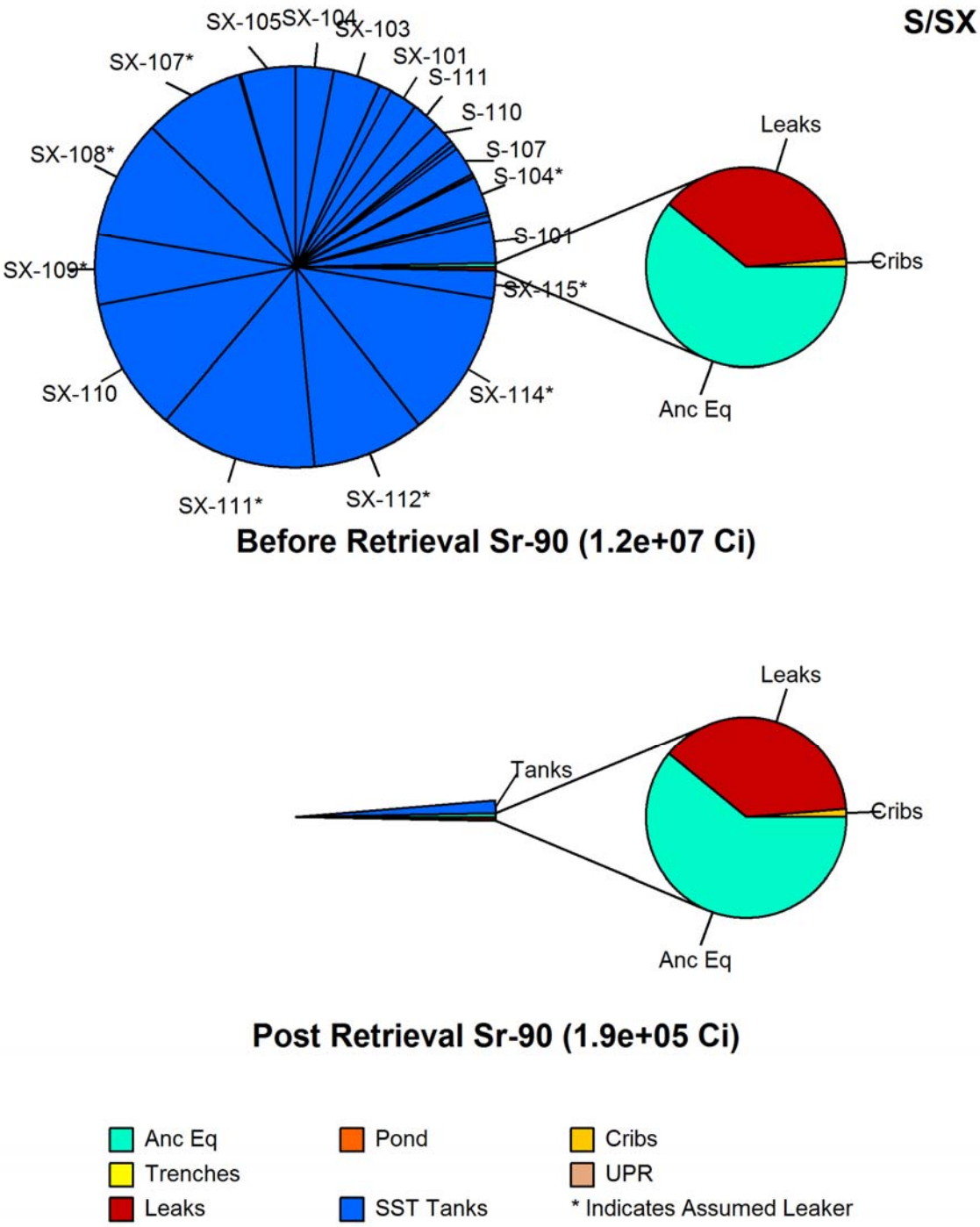


Figure E.3-7. S-SX Tank and Waste Farms Evaluation Unit Inventory Estimates for Sr-90 Before and After 99% Retrieval

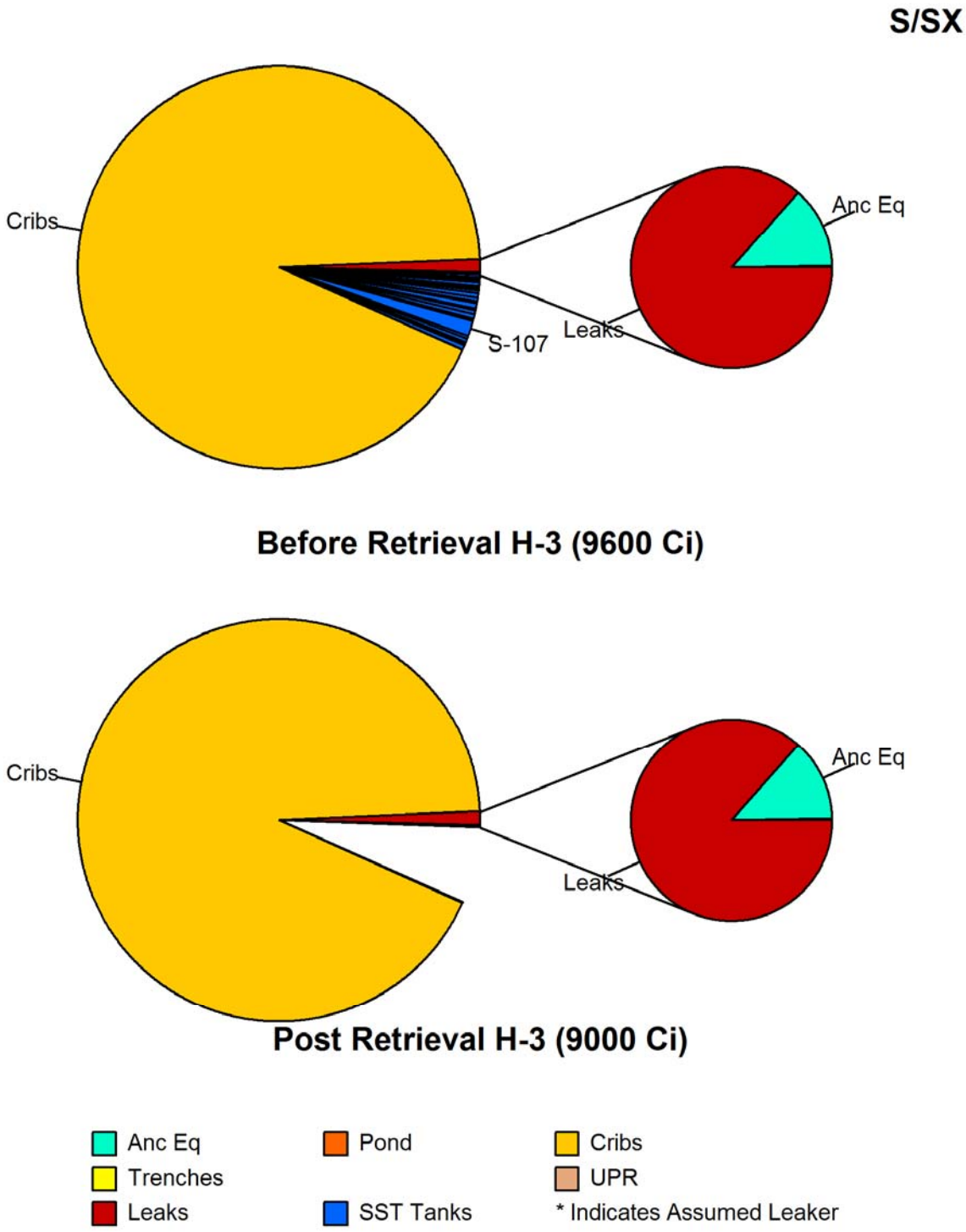


Figure E.3-8. S-SX Tank and Waste Farms Evaluation Unit Inventory Estimates for Tritium (H-3) Before and After 99% Retrieval

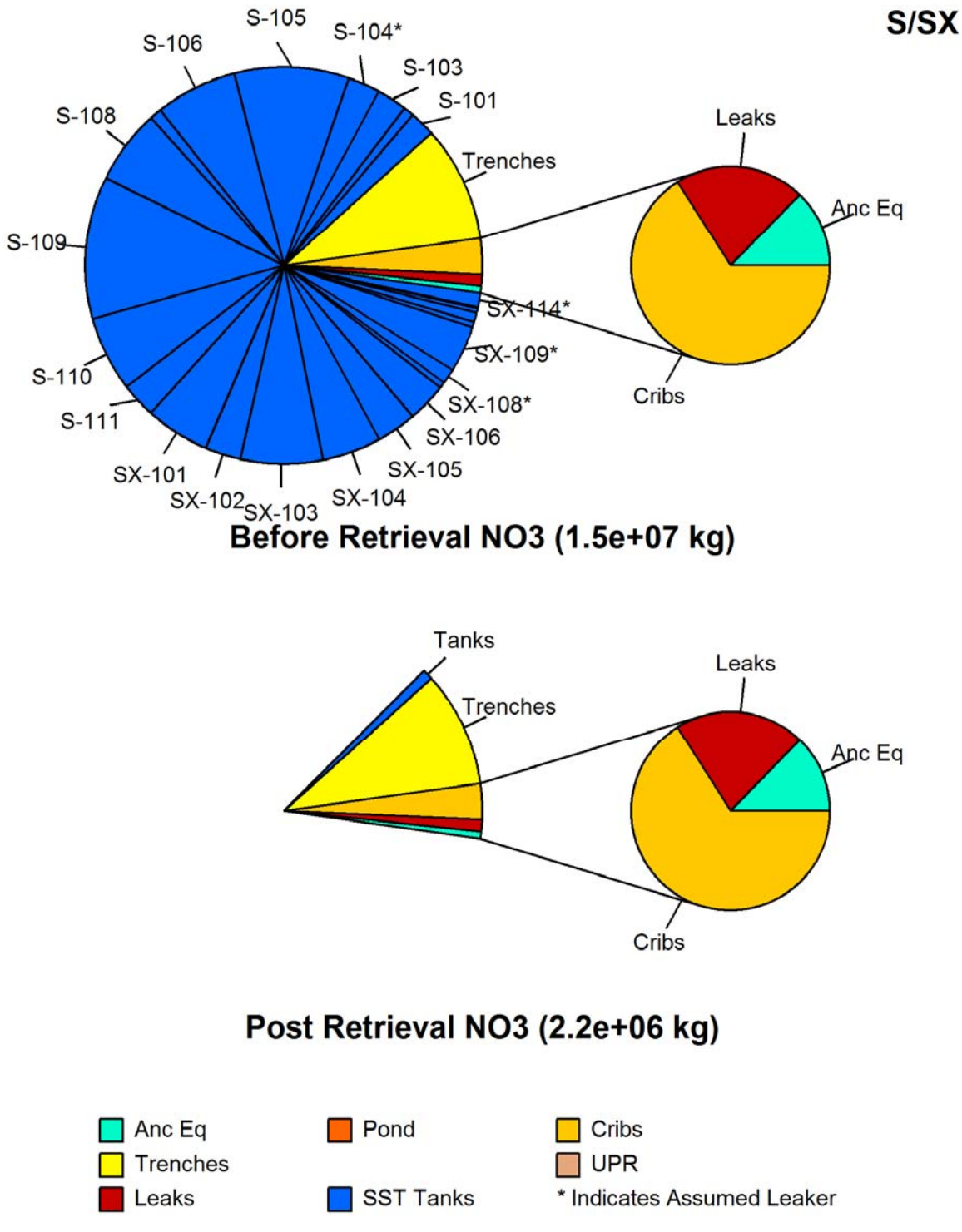


Figure E.3-9. S-SX Tank and Waste Farms Evaluation Unit Inventory Estimates for Nitrate (NO3) Before and After 99% Retrieval

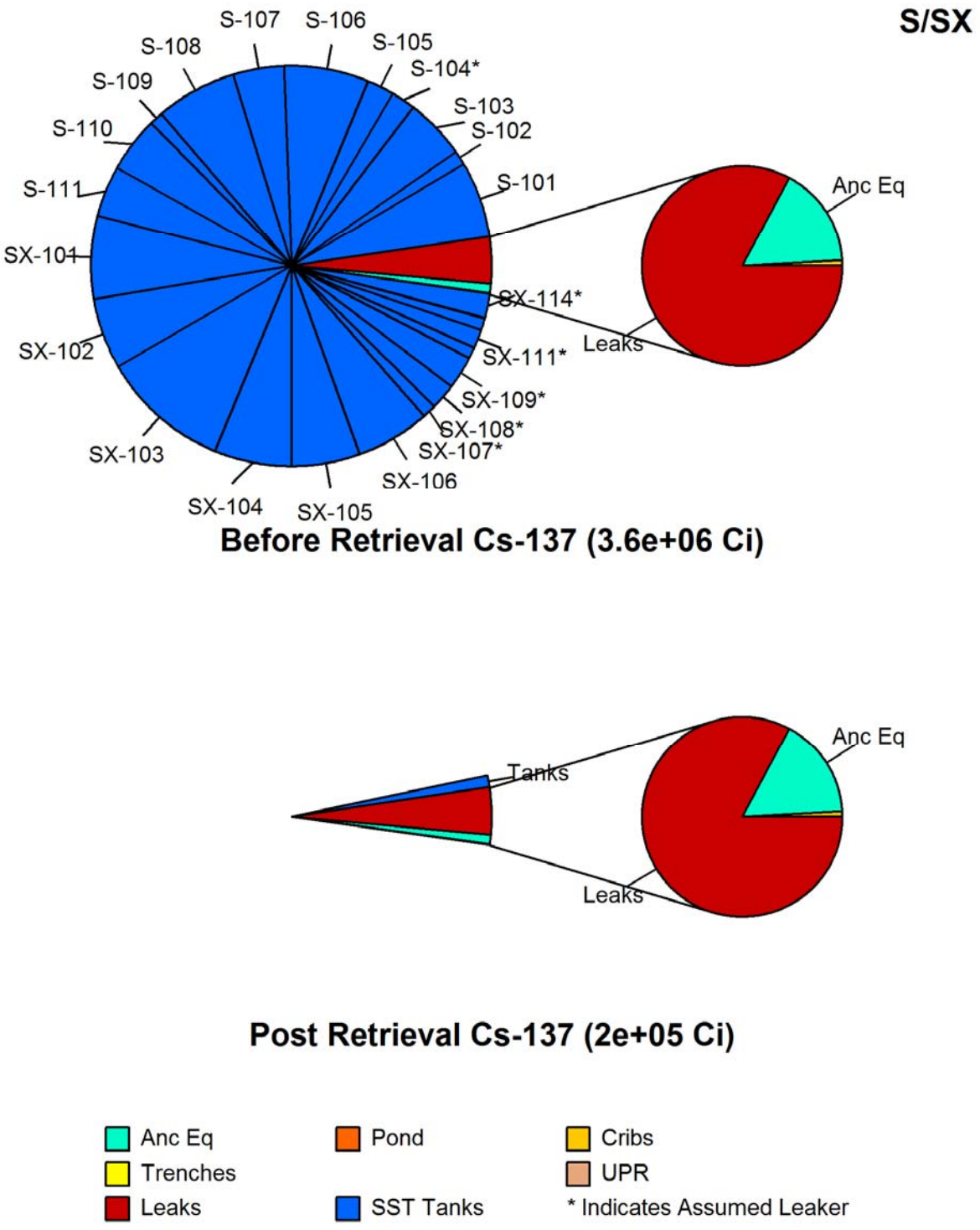


Figure E.3-10. S-SX Tank and Waste Farms Evaluation Unit Inventory Estimates for Cs-137 Before and After 99% Retrieval

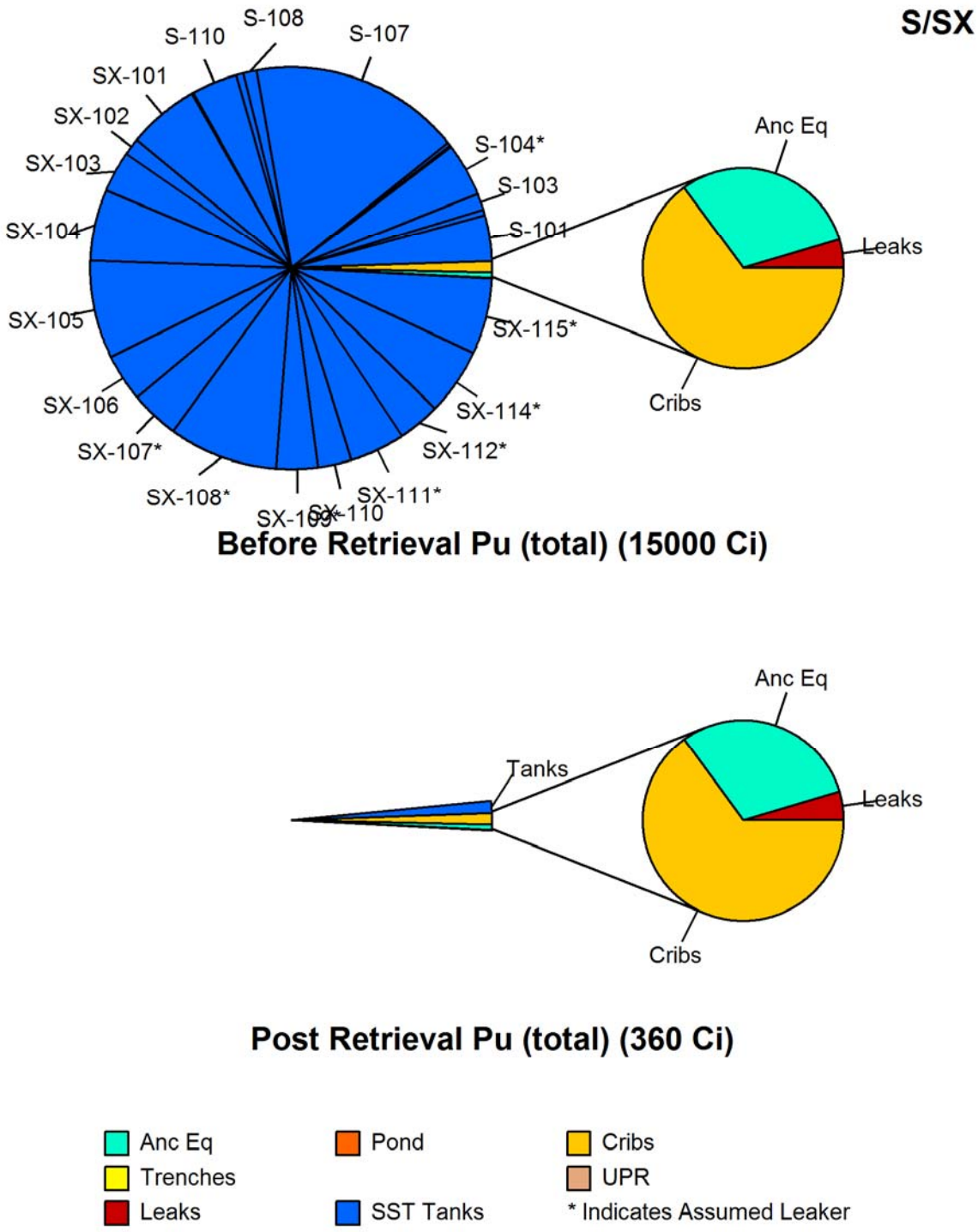


Figure E.3-11. S-SX Tank and Waste Farms Evaluation Unit Inventory Estimates for Plutonium (total) Before and After 99% Retrieval

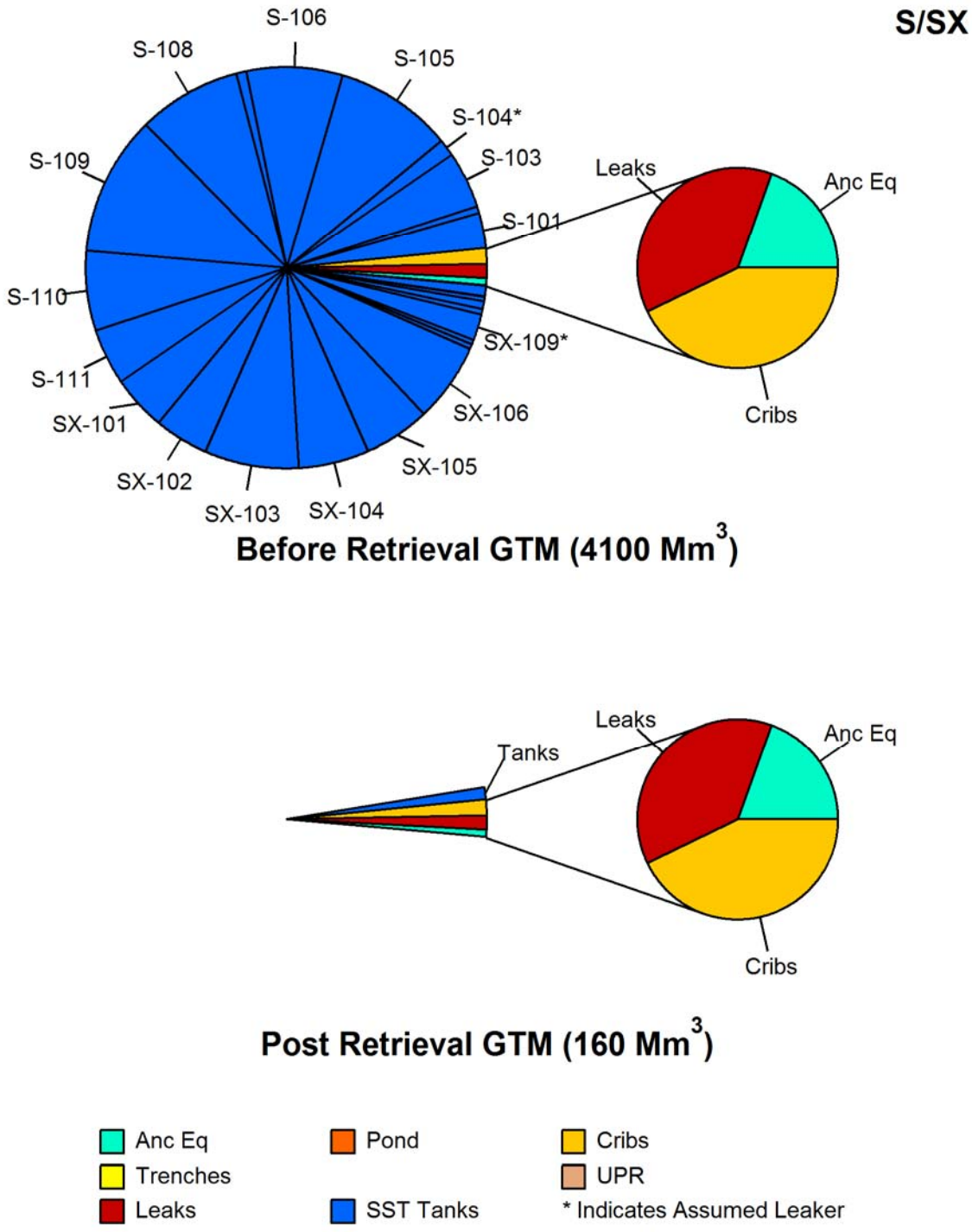


Figure E.3-12. S-SX Tank and Waste Farms Evaluation Unit Maximum Groundwater Threat Metric (GTM) of I-129 and Tc-99 Estimates Before and After 99% Retrieval

E.3.6. POTENTIAL RISK/IMPACT PATHWAYS AND EVENTS

CURRENT CONCEPTUAL MODEL

A common safety analysis was performed for all the single- and double-shell tanks including pathways and barriers (safety scenarios that dominate risk, safety systems and controls, barriers to release, failure mechanisms, pathways and receptors, time frames for exposure). See Section E.1.6 in Appendix E.1 for details.

POPULATIONS AND RESOURCES CURRENTLY AT RISK OR POTENTIALLY IMPACTED

Facility Worker, Co-located Person, and Public

A common analysis was performed for the Facility Worker, Co-located Person, and Public. See Section E.1.6 (Appendix E.1) for details.

Groundwater and Vadose Zone

The Group A and B primary contaminant groundwater plumes (Tc-99 and chromium) considered associated with the S-SX Tank and Waste Farms EU and liquid waste disposal facilities are described in Section E.3.5 and further details are provided in Appendix D.6 for the CP-GW-2 EU (200-UP GWIA).

As shown in Table E.3-7 (Section E.3.5), the vadose zone (VZ) GTM values for the Group A and B primary contaminants translate into ratings that range from *Not Discernible* (*ND*) for uranium (with a *Low* rating after the Active Cleanup period as described in Section E.2.5) and Sr-90 (which has an inventory that would translate to a *Very High* rating but appears relatively immobile in the area as described in Section E.2.5) to *Low* for C-14 to *Medium* for Tc-99 and I-129 to *High* for chromium (total and hexavalent) for the S-SX Tank and Waste Farms EU. Thus the overall rating for groundwater impact from vadose zone sources is *High*.

Columbia River

As described in Section E.3.5, no plumes associated with the S-SX Tank and Waste Farms EU currently intersect the Columbia River above benthic or riparian standards, which corresponds to *Not Discernible* ratings. The large dilution effect of the Columbia River results in a rating of *Not Discernible* for the free-flowing ecology.

Additional information concerning potential threats to the Columbia River from Tank Farm and liquid waste disposal facilities in the 200-West Area is provided in Appendix D.6 for the CP-GW-2 EU (200-UP GWIA).

Ecological Resources

- The major portion of the unit (>85%) consists of graveled surfaces, buildings, parking areas, and infrastructure related to the tanks.
- No wildlife were observed within the EU during the October reconnaissance, however, 6 bird species as well as black tailed jackrabbit sign were noted in the vicinity during previous surveys.
- No level 3 or higher quality habitat patches occur within the S-SX Tank and Waste Farms EU.
- Cleanup activities undertaken within the EU boundary would result in no net change in the amount of level 3 or higher resources within a 0.6 km radius.
- Because the area is an industrial site, and is contiguous with adjacent tank farms and other industrial areas—no significant change in habitat connectivity would be expected if habitat resources within the EU are lost.

Cultural Resources

- There are no archaeological sites known to be located within the S-SX Tank and Waste Farms EU.
- The 242S Evaporator Facility a contributing property within the Manhattan Project and Cold War Era Historic District, with no documentation required is located within the S-SX Tank and Waste Farms EU.

Archaeological sites and TCPs located within 500 meters of the EU

- The 272S Maintenance Shop also a contributing property within the Manhattan Project and Cold War Era Historic District, with no documentation required is located adjacent to the S-SX Tank and Waste Farms EU.
- The Hanford Site Plant Railroad, a contributing property within the Manhattan Project and Cold War Era Historic District, with documentation required is located in the vicinity of the S-SX Tank and Waste Farms EU.
- An historic isolate is likely associated with the Pre-Hanford Early Settlers/Farming Landscape.is located in the vicinity of the S-SX Tank and Waste Farms EU. This isolated find is not considered to be eligible to the National Register of Historic Places.

Closest Recorded TCP

- There are two recorded TCPs associated with the Native American Precontact and Ethnographic Landscape that are visible from the S-SX Tank and Waste Farms EU.

CLEANUP APPROACHES AND END-STATE CONCEPTUAL MODEL

Selected or Potential Cleanup Approaches

A common analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

Contaminant Inventory Remaining at the Conclusion of Planned Active Cleanup Period

See Section E.3.5 including Table E.3-2 and Figure E.3-3 through Figure E.3-11 for the inventory information after planned 99% retrieval. Furthermore, a more general analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

Risks and Potential Impacts Associated with Cleanup

A general analysis was performed for all the single- and double-shell tanks for workers and the Public. See Section E.1.6 (Appendix E.1) for details.

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

Facility Worker, Co-located Person, and Public

A common analysis was performed for the Facility Worker, Co-located Person, and Public. See Section E.1.6 (Appendix E.1) for details.

Groundwater

As described in Section E.3.5, there will be a continuing impact during this period to groundwater (as a protected resource) from those mobile S-SX Tank Farm primary contaminants currently with plumes that exceed thresholds. These impacts are described in Appendix D.6 for the CP-GW-2 EU (200-UP GWIA).

Furthermore, there are primary (e.g., tank wastes) and secondary contaminant sources (legacy source sites) in the vadose zone that pose risk to groundwater (as well as the vadose zone). The vadose zone (VZ)

GTM values for the Group A and B primary contaminants for the S-SX Tank and Waste Farms EU translate to ratings of *Not Discernible* (*ND*) for total uranium and Sr-90 (with ratings of *Low* after the Active Cleanup period to address uncertainties) to *Low* for C-14 to *Medium* for Tc-99 and I-129 to *High* for chromium (total and hexavalent) during this period (because of insufficient impact of recharge rates under treatment likely due to the large amounts of contaminants already in the groundwater and possible impacts from sources outside the S-SX Tank and Waste Farms EU). These ratings correspond to an overall rating of *High*.

However, the WMA S-SX Groundwater Extraction System, U Plant P&T System, and I-129 Plume Hydraulic Control in 200-UP and the 200 West Area P&T System in 200-ZP that is also used to treat contaminants extracted from 200-UP groundwater are assumed to be operational (i.e., treating or isolating groundwater contamination) during this evaluation period.

It is considered unlikely that additional groundwater resources would be impacted as a result of either interim remedial actions (e.g., pump and treat) or final closure activities (that are not covered in the Ecological or Cultural Resources results).

Columbia River

As described in Section E.3.5, the impacts to the Columbia River benthic, riparian, and free-flowing ecology for the Active Cleanup and Near-term, Post Cleanup periods are rated as *Not Discernible*. Additional information on groundwater plumes and potential threats associated with the S-SX Tank Farms and liquid waste disposal facilities are described in Appendix D.6 for the CP-GW-2 EU (200-UP GWIA).

It is considered unlikely that additional benthic or riparian resources would be impacted as a result of either interim remedial actions (e.g., pump and treat) or final closure activities (that are not covered in the Ecological or Cultural Resources results).

Ecological Resources

See Section E.1.6 (Appendix E.1) for details.

Cultural Resources

See Section E.1.6 (Appendix E.1) for details.

ADDITIONAL RISKS AND POTENTIAL IMPACTS IF CLEANUP IS DELAYED

A common analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

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

A common analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

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

Table E.3-8. Summary of Populations and Resources at Risk or Potentially Impacted after Cleanup

Population or Resource		Impact Rating	Comments
Human	Facility Worker	Low	Workers will be low risk from exposure to direct radiation and waste contaminants after waste retrieval, grouting, and capping.
	Co-located Person	Low	These persons will be at low risk from exposure to direct radiation and waste contaminants after waste retrieval, grouting, and capping.
	Public	Not Discernible (ND)	The Tank Farms will be in secure and controlled areas that prevent intentional and inadvertent intruders. No complete groundwater pathway and no impact from air pathway.
Environmental	Groundwater (A&B) from vadose zone[a]	*Low* (C-14, U(tot), Sr-90) *Medium* (Tc-99 and I-129) *High* (Cr-tot and Cr-VI) **Overall**: *High*	Current GTM values for Group A and B primary contaminants (Table E.3-7): *ND* (U(tot), Sr-90), *Low* (C-14), *Medium* (Tc-99, I-129) and *High* (total and hexavalent chromium). U(tot) and Sr-90 not likely to impact groundwater (Section E.3.5) and assigned *Low* ratings to address uncertainties. Insufficient predicted impact from decay (since chromium is risk driver) or changes in recharge rates to modify ratings. Groundwater treatment in 200-UP will not impact threat from vadose zone contamination.
	Columbia River from vadose zone[a]	Benthic: Not Discernible Riparian: Not Discernible Free-flowing: Not Discernible **Overall**: Not Discernible	TC&WM EIS screening results indicate that exposure to radioactive and chemical contaminants from peak groundwater discharge below benchmarks for both benthic and riparian receptors (Section E.3.5). Dilution factor of greater than 100 million between River and upwellings.
	Ecological Resources[b]	ND to Low	Continued monitoring could result in some disturbance to EU, and buffer lands. Remediation

Population or Resource		Impact Rating	Comments
			may improve habitat (and increased monitoring may lead to increases in exotic species, changes in species composition).
Social	Cultural Resources[b]	**Native American:** Direct: Unknown Indirect: Known **Historic Pre-Hanford:** Direct: Known Indirect: Unknown **Manhattan/Cold War**: Direct: None Indirect: None	Permanent indirect effects to viewshed are possible from capping. Permanent effects may be possible due to presence of contamination if capping occurs. No other expected cultural resources impacts.

a. Groundwater threat for Group A and B contaminants remaining in the vadose zone or to the Columbia River for all primary contaminants. Threats from existing plumes associated with the S-SX Tank and Waste Farms EU are described in Section E.3.5 and Appendix D.6 (CP-GW-2) for the 200-UP Groundwater Interest Area (GWIA).

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

As described in Section E.3.5, the TC&WM ecological screening analysis indicate that that exposure to radioactive contaminants from peak groundwater discharge was below screening levels at the Columbia River near-shore region, indicating there should be no expected adverse effects from radionuclides. Furthermore, results of the corresponding TC&WM screening evaluation for chemicals indicated that predicted chromium and nitrate concentrations could exceed screening values (i.e., Hazard Quotient of unity) in the near-shore region. However, the predicted nitrate peak concentration was in the past and would be unlikely to exceed human or aquatic standards in the future. For chromium the long travel time from 200-West to the Columbia River likely indicates that little chromium predicted to impact the near-shore region would be from 200-West sources (including the S-SX Tank and Waste Farms EU), which would also likely lead to insignificant impacts from the S-SX Tank and Waste Farms EU.

For more information, see Section E.1.6 (Appendix E.1).

E.3.7. SUPPLEMENTAL INFORMATION AND CONSIDERATIONS

A common analysis was performed for all the single- and double-shell tanks. See Section E.1.7 (Appendix E.1) for details.

E.3.8. ATTACHMENT -- S-SX TANK FARMS EVALUATION UNIT WIDS REVIEW

Hanford Site-Wide Risk Review

Evaluation Unit:	S-SX Tank Farms
ID:	CP-TF-2
Group:	Tank Farm
Operable Unit Cross-Walk:	WMA S/SX 200-DV-1 200-WA-1
Related EU:	CP-LS-7 CP-TF-9 CP-GW-2
Sites & Facilities:	S-SX Tank Farms, ancillary structures, associated liquid waste sites, and soils contamination. Includes 242-S Evaporator.
Key Data Sources Docs:	RPP-13033 RPP-40545 RPP-PLAN-40145 RPP-10435

Figure 1. Site Map with Evaluation Unit Boundaries and Tank Locations

Attached:

- Waste Site and Facility List
- Site Map with Evaluation Unit Boundaries and Associated Waste Sites
- Site Map with Evaluation Unit Boundaries and Associated Facilities

Prepared by: AMG, 08/29/2014
Reviewed by: GVL, 08/29/2014
Revisions: AMG, 09/10/2014

Hanford Site-Wide Risk Review
CP-TF-2 (S-SX Tank Farms)
Waste Site and Facility List

Site Code	Name	Site Status	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation
200-W-100-PL	200-W-100-PL; Encased Pipeline from 241-UX-154 to 241-SX-152 Diversion Box; Lines 4700, 4701, 4853, V762, V503 and V505	Inactive	Encased Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-W-137-PL	200-W-137-PL; Line V533; Pipeline from 241-S-151 Diversion Box to 216-S-1 & 2 Cribs	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-W-159-PL	200-W-159-PL; Cooling Water Lines from 241-SX-401 and 241-SX-402 to 216-U-10 Pond	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-W-160-PL	200-W-160-PL; Pipeline from 241-SX-401 and 241-SX-402 to 216-S-21 Crib	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-W-161-PL	200-W-161-PL; Line 557; Pipeline from 242-S to 216-S-25 Crib	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-W-162-PL	200-W-162-PL; Pipeline from 241-SX-701 to 216-SX-2 Crib	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-W-179-PL	200-W-179-PL; Lines SL100, SL101, SN216/281 and DR327; Pipelines Between 241-S-152 Diversion Box and 241-U Tank Farm	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-W-189-PL	200-W-189-PL; Lines SNL-5350 and SNL-5351; Transfer Lines from 219-S to 241-SY Tank Farm	Active	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	Not Applic	
200-W-223-PL	200-W-223-PL; Pipeline from 242-S Evaporator to 216-U-14 Ditch	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-W-235-PL	200-W-235-PL; Pipeline from 241-SX-701 Building to S Pit; 200-W-162-PL Replacement Pipeline	Inactive	Process Sewer	Pipeline and associated valves, etc.	TBD	
200-W-236	200-W-236; Pit South of 241-SX Tank Farm	Inactive	Depression/Pit (nonspecific)	Pond/Ditch - Surface Liquid Disposal Site	TBD	
200-W-37	200-W-37; Buried Tygon Tubing Near 241-S-101	Inactive	Dumping Area	Burial Ground	Not Applic	
200-W-54	200-W-54; Contamination Migration from 241-SX Tank Farm	Inactive	Contamination Migration	Unplanned Release - Surface/Near Surface	200-WA-1	
200-W-96	200-W-96; Contaminated Soil at 241-S/SX/SY Tank Farm	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	WMA S/SX	
200-W-97-PL	200-W-97-PL; Encased Pipeline from 240-S-151 Diversion Box to 241-S-151 Diversion Box; Lines V508, V509, V512, V513, V514, V515, V516, V517/3603 and V519/1115	Inactive	Encased Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-W-99-PL	200-W-99-PL; Encased Pipeline from 241-U-151 to 241-S-151 Diversion Boxes; Lines V455 and V456	Inactive	Encased Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
216-S-1&2	216-S-1&2; 216-S-5 Crib; 216-S-1 & 2	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	200-WA-1	
216-S-15	216-S-15; 216-S-2; 241-S-110 Pond; UN-216-W-3; 110-S Tank Overflow Pond	Inactive	Pond	Pond/Ditch - Surface Liquid Disposal Site	WMA S/SX	
216-S-21	216-S-21; 216-SX-1; 216-SX-1 Cavern or Crib	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	200-DV-1	
216-S-25	216-S-25; 216-S-25 Crib	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	200-WA-1	
216-S-3	216-S-3; 216-S-3 Crib; 216-S-5	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	WMA S/SX	
216-S-4	216-S-4; 216-S-4 Sump or Crib; 216-S-7; UN-216-W-1	Inactive	French Drain	Crib - Subsurface Liquid Disposal Site	200-WA-1	
216-S-8	216-S-8; Cold Aqueous Crib; Cold Aqueous Grave; Cold Aqueous Trench; Unirradiated Uranium Waste Trench; 216-S-3	Inactive	Trench	Crib - Subsurface Liquid Disposal Site	200-WA-1	
216-SX-2	216-SX-2; 216-SX-2 Crib	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	200-WA-1	
241-S-101	241-S-101; 241-S-TK-101	Inactive	Single-Shell Tank	Underground Storage Tank	WMA S/SX	
241-S-102	241-S-102; 241-S-TK-102	Inactive	Single-Shell Tank	Underground Storage Tank	WMA S/SX	
241-S-103	241-S-103; 241-S-TK-103	Inactive	Single-Shell Tank	Underground Storage Tank	WMA S/SX	
241-S-104	241-S-104; 241-S-TK-104	Inactive	Single-Shell Tank	Underground Storage Tank	WMA S/SX	
241-S-105	241-S-105; 241-S-TK-105	Inactive	Single-Shell Tank	Underground Storage Tank	WMA S/SX	
241-S-106	241-S-106; 241-S-TK-106	Inactive	Single-Shell Tank	Underground Storage Tank	WMA S/SX	
241-S-107	241-S-107; 241-S-TK-107	Inactive	Single-Shell Tank	Underground Storage Tank	WMA S/SX	
241-S-108	241-S-108; 241-S-TK-108	Inactive	Single-Shell Tank	Underground Storage Tank	WMA S/SX	
241-S-109	241-S-109; 241-S-TK-109	Inactive	Single-Shell Tank	Underground Storage Tank	WMA S/SX	
241-S-110	241-S-110; 241-S-TK-110	Inactive	Single-Shell Tank	Underground Storage Tank	WMA S/SX	

Note that only those waste sites with a WIDS (Waste Information Data System) Classification of "Accepted" are shown, along with non-duplicate facilities, identified via the Hanford Geographic Information System (HGIS).

Hanford Site-Wide Risk Review
CP-TF-2 (S-SX Tank Farms)
Waste Site and Facility List

Site Code	Name	Site Status	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation
241-S-111	241-S-111; 241-S-TK-111	Inactive	Single-Shell Tank	Underground Storage Tank	WMA S/SX	
241-S-112	241-S-112; 241-S-TK-112	Inactive	Single-Shell Tank	Underground Storage Tank	WMA S/SX	
241-S-151	241-S-151; 241-S-151 Diversion Box	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA S/SX	
241-S-152	241-S-152; 241-S-152 Diversion Box	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA S/SX	
241-S-302A	241-S-302A; 241-S-302-A Catch Tank; IMUST; Inactive Miscellaneous Underground Storage Tank; Lines V542, V763, V764, and DR324	Inactive	Catch Tank	Underground Storage Tank	WMA S/SX	
241-S-302B	241-S-302B; 241-S-302-B Catch Tank; IMUST; Inactive Miscellaneous Underground Storage Tank	Inactive	Catch Tank	Underground Storage Tank	Not Applic	
241-S-304	241-S-304; 241-S-304 Catch Tank	Inactive	Catch Tank	Underground Storage Tank	WMA S/SX	
241-S-A	241-S-A; 241-S-A Diversion Box; 241-S-A Valve Pit	Inactive	Valve Pit	Pipeline and associated valves, etc.	WMA S/SX	
241-S-B	241-S-B; 241-S-B Diversion Box; 241-S-B Valve Pit	Inactive	Valve Pit	Pipeline and associated valves, etc.	WMA S/SX	
241-S-C	241-S-C; 241-S-C Diversion Box; 241-S-C Valve Pit	Inactive	Valve Pit	Pipeline and associated valves, etc.	WMA S/SX	
241-S-D	241-S-D; 241-S-D Diversion Box; 241-S-D Valve Pit	Inactive	Valve Pit	Pipeline and associated valves, etc.	WMA S/SX	
241-SX-101	241-SX-101; 241-SX-TK-101	Inactive	Single-Shell Tank	Underground Storage Tank	WMA S/SX	
241-SX-102	241-SX-102; 241-SX-TK-102	Inactive	Single-Shell Tank	Underground Storage Tank	WMA S/SX	
241-SX-103	241-SX-103; 241-SX-TK-103	Inactive	Single-Shell Tank	Underground Storage Tank	WMA S/SX	
241-SX-104	241-SX-104; 241-SX-TK-104	Inactive	Single-Shell Tank	Underground Storage Tank	WMA S/SX	
241-SX-105	241-SX-105; 241-SX-TK-105	Inactive	Single-Shell Tank	Underground Storage Tank	WMA S/SX	
241-SX-106	241-SX-106; 241-SX-TK-106	Inactive	Single-Shell Tank	Underground Storage Tank	WMA S/SX	
241-SX-107	241-SX-107; 241-SX-TK-107	Inactive	Single-Shell Tank	Underground Storage Tank	WMA S/SX	
241-SX-108	241-SX-108; 241-SX-TK-108	Inactive	Single-Shell Tank	Underground Storage Tank	WMA S/SX	
241-SX-109	241-SX-109; 241-SX-TK-109	Inactive	Single-Shell Tank	Underground Storage Tank	WMA S/SX	
241-SX-110	241-SX-110; 241-SX-TK-110	Inactive	Single-Shell Tank	Underground Storage Tank	WMA S/SX	
241-SX-111	241-SX-111; 241-SX-TK-111	Inactive	Single-Shell Tank	Underground Storage Tank	WMA S/SX	
241-SX-112	241-SX-112; 241-SX-TK-112	Inactive	Single-Shell Tank	Underground Storage Tank	WMA S/SX	
241-SX-113	241-SX-113; 241-SX-TK-113	Inactive	Single-Shell Tank	Underground Storage Tank	WMA S/SX	
241-SX-114	241-SX-114; 241-SX-TK-114	Inactive	Single-Shell Tank	Underground Storage Tank	WMA S/SX	
241-SX-115	241-SX-115; 241-SX-TK-115	Inactive	Single-Shell Tank	Underground Storage Tank	WMA S/SX	
241-SX-151	241-SX-151; 241-SX-151 Diversion Box	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA S/SX	
241-SX-152	241-SX-152; 241-SX-152 Diversion Box; 241-SX-152 Transfer Box	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA S/SX	
241-SX-302	241-SX-302; 241-SX-302 Catch Tank; IMUST; Inactive Miscellaneous Underground Storage Tank; Line V595; SX-304	Inactive	Catch Tank	Underground Storage Tank	200-IS-1	
241-SX-401	241-SX-401; 241-SX-401 Condenser Shielding Building; 241-SX-401 Waste Disposal Condenser House	Inactive	Process Unit/Plant	Process Building	WMA S/SX	
241-SX-402	241-SX-402; 241-SX-402 Condenser Shielding Building; 241-SX-402 Waste Disposal Condenser House	Inactive	Process Unit/Plant	Process Building	WMA S/SX	
241-SX-A	241-SX-A; 241-SX-A Diversion Box; 241-SX-A Valve Pit	Inactive	Valve Pit	Pipeline and associated valves, etc.	WMA S/SX	
241-SX-B	241-SX-B; 241-SX-B Diversion Box; 241-SX-B Valve Pit	Inactive	Valve Pit	Pipeline and associated valves, etc.	WMA S/SX	
242-S	242-S; 242-S Evaporator	Inactive	Evaporator	Process Building	Not Applic	
244-S DCRT	244-S DCRT; 244-S Double-Contained Receiver Tank; 244-S Receiver Tank; 244-S RT; 244-S-TK/SMP; Lines 5350 and 5351; 244-S Catch Station	Inactive	Receiver Tank	Underground Storage Tank	WMA S/SX	
2607-W9	2607-W9; 2707-SX Septic Tank	Inactive	Septic Tank	Septic System	200-WA-1	X
2607-WZ	2607-WZ	Inactive	Septic Tank	Septic System	200-WA-1	X
UPR-200-W-114	UPR-200-W-114; Ground Contamination East of 241-SX Tank Farm; UN-200-W-114; UN-216-W-24	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	200-IS-1	

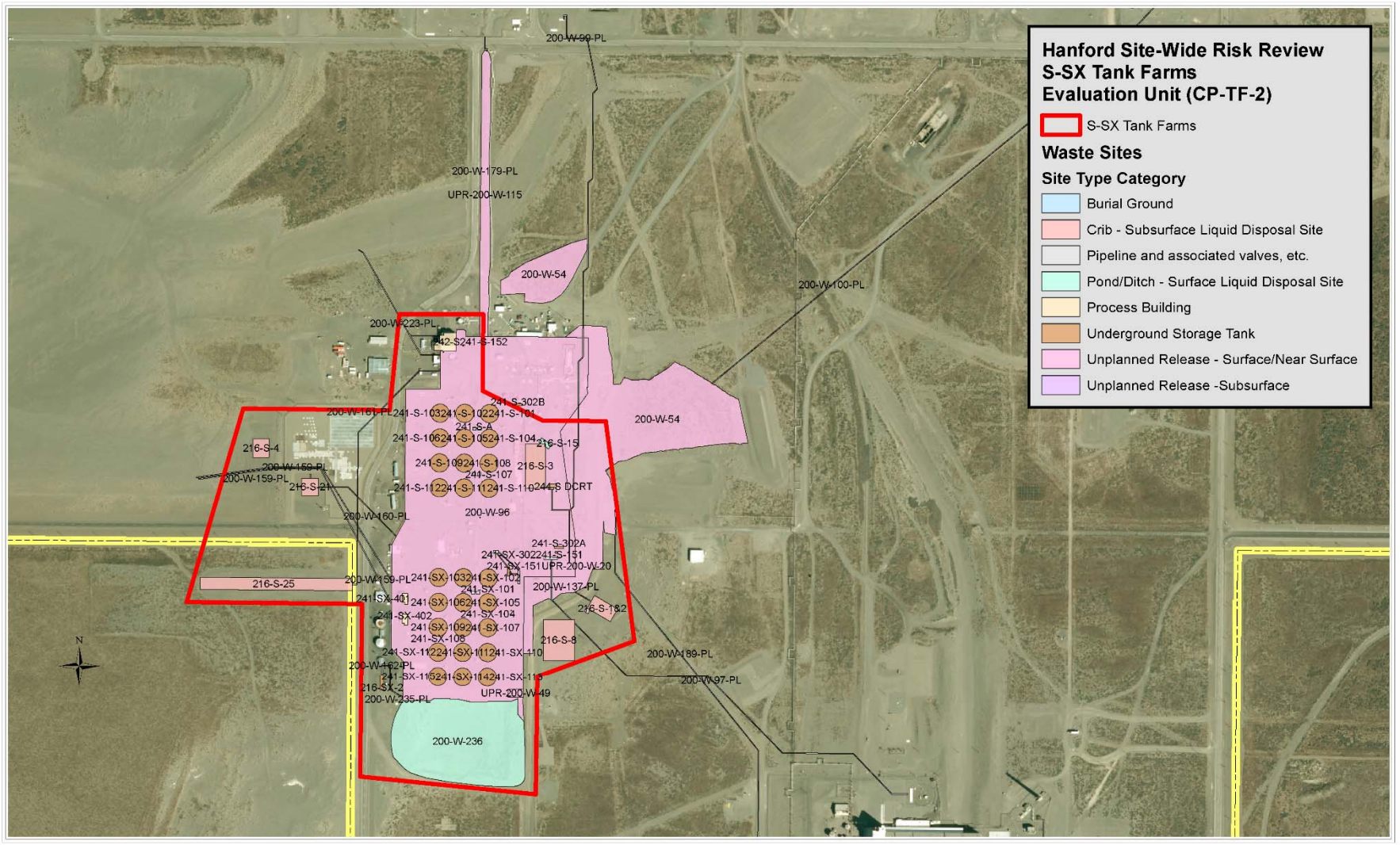
Note that only those waste sites with a WIDS (Waste Information Data System) Classification of "Accepted" are shown, along with non-duplicate facilities, identified via the Hanford Geographic Information System (HGIS).

Hanford Site-Wide Risk Review
CP-TF-2 (S-SX Tank Farms)
Waste Site and Facility List

Site Code	Name	Site Status	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation
UPR-200-W-115	UPR-200-W-115; Ground Contamination Above Transfer Line Along Cooper Street; UN-216-W-25	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	200-IS-1	
UPR-200-W-127	UPR-200-W-127; Liquid Release from 242-S Evaporator to the Ground; UN-200-W-127	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-W-140	UPR-200-W-140; 241-SX-107 Leak	Inactive	Unplanned Release	Unplanned Release - Subsurface	Not Applic	
UPR-200-W-141	UPR-200-W-141; 241-SX-108 Leak	Inactive	Unplanned Release	Unplanned Release - Subsurface	Not Applic	
UPR-200-W-142	UPR-200-W-142; 241-SX-109 Leak	Inactive	Unplanned Release	Unplanned Release - Subsurface	Not Applic	
UPR-200-W-143	UPR-200-W-143; 241-SX-111 Leak	Inactive	Unplanned Release	Unplanned Release - Subsurface	Not Applic	
UPR-200-W-144	UPR-200-W-144; 241-SX-112 Leak	Inactive	Unplanned Release	Unplanned Release - Subsurface	Not Applic	
UPR-200-W-145	UPR-200-W-145; 241-SX-113 Leak	Inactive	Unplanned Release	Unplanned Release - Subsurface	Not Applic	
UPR-200-W-146	UPR-200-W-146; 241-SX-115 Leak	Inactive	Unplanned Release	Unplanned Release - Subsurface	Not Applic	
UPR-200-W-20	UPR-200-W-20; Spread of Contamination from a Diversion Box; UN-200-W-20	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	TBD	
UPR-200-W-36	UPR-200-W-36; Groundwater Contamination at 216-S-1 and 216-S-2	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	200-WA-1	
UPR-200-W-49	UPR-200-W-49; Contamination Southeast of 241-SX; UN-200-W-49	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-W-50	UPR-200-W-50; Contamination Spread from 241-SX-114; UN-200-W-50	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-W-51	UPR-200-W-51; UPR-200-W-52; Release from 241-S Diversion Box; UN-200-W-51	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	200-WA-1	
UPR-200-W-80	UPR-200-W-80; 241-S/SX Contamination Migration; UN-200-W-80	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-W-81	UPR-200-W-81; Contamination Specks in 241-S/SX; UN-200-W-81	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
241S271A	ELECTRICAL/INSTRUMENT CONTROL BUILDING	INACTIVE	BUILDING	Infrastructure Building		X
241S271B	ELECTRICAL/INSTRUMENT CONTROL BUILDING	INACTIVE	BUILDING	Infrastructure Building		X
241SX271	TANK FARM CONTROL HOUSE	ACTIVE	BUILDING	Infrastructure Building		X
241SX281	EMERGENCY COOLING WATER PUMP HOUSE	ACTIVE	BUILDING	Infrastructure Building		X
241SX701	WASTE DISPOSAL CONDENSER HOUSE	ACTIVE	BUILDING	Process Building		
241SY271	INSTRUMENT AND ELECTICAL CONTROL HOUSE	ACTIVE	BUILDING	Infrastructure Building		X
242S702	TURBINE BUILDING VENTILATION	ACTIVE	BUILDING	Process Building		
244S	WASTE LIFT STATION -- VAULT	INACTIVE	STRUCTURE	Process Building		
244S271	INSTRUMENT CONTROL HOUSE	ACTIVE	BUILDING	Infrastructure Building		X
244S2904	FLUSH PIT AT 244S TANK FARM	INACTIVE	BUILDING	Process Building		
2508W10	SIREN WEST OF COOPER NORTH SIDE OF 13TH	ACTIVE	STRUCTURE	Infrastructure Building		X
2707SX	CARPENTER SHOP	ACTIVE	BUILDING	Infrastructure Building		X
2724SX	RAD MONITORING AND PROTECTIVE CLOTHING BLDG	INACTIVE	BUILDING	Infrastructure Building		X
2724SY	RAD MONITORING AND PROTECTIVE CLOTHING BLDG	INACTIVE	BUILDING	Infrastructure Building		X
MO2172	DECON TRAILER AT 242S	ACTIVE	BUILDING	Infrastructure Building		X
MO295	CHANGE MOBILE AT SY TANK FARM S/O 242S	INACTIVE	BUILDING	Infrastructure Building		X
MO298	CHANGE TRIALER BY 241SX	ACTIVE	BUILDING	Infrastructure Building		X
MO450	STORAGE MOBILE NORTH OF 241SY TANK FARM	ACTIVE	BUILDING	Infrastructure Building		X
MO563	S102 S112 RETREIVAL CONTROL ROOM TRAILER	INACTIVE	BUILDING	Infrastructure Building		X
MO636	LUNCH/CHG ROOM SW OF 241S // EAST OF COOPER AVE	ACTIVE	BUILDING	Infrastructure Building		X
MO819	CHANGE TRAILER AT SX TANK FARM S OF 242S	ACTIVE	BUILDING	Infrastructure Building		X
MO949	MOBILE LAB WEST OF 241SX401	INACTIVE	BUILDING	Infrastructure Building		X

Note that only those waste sites with a WIDS (Waste Information Data System) Classification of "Accepted" are shown, along with non-duplicate facilities, identified via the Hanford Geographic Information System (HGIS).

DRAFT



1 inch = 550 feet

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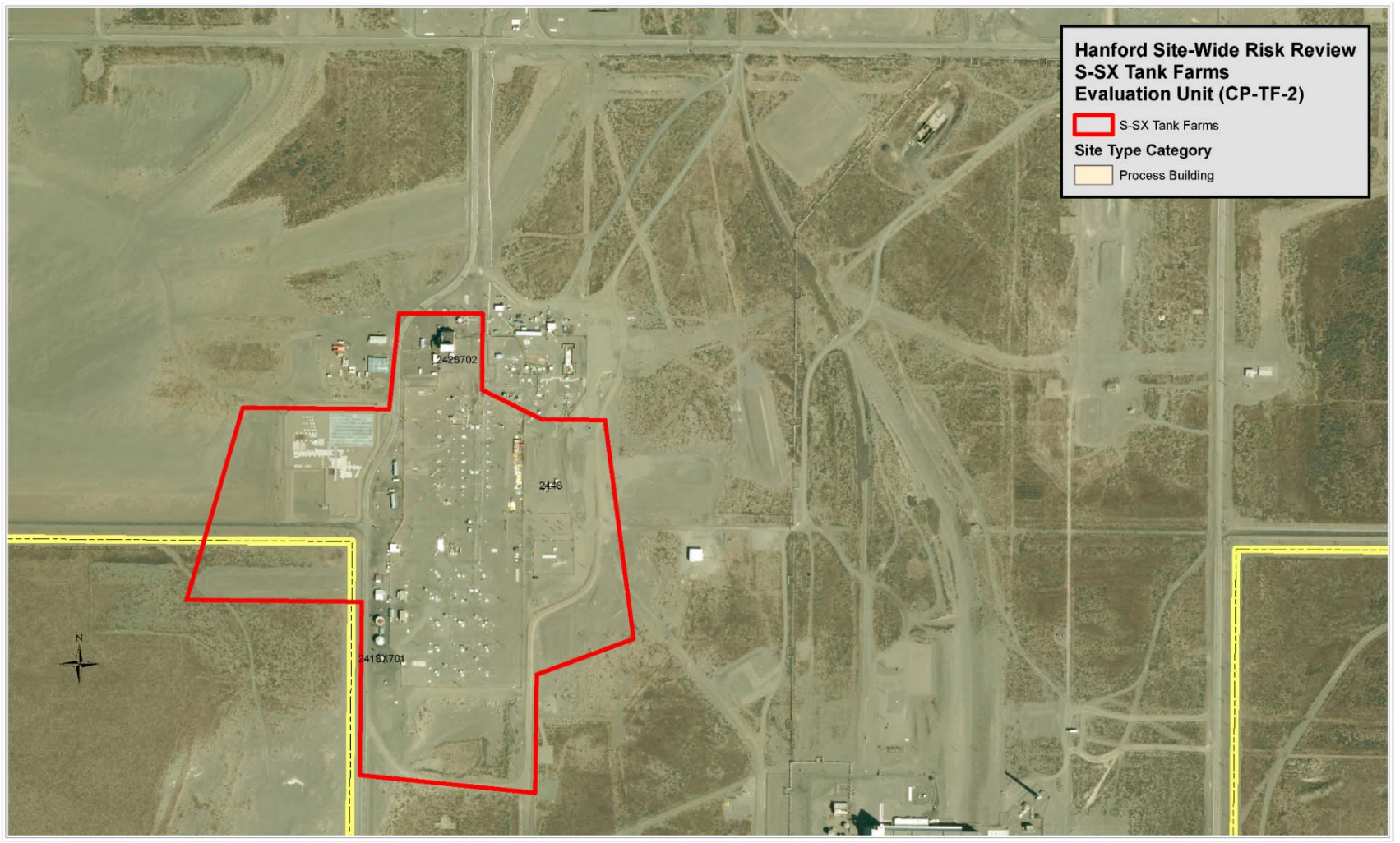

1 inch = 550 feet

APPENDIX E.4

Tank Waste and Farms

CP-TF-3 (TX-TY Tank Waste and Farms)
Evaluation Unit Summary Template

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PART E.4. CP-TF-3 TX-TY SINGLE-SHELL TANK WASTE AND FARMS (200-W)

E.4.1. EXECUTIVE SUMMARY

Much of the information related to the TX-TY Tank and Waste Farms Evaluation Unit (EU) is organized around the corresponding Waste Management Area (namely WMA TX-TY) that is regulated under the Resource Conservation and Recovery Act (RCRA) as modified in 40 CFR Part 265, Subpart F and Washington State's Hazardous Waste Management Act (HWMA, RCW 70.105 and its implementing requirements in the Washington State dangerous waste regulations [WAC 173-303-400]) (Horton 2007).

EU LOCATION:

North-Central part of 200-West on the Hanford Reservation; Central Plateau

RELATED EUS:

T Tank Waste and Farms (CP-TF-1), S-SX Tank Waste and Farms (CP-TF-2), U Tank Waste and Farms (CP-TF-4), A-AX Tank Waste and Farms (CP-TF-5), B-BX-BY Tank Waste and Farms (CP-TF-6), C Tank Waste and Farms (CP-TF-7), 200-East DST Waste and Farms (CP-TF-8), 200-West DST Waste and Farms (CP-TF-9) , 200-E Groundwater Plumes (CP-GW-1), 200-W Groundwater Plumes (CP-GW-2), and 200 Area Waste Transfer Pipeline (CP-LS-7)

PRIMARY CONTAMINANTS, CONTAMINATED MEDIA AND WASTES:

The TC&WM EIS describes tank wastes as including radioactive (tritium or H-3, C-14, Sr-90, Tc-99, I-129, Cs-137, U-233, U-234, U-235, U-238, Np-237, Pu-239, and Pu-240)[62] and non-radioactive contaminants (chromium, mercury, nitrate, lead, total uranium, and PCBs) of potential concern (DOE/EIS-0391 2012, Appendix D). The tank wastes contain saltcake, sludge, and supernatant phases. Contaminated media related to the TX-TY Tank Farms include ancillary equipment and surrounding vadose zone (including cribs and trenches) down to the saturated zone (for some mobile contaminants) from past and current discharges. The Record of Decision for the 200-ZP-1 Operable Unit (OU) (EPA 2008) associated with WMA TX-TY identifies Tc-99, I-129, chromium, and nitrate as tank waste constituents that must be addressed in cleanup. The 2015 Groundwater Monitoring Report (DOE/RL-2016-09, Rev. 0) lists tank wastes including chromium, nitrate, I-129, Tc-99, H-3, and uranium and non-tank wastes including carbon tetrachloride (CCl_4) and trichloroethene (TCE) for the 200-ZP GWIA that is used to geographically represent contaminant migration from the 200-ZP-1 OU for monitoring purposes.

After evaluating the contaminants associated with TX-TY Tank Farm tanks, ancillary equipment, legacy sources, and contaminated vadose zone, the primary contaminants from the tank wastes that drive human health risk to groundwater for the TX-TY Tank and Waste Farms Evaluation Unit are: Tc-99, I-129, chromium, and H-3. Those primary contaminants that may drive risk from groundwater discharge to the Columbia River are nitrate and chromium; however, any impacts are highly uncertain (see Section E.2.1). Cs-137 and Sr-90 are important from a safety standpoint and uranium isotopes, plutonium isotopes, and

[62] Other isotopes considered include U-232 and U-236 and Pu-238, Pu-241, and Pu-242 to be consistent with other EUs. These additional uranium and plutonium isotopes are included in the totals presented but are not used for rating because 1) uranium toxicity impacts (represented by total uranium drives corresponding risks and 2) plutonium has been found relatively immobile in the Hanford subsurface and has not been identified as a risk driver for groundwater impacts.

tritium are iconic constituents; these contaminants are included in the inventory summary even though they are not considered risk drivers for impacts to or from groundwater in this review. Carbon tetrachloride (CCl_4) and trichloroethene (TCE) are not tank wastes and thus are captured in Appendix D.6 for the CP-GW-2 EU (200-ZP GWIA).

BRIEF NARRATIVE DESCRIPTION:

Waste Management Area TX-TY (WMA TX-TY) occupies approximately 74,000 m^2 and contains 24 underground single-shell tanks (SSTs) constructed in 1947-48 (TX) and 1951-52 (TY) originally to support the bismuth phosphate process (Horton 2007, p. 2.1). Each of the tanks have capacities of 2.87×10^6 liters (arranged in three 4-tank and two 3-tank cascades) in additional to ancillary support equipment (e.g., diversion boxes, pumps, valves, and pipes). The TX Tank Farm tanks began receiving waste in the late 1940s and the TY Tank Farm tanks began receiving wastes in the early 1950s. Both TX-TY Tank Farms were used to support both the bismuth phosphate process (operated 1944-56) and the uranium recovery program being conducted in the U Plant (operated 1954-57). Some TX and TY Tank Farm tanks also received REDOX and PUREX wastes. Thus waste management operations created a complex intermingling of tank wastes; natural processes resulted in settling, stratification, and segregation of waste components. Waste was cascaded through a series of tanks (where cooling and precipitation of radionuclides and solids occurred in each tank). Some supernatant from the last tank in a cascade was sent to cribs when there was a shortage of tank storage capacity (Horton 2007, p. 2.2).

Past practices and unplanned disposals have resulted in legacy (vadose zone) contamination near the WMA TX-TY as described in Section E.4.3.

The SSTs in WMA TX-TY have been interim stabilized (i.e., liquid transferred to DSTs to <50 kgal drainable interstitial liquid and <5 kgal of supernatant). Initial corrective actions (i.e., cutting and capping water lines and stopping run-on of precipitation using surface water controls) have been implemented at WMA TX-TY (Horton 2007, p. 2.3).

SUMMARY TABLES OF RISKS AND POTENTIAL IMPACTS TO RECEPTORS

Table E.4-1 provides a summary of nuclear and industrial safety related consequences from CP-TF-3 (Tank and Waste Farms EU) to humans and impacts to important physical Hanford Site resources. Receptors are described in Section E.1.6 (Appendix E.1).

Table E.4-1. CP-TF-3 (TX-TY Tank Waste and Farms) impact Rating Summary for Human Health
(unmitigated basis with mitigated basis provided in parentheses (e.g., "High (Low)").

Population or Resource		Evaluation Time Period[a] Active Cleanup (to 2064) **Current Condition:** Maintenance & Monitoring (M&M)	 **From Cleanup Actions:** Retrieval & Closure
Human Health	Facility Worker[b]	***M&M***: Low-High[d] (Low-High)[d] ***Soil***: Not Discernible (ND)-High (ND-Low)	***Preferred method***: High (Low) ***Alternative***: High (Low)
	Co-located Person[b]	***M&M***: Low-Moderate (Low) ***Soil***: ND (ND)	***Preferred method***: Low-Moderate (Low) ***Alternative***: Low-Moderate (Low)
	Public[b]	***M&M***: Low (Low) ***Soil***: ND (ND)	***Preferred method***: Low (Low) ***Alternative***: Low (Low)
Environmental	Groundwater (A&B) from vadose zone[c]	*High* -- Tc-99, CCl_4, Cr(tot), Cr-VI *Medium* -- C-14 and I-129 *ND* -- Sr-90[f] and U(tot)[f] **Overall**: *High*	High -- Tc-99, CCl_4, Cr(tot), Cr-VI *Medium* -- C-14 and I-129 *ND* -- Sr-90[f] and U(tot)[f] **Overall**: *High*
	Columbia River from vadose zone[c]	Benthic: ND Riparian: ND Free-flowing: ND **Overall**: ND	Benthic: ND Riparian: ND Free-flowing: ND **Overall**: ND
	Ecological Resources[e]	ND to Low	Low to Medium
Social	Cultural Resources[e]	**Native American:** Direct: Known Indirect: Known **Historic Pre-Hanford:** Direct: Known Indirect: Known **Manhattan/Cold War:** Direct: Known Indirect: Unknown	**Native American:** Direct: Known Indirect: Known **Historic Pre-Hanford:** Direct: Known Indirect: Known **Manhattan/Cold War:** Direct: Known Indirect: Unknown

a. A rating for cultural resources is 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.

b. Evaluated in Section E.1.6 (Appendix E.1).

c. Groundwater threat for Group A and B contaminants remaining in the vadose zone or to the Columbia River for all primary contaminants. Threats from existing plumes associated with the TX-TY Tank and Waste Farms EU are described in Section E.4.5 and Appendix D.6 (CP-GW-2) for the 200-ZP Groundwater Interest Area. Groundwater in the area is being treated using the 200 West Pump and Treat Facility that has extracted carbon tetrachloride, chromium, Tc-99, and small amounts of I-129 (of those PCs in the table related to the CP-TF-3

vadose zone) (DOE/RL-2016-09, Rev. 0); however, groundwater treatment does not impact the vadose zone source or threat.

d. Industrial safety consequences range from low to high (based on the evaluation scale used) for both mitigated (with controls) and unmitigated (without controls). Mitigated radiological and toxicological consequences to facility workers are high (unmitigated) and low (mitigated).

e. 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.

f. The large amount of Sr-90 disposed of in the TX-TY Tank and Waste Farms EU would translate to a *Very High* rating, whereas the total uranium would have a *Medium* rating. However, there is no current Sr-90 or total uranium plume in the 200-ZP GWIA and it would likely require more than 150 years to reach groundwater in a sufficient amount to exceed the drinking water standard over an appreciable area (Section E.4.5). Total uranium and Sr-90 are given *Not Discernible* (*ND*) ratings for the Active Cleanup period and *Low* ratings afterwards to account for uncertainties in the evaluation. Thus Sr-90 and total uranium are not considered risk drivers during the evaluation period.

SUPPORT FOR RISK AND IMPACT RATINGS FOR EACH POPULATION OR RESOURCE

Human Health

The current and cleanup-related consequences related to work being conducted at the Tank Farms in the 200 Areas (Hanford Central Plateau) was evaluated in Section E.1.6 (Appendix E.1).

Groundwater, Vadose Zone, and Columbia River

Current

TX-TY Tank Farm contaminants are currently impacting groundwater and treatment is not predicted to decrease concentrations to below thresholds before active cleanup commences. Secondary sources (e.g., Tc-99 and total and hexavalent chromium) in the vadose also threaten to continue to impact groundwater in the future, including the Active Cleanup period. Note that there are current plumes for Tc-99, I-129, and chromium in the 200-ZP GWIA (CP-GW-2, Appendix D.6) that are associated with the TX-TY TF EU. As described in the TC&WM EIS (and summarized in Section E.4.5), there appears to be insufficient expected impact from radioactive decay (since Tc-99 and chromium are risk drivers) or recharge rate (due to large amounts of these contaminants already in the groundwater) on peak concentrations in the groundwater or near-shore region of the Columbia River during or after cleanup to modify ratings. Thus the rating for these receptors are the same as those shown in Table E.4-8.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

See Section E.1.1.

Ecological Resources

Current

There are currently some level 3 resources in EU (4%) and in buffer area (9%). People and trucks are present, which could lead to increases in exotic species and changes in species diversity in level 3 resource areas of EU and buffer.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

Potential for continual disturbance levels with increasing number of trucks, which may cause changes in abundance and diversity in level 3 resources in EU and buffer.

Cultural Resources

Current
Manhattan Project/Cold War significant resources have already been mitigated. Area is very disturbed and there are no known recorded archaeological resources within the EU. Traditional cultural places are visible from EU.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches
Because area has not been investigated either on the surface or subsurface, archaeological investigations may need to occur within pockets of undisturbed land if any prior to remediation. Potential for intact archaeological material to be present is very low.

Considerations for Timing of the Cleanup Actions

See Section E.1.1 (Appendix E.1).

Near-Term, Post-Cleanup Risks and Potential Impacts

See Section E.1.1 (Appendix E.1).

E.4.2. ADMINISTRATIVE INFORMATION

OU AND/OR TSDF DESIGNATION(S):

The TX-TY Tank Farms Evaluation Unit (EU), denoted *CP-TF-3 – TX-TY Tank Waste and Farms*, consists of 24 waste tanks, ancillary structures, associated liquid waste sites, and soils contamination; much of this EU is contained within Waste Management Area TX-TY (WMA TX-TY). Waste Management Area (WMA) TX-TY is regulated under the Resource Conservation and Recovery Act (RCRA) as modified in 40 CFR Part 265, Subpart F and Washington State's Hazardous Waste Management Act (HWMA, RCW 70.105 and its implementing requirements in the Washington State dangerous waste regulations [WAC 173-303-400]) (Horton 2007).

COMMON NAME(S) FOR EU:

There is no common name for the TX-TY Tank and Waste Farms EU because the EU is comprised of elements from other waste management units including Waste Management Area TX-TY (WMA TX-TY) that includes the 241-TX (or TX) and 241-TY (or TY) Tank Farms. The TX Tank Farm contains 18 waste tanks (TX-101 through TX-118) and the TY Tank Farm contains six waste tanks (TY-101 through TY-106). Other components in the EU (including associated legacy waste sites) are listed below in the *Primary EU Source Components* section.

KEY WORDS:

TX Tank Farm, TY Tank Farm, 241-TX Tank Farm, 241-TY Tank Farm, waste tanks, tank farm, Waste Management Area TX-TY, WMA TX-TY

REGULATORY STATUS

Regulatory Basis

DOE is the responsible agency for the closure of all single-shell tank (SST) waste management areas (WMAs) through post closure, in close coordination with other closure and cleanup activities of the Hanford Central Plateau. Washington State has a program that is authorized under RCRA and

implemented through the HWMA and its associated regulations; Ecology is the lead regulatory agency responsible for the closure of the SST system. Please refer to Section E.1.2 (Appendix E.1) for more information.

Applicable Regulatory Documentation

The relationship among the tank waste retrieval work plans (TWRWP) and the overall single-shell tank (SST) waste retrieval and closure process is described in Appendix I of the Hanford Federal Facility Agreement and Consent Order (HFFACO), along with requirements for the content of TWRWPs. WMA TX-TY was placed in assessment monitoring because of elevated *specific conductance* (Horton 2007, p. iii). A groundwater quality assessment plan was written (Caggiano & Chou 1993) describing the monitoring activities used in deciding whether WMA TX-TY has affected groundwater.

Applicable Consent Decree or TPA Milestones

Federal Facility Agreement and Consent Order, 1989 and amended through June 16, 2014: Milestone M-045-00; Lead Agency Ecology: *Complete the closure of all Single Shell Tank Farms by 01/31/2043*

RISK REVIEW EVALUATION INFORMATION

Completed: Revised August 25, 2015

Evaluated by: K. G. Brown

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

E.4.3. SUMMARY DESCRIPTION

CURRENT LAND USE

DOE Hanford Site for industrial use. All current land-use activities in the 200-West Area are *industrial* in nature (EPA 2012).

DESIGNATED FUTURE LAND USE

Industrial-Exclusive. All four land-use scenarios listed in the Comprehensive Land Use Plan (CLUP) indicate that the 200-West Area (of which TX-TY Tank and Waste Farms EU is a part) is denoted *Industrial-Exclusive* (DOE/EIS-0222-F). An industrial-exclusive area is "suitable and desirable for treatment, storage, and disposal of hazardous, dangerous, radioactive, and nonradioactive wastes" (DOE/EIS-0222-F).

PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

The legacy source sites associated with the TX-TY Tank and Waste Farms EU are enumerated in Attachment Section E.4.8. To summarize, past practices and unplanned disposals have resulted in legacy (vadose zone) contamination near the WMA TX-TY (Horton 2007, p. 2.3-2.6)[63] including trenches: 216-T-21 through 216-T-24 (5×10^6 L of first cycle supernatant waste each) and 216-T-25 (3×10^6 L of evaporator waste) and cribs: 216-T-28 (42.3×10^6 L of waste) and 216-T-19 (455×10^6 L of effluent). Thirteen of the 24

[63] The wastes disposed to some of the cribs and trenches adjacent to WMA TX-TY were similar to the wastes stored in the single-shell tanks making it difficult to distinguish waste sources for existing groundwater contamination.

SSTs in WMA TX-TY are declared "assumed leakers" (Templeton 2016, pp. 22-23) with leaks estimates ranging from not estimated (TX-105 and TX-107 through TX-117) to < 1,000 gallons (TY-101 in 1973) to 35,000 gallons (TY-105 in 1960). There are also 11 unplanned releases documented in or near WMA TX-TY. Additional details are provided In Section E.4.4.

Waste Tanks and Ancillary Equipment

The 24 waste tanks in the TX-TY Tank and Waste Farms EU are:

- (241-)TX-101 (241-TX-TK-101)
- (241-)TX-102 (241-TX-TK-102)
- (241-)TX-103 (241-TX-TK-103)
- (241-)TX-104 (241-TX-TK-104)
- (241-)TX-105 (241-TX-TK-105)
- (241-)TX-106 (241-TX-TK-106)
- (241-)TX-107 (241-TX-TK-107)
- (241-)TX-108 (241-TX-TK-108)
- (241-)TX-109 (241-TX-TK-109)
- (241-)TX-110 (241-TX-TK-110)
- (241-)TX-111 (241-TX-TK-111)
- (241-)TX-112 (241-TX-TK-112)
- (241-)TX-113 (241-TX-TK-109)
- (241-)TX-114 (241-TX-TK-110)
- (241-)TX-115 (241-TX-TK-111)
- (241-)TX-116 (241-TX-TK-112)
- (241-)TX-117 (241-TX-TK-112)
- (241-)TX-118 (241-TX-TK-112)
- (241-)TY-101 (241-TY-TK-101)
- (241-)TY-102 (241-TY-TK-102)
- (241-)TY-103 (241-TY-TK-103)
- (241-)TY-104 (241-TY-TK-104)
- (241-)TY-105 (241-TY-TK-105)
- (241-)TY-106 (241-TY-TK-106)

The ancillary equipment included in the TX-TY Tank and Waste Farms EU is listed in Attachment Section E.4.8 and consists of pipelines, diversion boxes, and catch tanks.

Groundwater Plumes

The TX-TY Tank and Waste Farms EU is associated with the 200-ZP groundwater interest area (GWIA). The current 200-ZP plumes associated with the TX-TY Tank and Waste Farms EU that exceed water quality standards are chromium, I-129, Tc-99, and tritium (DOE/RL-2016-09, Rev. 0). Uranium is not a contaminant of concern in the 200-ZP GWIA; however, it is extracted from wells in the 200-UP GWIA. There are other contaminants of concern (i.e., carbon tetrachloride and trichloroethene) associated with the 200-ZP GWIA that exceed final cleanup levels (EPA 2008); however, these contaminants do not result from sources in the TX-TY Tank and Waste Farms EU. An interim pump-and-treat (P&T) system was operated in 200-ZP from 1996 until 2012 when the final 200 West P&T system came on line (EPA 2008) to reduce the mass of carbon tetrachloride (as well as the secondary contaminants trichloroethene and chloroform) in the groundwater.

See Appendix D.6 (CP-GW-2 EU) for additional details.

Operating Facilities

Because of the prohibition on waste additions to the Hanford SSTs,[64] the TX-TY Tank and Waste Farms EU components are not considered Operating Facilities for this review. See Section E.1.4 (Appendix E.1) for details.

D&D of Inactive Facilities

Not Applicable.

[64] Berman presentation on July 29, 2009, titled "Hanford Single-Shell Tank Integrity Program." Available at www.em.doe.gov.

LOCATION AND LAYOUT MAPS

A series of maps are used to illustrate the location of the components within the CP-TF-1 EU and the TX-TY Tank and Waste Farms EU relative to the Hanford Site. Figure E.2-1 shows the relationship between the 200-W (200 West) Area (where the TX-TY Tank Farms and Waste Management Area TX-TY are located) and the Hanford Site. Figure E.4-1 illustrates the TX-TY Tank and Waste Farms EU boundary. Figure E.4-2 shows a detailed view of the waste tanks, ancillary equipment, and legacy source units in the TX-TY Tank and Waste Farms EU.

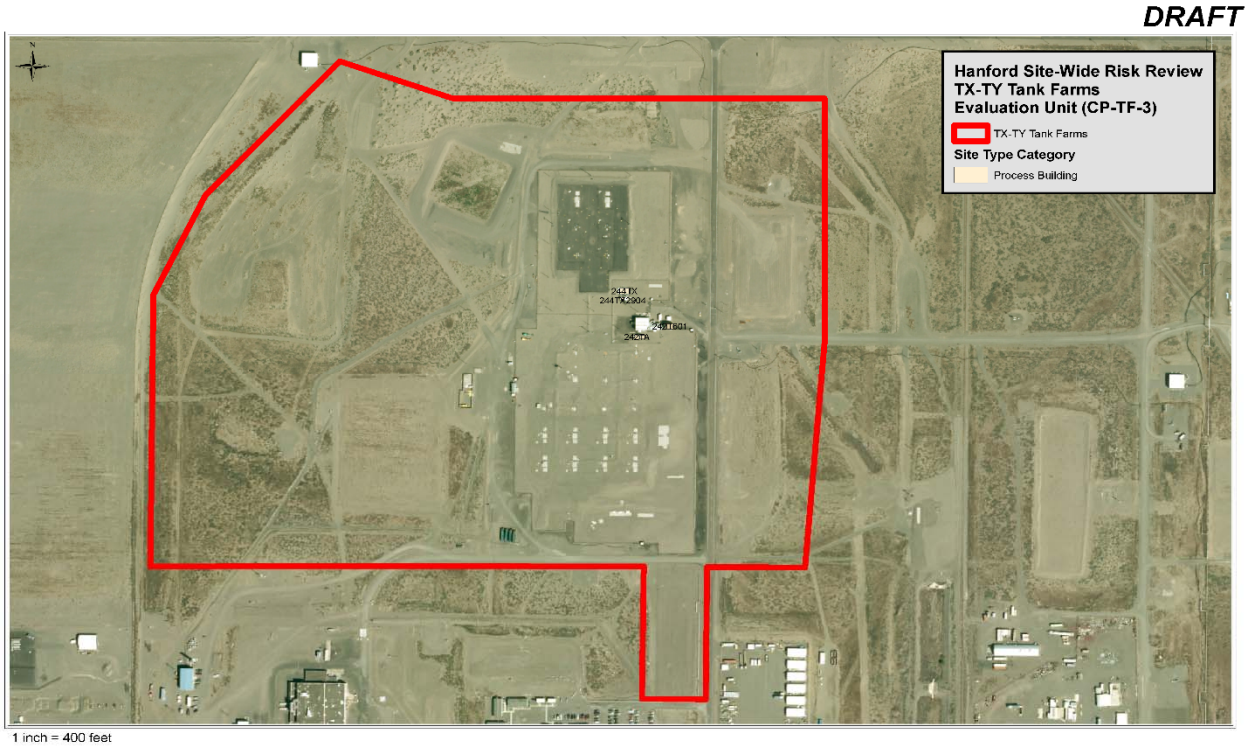


Figure E.4-1. Polygon representing the boundary of the TX-TY Tank Farms Evaluation Unit (Attachment Section E.4.8)

DRAFT

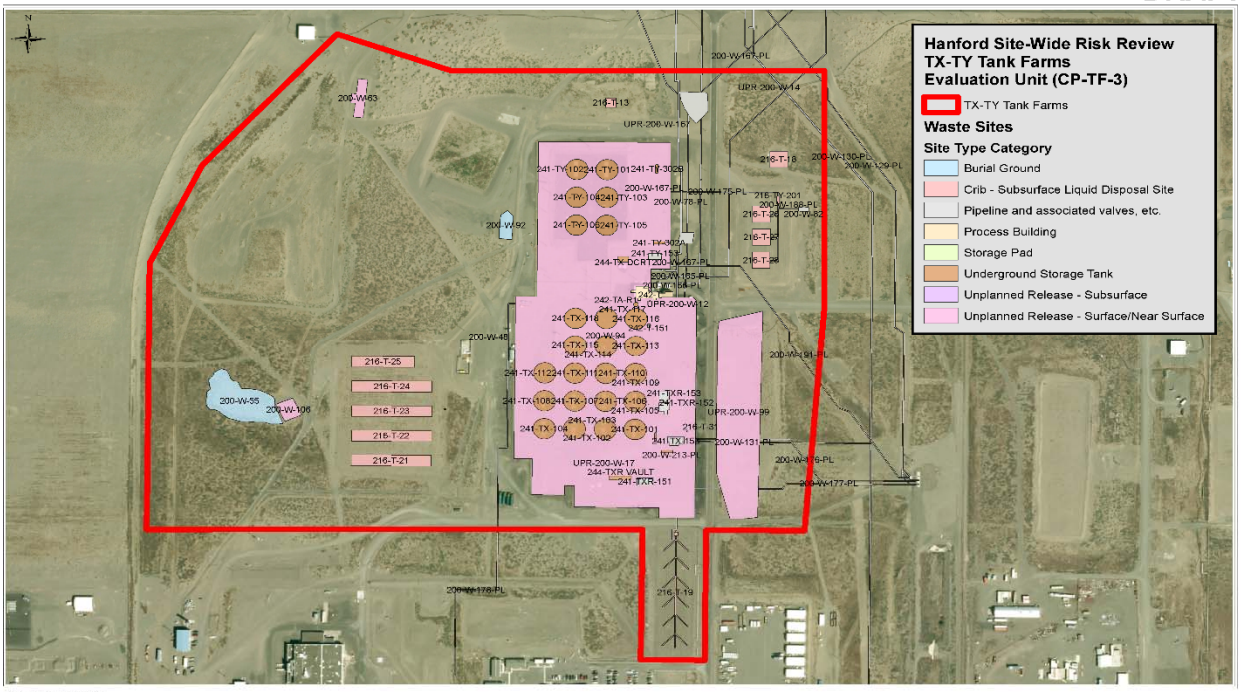


Figure E.4-2. Hanford TX-TY Tank Farms Evaluation Unit including tanks, legacy source units, and ancillary equipment (Attachment Section E.4.8).

E.4.4. UNIT DESCRIPTION AND HISTORY

EU FORMER / CURRENT USES

Waste Management Area TX-TY (WMA TX-TY) occupies approximately 74,000 m^2 and contains 24 underground single-shell tanks (SSTs) constructed in 1947-48 (TX) and 1951-52 (TY) originally to support the bismuth phosphate process (Horton 2007, p. 2.1). Each of the tanks have capacities of 2.87×10^6 liters (arranged in three 4-tank and two 3-tank cascades) in additional to ancillary support equipment (e.g., diversion boxes, pumps, valves, and pipes). The TX Tank Farm tanks began receiving waste in the late 1940s and the TY Tank Farm tanks began receiving wastes in the early 1950s. Both TX-TY Tank Farms were used to support both the bismuth phosphate process (operated 1944-56) and the uranium recovery program being conducted in the U Plant (operated 1954-57). Some TX and TY Tank Farm tanks also received REDOX and PUREX wastes. Thus waste management operations created a complex intermingling of tank wastes; natural processes resulted in settling, stratification, and segregation of waste components. Waste was cascaded through a series of tanks (where cooling and precipitation of radionuclides and solids occurred in each tank). Some supernatant from the last tank in a cascade was sent to cribs when there was a shortage of tank storage capacity (Horton 2007, p. 2.2).

LEGACY SOURCE SITES

Past practices and unplanned disposals have resulted in legacy (vadose zone) contamination near the WMA TX-TY (Horton 2007, p. 2.3-2.6)[65]:

- The 216-T-21 through T-24 specific retention trenches were used in 1954 and received a total of 5×10^6 L of first cycle supernatant waste from TX Tank Farm tanks.
- The 216-T-25 trench was active during September 1954 and received 3×10^6 L of evaporator waste from the 242-T Evaporator.
- The 216-T-28 crib was active from 1960-1966 and received 42.3×10^6 L of waste including steam condensate decontamination waste, miscellaneous waste from 221-T Building, and decontamination waste from the 2706-T Building and 300 Area laboratory waste.
- The 216-T-19 crib and tile field, located south of the TX Tank Farm, operated from 1951-1980 and received 455×10^6 L of effluent from the 242-T Evaporator and T Plant operations.
- Thirteen of the 24 SSTs in WMA TX-TY are declared "assumed leakers" (Weyns 2014, p. 19) with leaks estimates ranging from < 1,000 gallons (TY-101 in 1973) to 35,000 gallons (TY-105 in 1960).
- Eleven unplanned releases have been documented in or near WMA TX-TY.

WASTE TANKS

See Section E.4.3 for details.

GROUNDWATER PLUMES

The 200-ZP groundwater plumes (Tc-99, I-129, chromium, and H-3) considered to be associated with the TX-TY Tank Farms and co-located liquid waste disposal facilities are described in detail in Section E.4.5 with additional information in Appendix D.6 for the CP-GW-2 EU (200-ZP GWIA). Sites within the CP-TF-3 EU, including 216-T-18, 216-T-26, 216-T-27, and 216-T-28 Cribs and 216-T-19 Crib and Tile Field are suspected of being able to contribute mobile contaminants to the saturated zone (i.e., representing migration of contaminants from the waste site to the uppermost aquifer) (DOE/RL-92-16, Rev. 0, Table 2-2). Note that no source inventory was provided for carbon tetrachloride and trichloroethene (not tank wastes), but there are carbon tetrachloride and trichloroethene plumes near the TX-TY Tank and Waste Farms EU that are not associated with the TX-TY Tank and Waste Farms EU sites.

D&D OF INACTIVE FACILITIES – NOT APPLICABLE

OPERATING FACILITIES – NOT APPLICABLE

Because of the prohibition on waste additions to the Hanford SSTs,[66] the TX-TY Tank and Waste Farms EU components are not considered Operating Facilities for this Review.

[65] The wastes disposed to some of the cribs and trenches adjacent to WMA TX-TY were similar to the wastes stored in the single-shell tanks making it difficult to distinguish waste sources for existing groundwater contamination.
[66] Berman presentation on July 29, 2009, titled "Hanford Single-Shell Tank Integrity Program." Available at www.em.doe.gov.

ECOLOGICAL RESOURCES SETTING

Landscape Evaluation and Resource Classification:

More than 60% of the acreage in the TX-TY Tank and Waste Farms EU is classified as level 0 or level 1 habitat and does not provide significant habitat resources (Appendix J, Table 2, p. J-76 and Figure 10, p. J-77). The EU contains approximately 8 acres of level 3 biological resources. The amount and proximity of the biological resources to the EU was examined within the adjacent landscape buffer area radiating approximately 864 m from the geometric center of the EU (equivalent to 579 acres). More than 60% of the combined total area (EU and adjacent landscape buffer area) is classified as level 0 or 1 habitat. One individual level 3 species occurrence lies within the adjacent landscape buffer—likely Piper's daisy (*Erigeron piperianus*).

Level 2 habitat on the eastern side of the EU is contiguous with larger patches of habitat within the adjacent landscape buffer area that are connected by narrow corridors to habitat outside the 200 West Area. These connections are bisected by various roadways. The level 3 habitat within the EU is isolated from any connections to habitats outside the 200 West Area, although it is contiguous with small amounts of level 3 or level 2 habitats to the south within the adjacent landscape buffer area. Habitats to the south fall within the EU for Plutonium Contaminated Waste Sites and may be affected by remediation actions taken for that unit.

Field Survey:

PNNL biologists conducted pedestrian and vehicle surveys throughout the TX-TY Tank and Waste Farms EU. Canopy cover of species was estimated visually in level 2 resource areas, and measured along a transect in a level 3 resource area (Appendix J, Table 1, p. J-75). Much of the EU (~55 acres) has been previously disturbed by ongoing operations and the installation and operation of various pump and treat wells and remaining habitat occurs in strips and patches surrounded by roads and infrastructure (Appendix J, Table 2, p. J-76 and Figure 10, p. J-77). Several areas have been revegetated with a mixture of crested wheatgrass (*Agropyron cristatum)* and shrubs. Vegetation measurements confirmed the status of level 2 and level 3 resources within the EU (Appendix J, Table 1, p. J-75).

Wildlife sign observed during the October field survey included coyote (*Canis latrans*) tracks, rabbit tracks, small mammal burrows, and harvester ant hills. Previous PNNL ECAP surveys conducted in 2009 and 2010 identified the following wildlife in habitats within the EU: side-blotched lizard (*Uta stansburiana*), western meadowlark (*Sturnella neglecta*), rock dove (*Columba livia*), and northern pocket gopher (*Thomomys talpoides*).

CULTURAL RESOURCES SETTING

Cultural resources known to be recorded within the TX-TY Tank and Waste Farms EU are limited to three Manhattan Project/Cold War Era Landscape National Register-eligible sites with documentation required; two tank farms (241 TY and 241 TX Waste Disposal Tank Farm) and one railroad (the Hanford Site Plant Railroad). All have been documented as described in the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan* (DOE/RL-97-56). Additionally, a non-contributing/ineligible portion of a National Register-eligible historic/ethnohistoric Trail/Road which is associated with both the Native American Precontact and Ethnographic and the Pre-Hanford Early Settlers/Farming Landscapes, passes through the TX-TY Tank and Waste Farms EU.

Much of the TX-TY Tank and Waste Farms EU has not been inventoried for archaeological resources with the exception of a very small portion with negative findings. Closure and remediation of the tank farms located within TX-TY Tank and Waste Farms EU have been addressed in an NHPA Section 106 review

completed. Given the extensive disturbance, it is unlikely but there is a possibility 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), particularly where the undisturbed soil deposits exist within the TX-TY Tank and Waste Farms EU.

One isolated find and one site associated with the Pre-Hanford Farming Landscape and one isolated find associated with the Native American Precontact and Ethnohistoric Landscape are located within 500 meters of the TX-TY Tank and Waste Farms EU. None of these items are considered to be eligible to the National Register of Historic Places.

Historic maps reveal that an historic/ethnohistoric /Trail Road ran through the TX-TY Tank and Waste Farms EU indicating that there was a presence of Native American and Pre-Hanford Farming Landscape cultural resources associated with transportation and travel through the area. Given the extensive ground disturbance within the entire EU and the geomorphology in the area however, overall it is unlikely that intact archaeological resources are present on the surface or in the subsurface within the TX-TY Tank and Waste Farms EU. Pockets of undisturbed soil may exist, it may be appropriate to conduct 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 associated with these landscapes (e.g. East Benton Historical Society, the Franklin County Historical Society, the Prosser Cemetery Association, the Reach, and B-Reactor Museum Association) may need to occur. Indirect effects are always possible when TCPs are known to be located in the general vicinity. 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.

E.4.5. WASTE AND CONTAMINATION INVENTORY

Table E.4-2 provides inventory estimates of the various source components associated with the TX-TY Tank and Waste Farms EU including tank wastes and ancillary equipment, legacy sources including leaks, cribs, trenches, unplanned releases (UPRs), vadose zone sources, saturated zone (plume) estimates, treatment amounts, and remaining vadose zone estimates (i.e., the difference of the vadose zone estimates and the saturated zone and treatment estimates)[67]. This information is further summarized in Figure E.4-3 through Figure E.4-11 before and after planned 99% retrieval[68].

[67] The basis for the saturated and vadose zone estimates are provided in Chapter 6 of the Methodology Report (CRESP 2015a) and examples are provided in the demonstration section for the 200-UP-1 Operable Unit. These estimates tend to have very high associated uncertainties.

[68] According to the Tri-Party Agreement (Ecology, EPA, and DOE, 1998), retrieval limits for residual wastes are 360 ft^3 and 30 ft^3 for 100-Series and 200-Series tanks, respectively, corresponding to the 99% waste retrieval goal as defined in TPA Milestone M-45-00. For purposes of this Review the 99% and 90% Retrieval Scenarios reflect assumptions described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 and apply only to tank volumes and inventories. They are calculated assuming retrieval of a fully mixed tank of homogeneous composition. For tanks that have been declared "Retrieval Completed" or "Retrieved to Limit of … Technologies" (Templeton, AM 2016, page 9, partially duplicated in Table E.1-7), no further retrieval for either the 99% or 90% retrieval scenario is assumed. This includes tank 241-S-112 and all C Tank Farm tanks except 241-C-105. For tanks that are currently undergoing retrieval (tanks 241-AY-102 and 241-C-105), a retrieval amount equivalent to the 99% and 90% retrieval volumes described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 are calculated.

For example, the major sources for Tc-99 and I-129 before retrieval are the TX-TY tank wastes and leaks from these tanks. The maximum groundwater threat metric (GTM) (Figure E.4-12)[69] is dominated by the TX-TY Tank Farm wastes before retrieval and by leaks after planned retrieval (as are the Tc-99 and I-129 legacy sources). The tritium inventory, both pre- and post-retrieval, is dominated by cribs and past leaks. For chromium and nitrate, cribs and trenches and the TX-TY Tank Farm tank wastes are major sources before retrieval. After retrieval, the cribs, leaks, and trenches dominate the source of chromium and nitrate. Current uranium, Sr-90, Cs-137, and plutonium isotope inventories tend to be dominated by the tank wastes; the post-retrieval inventories tend to be dominated by various legacy sources in the vadose zone including past leaks and cribs for uranium, leaks for Sr-90 and Cs-137, and cribs for plutonium isotopes.

CONTAMINATION WITHIN PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

The estimated TX-TY Tank Farm inventory for the Legacy / Vadose Zone Source Sites (i.e., cribs, trenches, and soil contaminated by tank leaks and unplanned releases) is summarized in Table E.4-2 and further described in Figure E.4-3 through Figure E.4-11 before and after planned 99% retrieval (which will have no impact on the current legacy source site inventories). These values constitute estimates of the initial amounts of contaminants discharged to the vadose zone that are then used to estimate the remaining inventory in the vadose zone as described below (i.e., by difference using the process described in Chapter 6 of the Methodology Report (CRESP 2015a) as revised for the 2015 groundwater monitoring results (DOE/RL-2016-09, Rev. 0) as described in Appendix D.1). These estimates necessarily have large associated uncertainties.

Waste Tanks and Ancillary Equipment

The estimated total inventory for all the TX-TY waste tanks and Ancillary Equipment is provided in Table E.4-2 for both the 90% and planned 99% retrieval scenarios. The tank-by-tank inventories are provided in Table E.4-3 through Table E.4-6. Safety-related information (i.e., hydrogen generation rates and times to the lower flammability limit are also provided in Table E.4-3. The inventories for the various contaminant in the TX-TY Tank Farm tanks vary over several orders of magnitude as does the GTM. This information is further summarized in Figure E.4-3 through Figure E.4-11 before and after planned 99% retrieval and for the maximum GTM in Figure E.4-12.

Vadose Zone Contamination

The estimated inventories for the vadose zone, saturated zone, and treatment amounts are found in Table E.4-7. These inventories represent the vadose zone contamination *outside* the tanks and ancillary equipment (i.e., that are generally available for transport through the environment). These are used to estimate the inventory remaining in the vadose zone using the process described in Chapter 6 of the Methodology Report (CRESP 2015a) as revised for the 2015 groundwater results (Appendix D.1). The focus in this section will be on the Group A and B contaminants in the vadose zone due to their mobility and persistence and potential threats to groundwater. To summarize:

- *Tc-99 and I-129* – There are existing Tc-99 and I-129 plumes in the groundwater (200-ZP GWIA) that are associated with the TX-TY TF EU. The vadose zone inventory is dominated by past leaks from SSTs.

[69] Maximum of the GTMs for Tc-99 and I-129 only.

- *Sr-90* – There is no current plume for Sr-90. The vadose zone inventory is dominated by past leaks and ancillary equipment. Thus the majority of the Sr-90 originally discharged into the vadose zone would have had to travel through much of the vadose zone to impact groundwater. Using an analysis similar to that in Section E.2.5 for Sr-90 in the WMA T (200-West), a Sr-90 plume is not expected in the next 150 years due to retardation in the vadose zone or after due to radioactive decay (+97% reduction in Sr-90 inventory). Thus Sr-90 is not considered a significant threat to the Hanford groundwater.
- *Chromium* – There is currently a chromium plume associated with past leaks from SSTs in the TX-TY TF EU. The vadose zone inventory is dominated by cribs, leaks, and trenches.
- *Uranium* – Uranium has been measured in the 200-ZP-1 OU, but not exceeding the drinking water standard. The vadose zone inventory is dominated by leaks and cribs. Based on analysis very similar to that in Section E.2.5 for the T Tank and Waste Farms EU, an appreciable uranium plume would not be expected in the next 150 years but perhaps during the 1,000-year period after cleanup. Thus total uranium is not considered a significant threat to the Hanford groundwater during the Active Cleanup or Near-term, Post Cleanup periods.
- *C-14* – There was C-14 discharged to the TX-TY TF EU; however, no plume has been identified in the 200-ZP GWIA nor is one expected based on the TC&WM EIS groundwater screening analysis (Appendix O, DOE/EIS-0391 2012).
- *Carbon tetrachloride* and *trichloroethene* – There are current carbon tetrachloride and trichloroethene plumes in the 200-ZP GWIA; however, these plumes are not associated with TX-TY Tank and Waste Farms EU sources. The 216-T-19 crib (which is considered part of this EU as described in Attachment Section E.4.8) did receive carbon tetrachloride, which serves as a potential vadose zone source for this EU; however, this source is relatively minor compared to other sources linked to the carbon tetrachloride plume (DOE/RL-2016-09, Rev. 0). No trichloroethene discharges to TX-TY TF EU sources were identified.

Using the process outlined in Chapter 6 of the Methodology Report (CRESP 2015a) as revised for the 2015 groundwater monitoring results (Appendix D.1), the vadose zone inventories in Table E.4-2 are estimated by difference and used to calculate Groundwater Threat Metric (GTM) values for the Group A and B contaminants remaining in the vadose zone as illustrated in Table E.4-7. The resulting vadose zone (VZ) ratings for threats to groundwater are *Not Discernible* for uranium and Sr-90[70], *Medium* for I-129 and C-14, and *High* for Tc-99, carbon tetrachloride, and chromium (total and hexavalent). The overall rating would be *High.*

Groundwater Plumes

Legacy waste sites within the CP-TF-3 EU are suspected of be able to contribute mobile contaminants to the saturated zone (DOE/RL-92-16, Rev. 0) and 200-ZP plumes have been linked to CP-TF-3 sources (DOE/RL-2016-09, Rev. 0). In general groundwater plumes are evaluated in separate EUs; however, those portions of groundwater plumes that can be associated with the TF EU (i.e., a plume with sources associated with the TF EU) will be evaluated to provide a better idea of the saturated zone versus remaining vadose zone threats to groundwater. The estimated inventory for the saturated zone

[70] The total uranium and Sr-90 GTM values would translate to *Medium* and *Very High* ratings, respectively, if mobile. However, no appreciable uranium or Sr-90 plume would be expected in the next 150 years due to transport and decay (Sr-90) considerations (Section E.2.5). Uranium or Sr-90 may impact groundwater after the 150-year period. Thus a *Low* rating for uranium and Sr-90 would apply to the period after Active Cleanup to address uncertainties.

contamination is provided in Table E.4-7 where Photoshop was used to estimate the fraction of the plumes considered associated with the TX-TY Tank and Waste Farms EU (Attachment 6-4 in the Methodology Report (CRESP 2015a) as revised in Appendix D.1 for the 2015 groundwater monitoring results[71]). This information is also used to estimate amounts treated and remaining in the vadose zone. For the groundwater plumes described in the 200-ZP GWIA (DOE/RL-2016-09, Rev. 0), apportionment of plumes and ratings from the Group A and B primary contaminants to the TX-TY Tank and Waste Farms EU would be as follows:

- *Carbon tetrachloride* and *trichloroethene* – There are plumes for these contaminants in the 200-ZP GWIA, but no major sources related to TX-TY Tank and Waste Farms EU sources (including the 216-T-19 crib that is considered a potential vadose zone source); thus there is no portion of the carbon tetrachloride or trichloroethene plume considered associated with the TX-TY Tank and Waste Farms EU. The corresponding ratings would be ND.
- *Chromium* – There are plumes in the OU (assumed to be hexavalent chromium); the single plume near the TX-TY Tank and Waste Farms EU is considered associated with the EU and the area of this plume is 4% of the area of the chromium plumes (Appendix D.1). The area is assumed to describe both the total chromium and hexavalent chromium contaminants.
- *I-129* – There are small plumes in the GWIA, including one from 200-PO; the two small plume near the TX-TY Tank and Waste Farms EU are considered associated with the EU, and the area of these plumes is 42% of the total area of the plumes (Appendix D.1).
- *Tc-99* – There are plumes in the OU; the single plume near the TX-TY Tank and Waste Farms EU is considered associated with the EU, and the area of this plume is 54% of the area of the plumes (Appendix D.1).

The groundwater plumes for the Group A and B primary contaminants (e.g., Tc-99, I-129, and chromium) associated with the TX-TY Tank Farm and co-located liquid waste disposal facilities are described in detail in Appendix D.6 for the CP-GW-2 EU (200-ZP GWIA). Note that carbon tetrachloride (*Very High*) is the risk driver for the 200-ZP GWIA (Appendix G.6); however, there are no T TF EU sources associated with the plume, and the remaining vadose zone sources would drive the risks associated with the TX-TY TF EU.

Impact of Recharge Rate and Radioactive Decay on Groundwater Ratings

The TC&WM EIS screening groundwater transport analysis (Appendix O, DOE/EIS-0391 2012) as discussed in Section E.2.5 for the T Tank and Waste Farms EU indicates that there is insufficient impact of emplacing the engineered surface barrier (and resulting reduction of infiltrating water) on the predicted peak groundwater concentrations (relative to thresholds) at the T Barrier[72] to change ratings. Again the impact is not ascribed to ineffectiveness of the surface barrier but instead to the large amount

[71] From the graphic map files provided by PNNL, the Photoshop Magic Wand Tool was used to select areas representing plumes and then the "Record Measurements" Tool was used to provide relative areal extents. A Custom Measurement Scale was set to that of the map.

[72] The barrier represents the edge of the infiltration barrier to be constructed over disposal areas that are within 100 meters [110 yards] of facility fence lines (DOE/EIS-0391 2012). The T Barrier is the closest to the TX-TY Tank and Waste Farms EU. Despite including sources other than those for the TX-TY Tank and Waste Farms EU, the analysis in the TC&WM EIS was considered a reasonable source of information to assess the impact of the engineered surface barrier emplacement.

of contamination already present in the subsurface and possible contributions of sources outside the TX-TY Tank and Waste Farms EU (used in the TC&WM EIS analysis[73]).

Columbia River

The process illustrated in Chapter 6 of the Methodology Report (CRESP 2015a) as revised for the 2015 groundwater and Columbia River results (Appendix D.1) is used to evaluate potential impacts to the Columbia River. Note that the evaluation of potential benthic and riparian impacts has a common thread up to the point when the shoreline impact (benthic) or riparian zone impact area is used to define ratings. Thus a common evaluation for the benthic and riparian zone is performed here. Since the TX-TY and T Tank and Waste Farms EUs are proximate (200-W) and share the 200-ZP GWIA, the results for potential impacts to the Columbia River for the TX-TY Tank and Waste Farms EU (Section E.2.5) are the same for the T Tank and Waste Farms EU. These are summarized in the following sections.

Benthic and Riparian Zone – Current Impacts

Current impacts from the T Tank and Waste Farms EU to the Columbia River benthic and riparian zone ecology would be rated as *Not Discernible*.

Benthic and Riparian Zone – Active Cleanup and Near-term, Post Cleanup

The impacts to the Columbia River benthic and riparian ecology for the Active Cleanup and Near-term, Post Cleanup periods are also rated as *Not Discernible*.

Benthic and Riparian Zone – Long-term

There should be no expected adverse effects from radionuclides for Columbia River benthic and riparian receptors over the time period evaluated (10,000 years).

Only chromium and nitrate would be predicted to exceed relevant thresholds. However, the screening results indicate that future nitrate peak concentration (and discharge) appear to not exceed either the drinking water standard or ambient water quality criterion in the next 10,000 years. Furthermore, any chromium predicted to reach the Columbia River from TX-TY Tank Farm sources would likely lead to insignificant long-term impacts to the benthic and riparian ecology.

Threats to the Columbia River Free-flowing Ecology

As described in Section E.2.5, the large dilution effect of the Columbia River on the contamination from the seeps and groundwater upwellings results in *Not Discernible* ratings for the Active Cleanup and Near-term, Post Cleanup periods and insignificant long-term impacts to the free-flowing ecology for all contaminants.

Potential Impact of Recharge Rate on Threats to the Columbia River

The No Action Alternative evaluation in the TC&WM EIS suggests that remedial actions (e.g., surface barrier emplacement that would decrease recharge in the areas near the Tank Farms) would appear to not have significant impacts on the long-term peak concentrations in the near-shore area (benthic and riparian receptors) of the Columbia River. This is not due to ineffectiveness of the barrier but instead due to large amounts of contaminant already in the groundwater. Thus ratings are not changed based on the remedial actions assumed in the TC&WM EIS.

[73] Analyses specific to each Tank Farm or Central Plateau EU are not available; thus the aggregate screening analysis provided in the TC&WM EIS was used as an indication.

Facilities for D&D – Not Applicable

Operating Facilities – Not Applicable

Because of the prohibition on waste additions to the Hanford SSTs,[74] the TX-TY Tank and Waste Farms EU components are not considered Operating Facilities for this Review.

[74] Berman presentation on July 29, 2009, titled "Hanford Single-Shell Tank Integrity Program." Available at www.em.doe.gov.

Table E.4-2. Summary Table of Infrastructure and Subsurface Contamination Inventory for the TX-TY Tank Farms Evaluation Unit (CP-TF-3) [a,b]

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[c]	99% Retrieval Scenario[c]
Infrastructure (Tanks and Ancillary Equipment)				
Tank Waste	Waste (kGal)	7171	717.1	71.71
	Sludge (kGal)	1218	121.8	12.18
	Saltcake (kGal)	5942	594.2	59.42
	Supernatant (kGal)	11	1.1	0.11
Tank Waste (rad)	Am-241 (Ci)	11000	1100	110
	C-14 (Ci)	67	6.7	0.67
	Co-60 (Ci)	200	20	2
	Cs-137 (Ci)	1900000	190000	19000
	Eu-152 (Ci)	22	2.2	0.22
	Eu-154 (Ci)	1000	100	10
	H-3 (Ci)	280	28	2.8
	I-129 (Ci)	2.6	0.26	0.026
	Ni-59 (Ci)	260	26	2.6
	Ni-63 (Ci)	23000	2300	230
	Pu (total) (Ci)	19000	1900	190
	Sr-90 (Ci)	700000	70000	7000
	Tc-99 (Ci)	2500	250	25
	U (total) (Ci)	91	9.1	0.91
Tank Waste (non-rad)	Cr (kg)	53000	5300	530
	Hg (kg)	330	33	3.3
	NO3 (kg)	13000000	1300000	130000
	Pb (kg)	5700	570	57
	U (total) (kg)	91000	9100	910
Ancillary Equipment (non-rad)	Pb (kg)	40	40	40
	U (total) (kg)	660	660	660
MUST (non-rad)	Pb (kg)	11	11	11
	U (total) (kg)	8.3	8.3	8.3

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[(c)]	99% Retrieval Scenario[(c)]
Vadose Zone Source (Leaks and Intentional Discharges into Cribs and Trenches)				
Leaks (rad)	C-14 (Ci)	15	15	15
	Cs-137 (Ci)	160000	160000	160000
	H-3 (Ci)	110	110	110
	I-129 (Ci)	0.21	0.21	0.21
	Pu (total) (Ci)	30	30	30
	Sr-90 (Ci)	60000	60000	60000
	Tc-99 (Ci)	110	110	110
	U (total) (Ci)	3.3	3.3	3.3
Leaks (non-rad)	Cr (kg)	3200	3200	3200
	Hg (kg)	1.4	1.4	1.4
	NO3 (kg)	290000	290000	290000
	Pb (kg)	130	130	130
	U (total) (kg)	1400	1400	1400
Cribs (rad)	Am-241 (Ci)	19	19	19
	C-14 (Ci)	4.2	4.2	4.2
	Co-60 (Ci)	1.2	1.2	1.2
	Cs-137 (Ci)	690	690	690
	Eu-152 (Ci)	0.05	0.05	0.05
	Eu-154 (Ci)	5.7	5.7	5.7
	H-3 (Ci)	5100	5100	5100
	I-129 (Ci)	0.018	0.018	0.018
	Ni-59 (Ci)	0.034	0.034	0.034
	Ni-63 (Ci)	3.1	3.1	3.1
	Pu (total) (Ci)	350	350	350
	Sr-90 (Ci)	650	650	650
	Tc-99 (Ci)	2	2	2

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[(c)]	99% Retrieval Scenario[(c)]
	U (total) (Ci)	3.2	3.2	3.2
Cribs (non-rad)	CCl4 (kg)	1700	1700	1700
	Cr (kg)	9600	9600	9600
	Hg (kg)	13	13	13
	NO3 (kg)	840000	840000	840000
	Pb (kg)	22	22	22
	U (total) (kg)	1200	1200	1200
Trenches (rad)	Am-241 (Ci)	4.2	4.2	4.2
	C-14 (Ci)	0.65	0.65	0.65
	Co-60 (Ci)	2.5	2.5	2.5
	Cs-137 (Ci)	3700	3700	3700
	Eu-152 (Ci)	0.093	0.093	0.093
	Eu-154 (Ci)	6.5	6.5	6.5
	H-3 (Ci)	49	49	49
	I-129 (Ci)	0.014	0.014	0.014
	Ni-59 (Ci)	0.21	0.21	0.21
	Ni-63 (Ci)	29	29	29
	Pu (total) (Ci)	4.8	4.8	4.8
	Sr-90 (Ci)	580	580	580
	Tc-99 (Ci)	1.6	1.6	1.6
	U (total) (Ci)	0.19	0.19	0.19
Trenches (non-rad)	Cr (kg)	2900	2900	2900
	Hg (kg)	2.9	2.9	2.9
	NO3 (kg)	860000	860000	860000
	U (total) (kg)	270	270	270
UPR (rad)	Am-241 (Ci)	0.005	0.005	0.005
	C-14 (Ci)	0.00078	0.00078	0.00078

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[(c)]	99% Retrieval Scenario[(c)]
	Co-60 (Ci)	0.0031	0.0031	0.0031
	Cs-137 (Ci)	4.6	4.6	4.6
	Eu-152 (Ci)	0.00011	0.00011	0.00011
	Eu-154 (Ci)	0.0078	0.0078	0.0078
	H-3 (Ci)	0.059	0.059	0.059
	I-129 (Ci)	1.70E-05	1.70E-05	1.70E-05
	Ni-59 (Ci)	0.00026	0.00026	0.00026
	Ni-63 (Ci)	0.036	0.036	0.036
	Pu (total) (Ci)	0.00084	0.00084	0.00084
	Sr-90 (Ci)	0.69	0.69	0.69
	Tc-99 (Ci)	0.002	0.002	0.002
	U (total) (Ci)	0.0002	0.0002	0.0002
UPR (non-rad)	Cr (kg)	3.5	3.5	3.5
	Hg (kg)	0.0031	0.0031	0.0031
	NO3 (kg)	1000	1000	1000
	U (total) (kg)	0.3	0.3	0.3
Vadose Zone (from Vadose Zone Sources)				
VZ Remaining (rad)	Am-241 (Ci)	23	23	23
	C-14 (Ci)	20	20	20
	Co-60 (Ci)	3.7	3.7	3.7
	Cs-137 (Ci)	170000	170000	170000
	Eu-152 (Ci)	0.14	0.14	0.14
	Eu-154 (Ci)	12	12	12
	H-3 (Ci)	5300	5300	5300
	I-129 (Ci)	0.24	0.24	0.24
	Ni-59 (Ci)	0.25	0.25	0.25
	Ni-63 (Ci)	33	33	33

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[(c)]	99% Retrieval Scenario[(c)]
	Pu (total) (Ci)	380	380	380
	Sr-90 (Ci)	62000	62000	62000
	Tc-99 (Ci)	110	110	110
	U (total) (Ci)	6.7	6.7	6.7
VZ Remaining (non-rad)	CCl4 (kg)	1300[(d)]	1300[(d)]	1300[(d)]
	Cr (kg)	16000[(e)]	16000[(e)]	16000[(e)]
	Cr-VI (kg)	16000[(e)]	16000[(e)]	16000[(e)]
	Hg (kg)	17	17	17
	NO3 (kg)	2000000	2000000	2000000
	Pb (kg)	150	150	150
	U (total) (kg)	2900	2900	2900
VZ Treatment (rad)	I-129 (Ci)	2.40E-10	2.40E-10	2.40E-10
	Tc-99 (Ci)	3.3	3.3	3.3
VZ Treatment and other sinks (non-rad)	CCl4 (kg)	350[(d)]	350[(d)]	350[(d)]
	Cr (kg)	10	10	10
	Cr-VI (kg)	10	10	10
Saturated Zone (from Vadose Zone Sources)				
SZ Inventory (rad)	I-129 (Ci)	0.00035	0.00035	0.00035
	Tc-99 (Ci)	1.1	1.1	1.1
SZ Inventory (non-rad)	Cr (kg)	0	0	0
	Cr-VI (kg)	11	11	11

a. Tanks (SST and DST): Best Basis Inventory (BBI) February 2017; Ancillary Equipment (Anc Eq): Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix D; Unplanned Releases (UPRs): Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0); Ponds: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0); Cribs: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0); Trenches: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0) and Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix S; Leaks: Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix D; MUSTs: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0) and Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix S.

b. All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

c. 99% and 90% Retrieval Scenarios reflect assumptions described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 and apply only to tank volumes and inventories. They are calculated assuming retrieval of a fully mixed tank of homogeneous composition. For tanks that have been declared "Retrieval Completed" or "Retrieved to Limit of … Technologies" (Templeton, AM 2016, page 9, partially duplicated in Table E.1-7), no further retrieval for either the 99% or 90% retrieval scenario is assumed. This includes tank 241-S-112 and all C Tank Farm tanks except 241-C-105. For tanks that are currently undergoing retrieval (tanks 241-AY-102 and 241-C-105), a retrieval amount equivalent to the 99% and 90% retrieval volumes described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 are calculated.

d. The only sink other than treatment that was considered for the Report (because estimates were available in literature) was the loss of carbon tetrachloride (CCl_4) to the atmosphere. This sink would likely apply to other contaminants (e.g., tritium), but estimates were not available. Other sinks are likely; however, either estimates were not significant or not available. A total of 21% (or 350 kg) of the original carbon tetrachloride inventory (CCl_4) was assumed loss to atmosphere as described in the Methodology Report (CRESP 2015a). The amount lost is highly uncertain; a range of 21 to 38% was estimated (DOE/RL-2007-22 2007, p. 4-3).

e. Differences in inventories for Cr vs Cr-IV are due to differing Water Quality Standards (WQS) and thus plume extents: 100 mg/L for total chromium vs 48 mg/L for chromium (VI). The difference is not distinguishable within the number of significant digits (2) displayed.

Table E.4-3. Current Bulk Inventory and Steady State Flammability Results (by Tank) for the TX-TY Tank Farms (CP-TF-3)

Tank ID	Tank Type	Capacity (kGal)[a]	Sludge (kGal)[a]	Saltcake (kGal)[a]	Supernatant (kGal)[a]	HGR (ft^3/d)[b]	Days to 25% LFL Barometric[c]	Days to 25% LFL Zero Ventilation[d]
TX-101	SST	758	73	13	0	0.5	NA	>1826
TX-102	SST	758	2	211	0	0.58	NA	1810
TX-103	SST	758	0	144	0	0.45	NA	>1826
TX-104	SST	758	34	33	2	0.43	NA	>1826
TX-105	SST	758	11	560	0	1.5	NA	382
TX-106	SST	758	5	337	0	0.71	NA	1231
TX-107	SST	758	0	27	0	0.34	NA	>1826
TX-108	SST	758	6	112	0	0.4	NA	>1826
TX-109	SST	758	359	0	0	0.93	NA	891
TX-110	SST	758	37	425	0	0.82	NA	713
TX-111	SST	758	43	316	0	0.71	NA	1096
TX-112	SST	758	0	627	0	0.92	NA	515
TX-113	SST	758	93	545	0	0.82	NA	608
TX-114	SST	758	4	518	0	0.74	NA	770
TX-115	SST	758	8	536	0	0.83	NA	616
TX-116	SST	758	66	533	0	0.65	NA	878
TX-117	SST	758	29	597	0	1.6	NA	313
TX-118	SST	758	0	247	0	1	NA	913
TY-101	SST	758	59	46	0	0.93	NA	1261
TY-102	SST	758	0	64	8	0.88	NA	1407
TY-103	SST	758	101	51	0	0.59	NA	>1826
TY-104	SST	758	41	0	1	0.89	NA	1423
TY-105	SST	758	231	0	0	0.78	NA	1284
TY-106	SST	758	16	0	0	0.34	NA	>1826

a. Volumes from the Waste Tank Summary Report for Month Ending November 30, 2016 (Templeton, AM 2016).

b. Hydrogen generation rate (ft^3/d) (RPP-5926 Rev. 17). Note in 2001 all 24 tanks were removed from the flammable gas watch list (including T-110 in the T Tank and Waste Farms EU) (Johnson, et al. 2001, p. iii).
c. Time (in days) to 25% of the Lower Flammability Limit (LFL) under a barometric (barom) breathing scenario (RPP-5926, Rev. 17). "NA" indicates that the headspace will not reach specified flammability level.
d. Time (in days) to 25% of the LFL under a zero ventilation scenario (RPP-5926, Rev. 17).

Table E.4-4. Current Primary Contaminant Inventory (by Tank) for the TX-TY Tank Farms (CP-TF-3) [(a)]

Tank ID	Baseline Status[(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)
TX-101	2001	160	0.53	NR[(c)]	1.1	35000	0.11	6.5	5.3
TX-102	2001	140	2.0	NR	4.2	93000	0.56	27	6.4
TX-103	2001	110	1.5	NR	3.3	57000	0.43	21	5.0
TX-104	2001	70	0.42	NR	1.7	29000	0.14	8.1	3.1
TX-105	2001	900	7.5	NR	43	230000	3.0	180	38
TX-106	2001	280	3.7	NR	7.9	140000	1.0	50	12
TX-107	2001	300	0.36	NR	0.65	15000	0.12	5.8	1.9
TX-108	2001	89	1.2	NR	2.6	39000	0.34	16	4.0
TX-109	2001	620	0.44	NR	0.090	28000	0.0051	0.31	0.58
TX-110	2001	330	4.5	NR	9.4	120000	1.2	58	15
TX-111	2001	280	3.7	NR	7.8	110000	1.0	48	12
TX-112	2001	520	7.1	NR	15	210000	2.0	94	24
TX-113	2001	26	9.6	NR	11	29000	3.8	41	49
TX-114	2001	380	5.1	NR	11	140000	1.4	68	17
TX-115	2001	380	5.3	NR	11	200000	1.5	70	17
TX-116	2001	260	3.7	NR	20	120000	1.5	87	20
TX-117	2001	440	6.0	NR	34	180000	2.4	140	31
TX-118	2001	5700	2.5	NR	12	78000	1.0	95	13
TY-101	2001	8.2	0.33	NR	0.0064	160	0.0011	0.073	0.16
TY-102	2001	0.98	0.19	NR	0.046	8900	0.12	5.6	1.5
TY-103	2001	22	0.56	NR	0.096	25000	0.11	5.3	1.4
TY-104	2001	20	0.74	NR	0.0025	6900	0.00043	0.030	0.076
TY-105	2001	10	0.10	NR	0.012	6400	0.0030	0.15	1.2
TY-106	2001	1.4	0.011	NR	0.0034	4500	0.00046	0.029	0.19

a. From Best Basis Inventory (BBI) Summary (February 2017). All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.
b. This is the “Baseline Status” date as reported in the BBI (February 2017) as “Baselined 2001.” It should not be necessarily be considered the decay date for isotope inventories.
c. NR = Not reported for this EU

Table E.4-5. Current Primary Contaminant Inventory[a] and Groundwater Threat Metric (by Tank) for the TX-TY Tank Farms (CP-TF-3)

Tank ID	I-129 (Ci)	Ni-59 (Ci)	Ni-63 (Ci)	Pu (total) (Ci)[b]	Sr-90 (Ci)	Tc-99 (Ci)	U (total) (Ci)[c]	GTM (Mm3)[d]
TX-101	0.018	2.3	200	530	180000	14	5.1	15
TX-102	0.11	7.8	670	150	1500	110	3.8	120
TX-103	0.070	6.1	530	120	450	67	1.0	75
TX-104	0.021	1.7	160	100	66000	20	0.58	22
TX-105	0.26	30	2700	2000	6300	240	15	270
TX-106	0.17	15	1300	300	9700	160	3.8	180
TX-107	0.018	1.3	110	310	820	16	0.19	17
TX-108	0.050	4.8	420	94	3000	47	3.5	52
TX-109	0.00098	0.024	3.2	2500	8400	47	2.4	52
TX-110	0.17	18	1500	360	1900	160	3.2	180
TX-111	0.14	15	1300	310	1800	140	2.7	150
TX-112	0.28	28	2500	550	2000	260	4.8	290
TX-113	0.31	38	3500	76	4900	300	1.9	330
TX-114	0.19	21	1800	410	1500	180	3.6	200
TX-115	0.24	21	1800	400	5200	230	3.8	260
TX-116	0.16	15	1300	410	1200	160	3.4	170
TX-117	0.21	24	2200	590	2000	200	4.6	220
TX-118	0.11	9.9	900	9200	170000	110	2.4	120
TY-101	0.00086	0.24	21	130	4700	4.7	0.99	5.2
TY-102	0.011	1.7	150	0.84	800	8.2	0.076	9.1
TY-103	0.027	1.6	130	200	48000	30	15	33
TY-104	0.00038	0.078	6.3	50	17000	8.4	3.5	9.4
TY-105	0.046	0.027	2.1	35	150000	44	4.9	49
TY-106	0.00022	0.0028	0.24	2.1	9600	1.1	0.35	1.2

a. From Best Basis Inventory (BBI) Summary (February 2017). All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

b. Sum of plutonium isotopes 238, 239, 240, 241, and 242

c. Sum of uranium isotopes 232, 233, 234, 235, 236, and 238
d. The Groundwater Threat Metric (GTM) shown for tanks is equal to the maximum of the GTM for Tc-99 and I-129.

Table E.4-6. Current Primary Contaminant Inventory (by Tank) for the TX-TY Tank Farms (CP-TF-3) [a]

Tank ID	CCl4 (kg)	CN (kg)	Cr (kg)	Cr-VI (kg)	Hg (kg)	NO3 (kg)	Pb (kg)	TBP (kg)	TCE (kg)	U (total) (kg)
TX-101	NR[b]	NR	1500	NR	13	78000	37	NR	NR	7500
TX-102	NR	NR	1600	NR	1.6	420000	96	NR	NR	4700
TX-103	NR	NR	1200	NR	0.79	280000	69	NR	NR	620
TX-104	NR	NR	1100	NR	4.7	110000	32	NR	NR	360
TX-105	NR	NR	5300	NR	6	1200000	260	NR	NR	17000
TX-106	NR	NR	2900	NR	2.7	700000	160	NR	NR	3600
TX-107	NR	NR	490	NR	0.23	69000	12	NR	NR	120
TX-108	NR	NR	910	NR	2.7	250000	66	NR	NR	4600
TX-109	NR	NR	1600	NR	0.72	240000	380	NR	NR	3600
TX-110	NR	NR	3400	NR	2.1	950000	240	NR	NR	2500
TX-111	NR	NR	2900	NR	1.8	730000	200	NR	NR	2000
TX-112	NR	NR	5200	NR	3.9	1400000	340	NR	NR	3100
TX-113	NR	NR	1600	NR	4.5	1700000	360	NR	NR	1600
TX-114	NR	NR	3800	NR	4	1100000	350	NR	NR	2600
TX-115	NR	NR	4100	NR	5.4	1200000	280	NR	NR	3200
TX-116	NR	NR	1300	NR	13	1600000	980	NR	NR	2900
TX-117	NR	NR	4300	NR	8.4	1300000	660	NR	NR	3000
TX-118	NR	NR	3200	NR	1.1	120000	180	NR	NR	1300
TY-101	NR	NR	5300	NR	54	110000	160	NR	NR	1700
TY-102	NR	NR	82	NR	0.99	140000	26	NR	NR	67
TY-103	NR	NR	930	NR	60	150000	480	NR	NR	17000
TY-104	NR	NR	370	NR	27	14000	160	NR	NR	5500
TY-105	NR	NR	180	NR	110	240000	510	NR	NR	7200
TY-106	NR	NR	4.2	NR	0.019	14000	23	NR	NR	520

a. From Best Basis Inventory (BBI) Summary (February 2017). All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

b. NR = Not reported for this EU

Table E.4-7. Summary of the Evaluation of Current Threats to Groundwater as a Protected Resource from Remaining Vadose Zone (VZ) Contamination associated with the TX-TY Tank and Waste Farms Evaluation Unit (CP-TF-3)

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 $M^{Tot\ (d)}$	VZ GTM (Mm^3)	VZ Rating[e]
C-14	A	2000 pCi/L	0.23	0	1.84	2.02E+01 Ci	---	---	2.02E+01 Ci	1.01E+01	*Medium*
I-129	A	1 pCi/L	0.23	0.2	1.84	2.43E-01 Ci	3.49E-04 Ci	2.42E-10 Ci	2.43E-01 Ci	9.34E+01	*Medium*
Sr-90	B	8 pCi/L	0.23	22	1.84	6.17E+04 Ci	---	---	6.17E+04 Ci	4.36E+04	*ND*[f]
Tc-99	A	900 pCi/L	0.23	0	1.84	1.13E+02 Ci	1.09E+00 Ci	3.34E+00 Ci	1.09E+02 Ci	1.21E+02	*High*
CCl_4	A	5 µg/L	0.23	0	1.84	1.66E+03 kg	---	---	1.31E+03 kg	2.63E+02	*High*
Cr	B	100 µg/L	0.23	0	1.84	1.57E+04 kg	---	1.03E+01 kg	1.57E+04 kg	1.57E+02	*High*
Cr-VI	A	48 µg/L	0.23	0	1.84	1.57E+04 kg	1.07E+01 kg	1.03E+01 kg	1.57E+04 kg	3.26E+02	*High*
TCE	B	5 µg/L	0.23	2	1.84	---	---	---	---	---	*ND*
U(tot)	B	30 µg/L	0.23	0.8	1.84	2.88E+03 kg	---	---	2.88E+03 kg	1.30E+01	*ND*[f]

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

b. "Model Toxics Control Act−Cleanup" (WAC 173-340) Method B groundwater cleanup level for hexavalent chromium. Other WQS values represent drinking water standards.

c. Treatment amounts from the 2015 Hanford Annual Groundwater Report (DOE/RL-2016-09, Rev. 0). Groundwater contamination is being treated in the area using the 200 West Pump and Treat Facility.

d. The remaining vadose zone inventory is estimated by difference (CRESP 2015a; Appendix D.1) and thus has a high associated uncertainty.

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

f. As discussed in Section E.4.5, no appreciable total uranium or Sr-90 plume would be expected in the next 150 years due to transport and decay (Sr-90) considerations. Thus the *Low* rating would apply to the period after the Active Cleanup is complete to account for uncertainties.

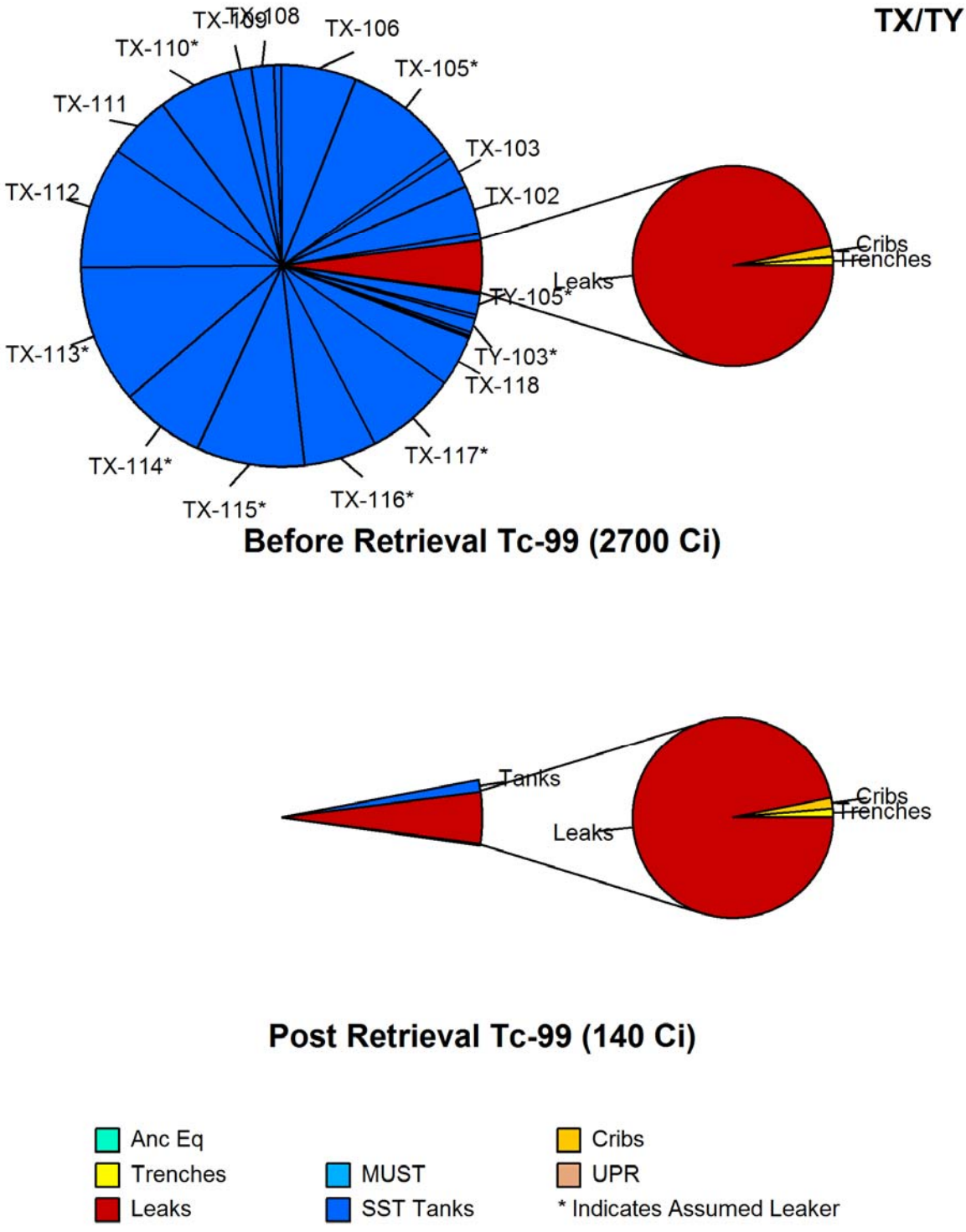


Figure E.4-3. TX-TY Tank and Waste Farms Evaluation Unit Inventory Estimates for Tc-99 Before and After 99% Retrieval

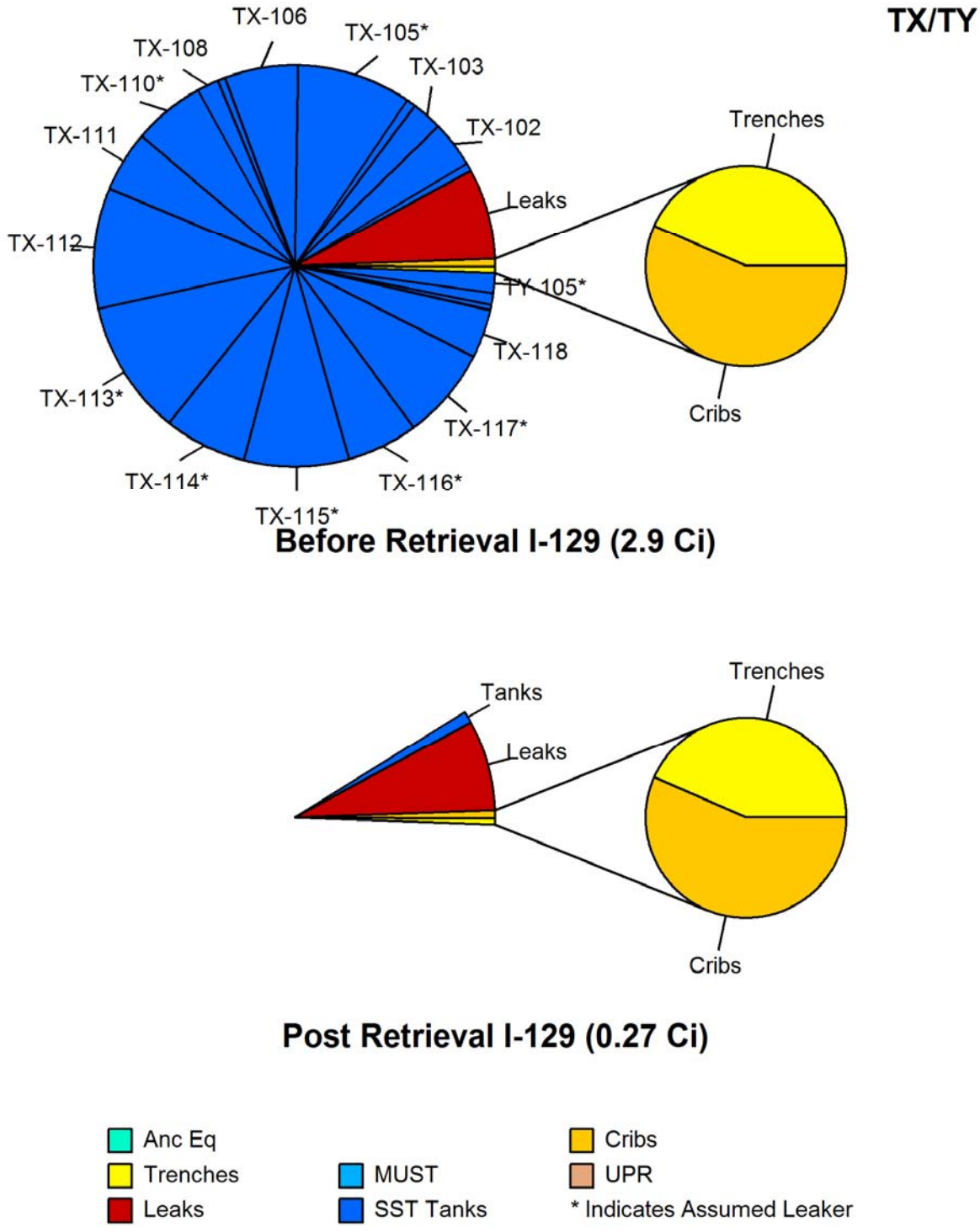


Figure E.4-4. TX-TY Tank and Waste Farms Evaluation Unit Inventory Estimates for I-129 Before and After 99% Retrieval

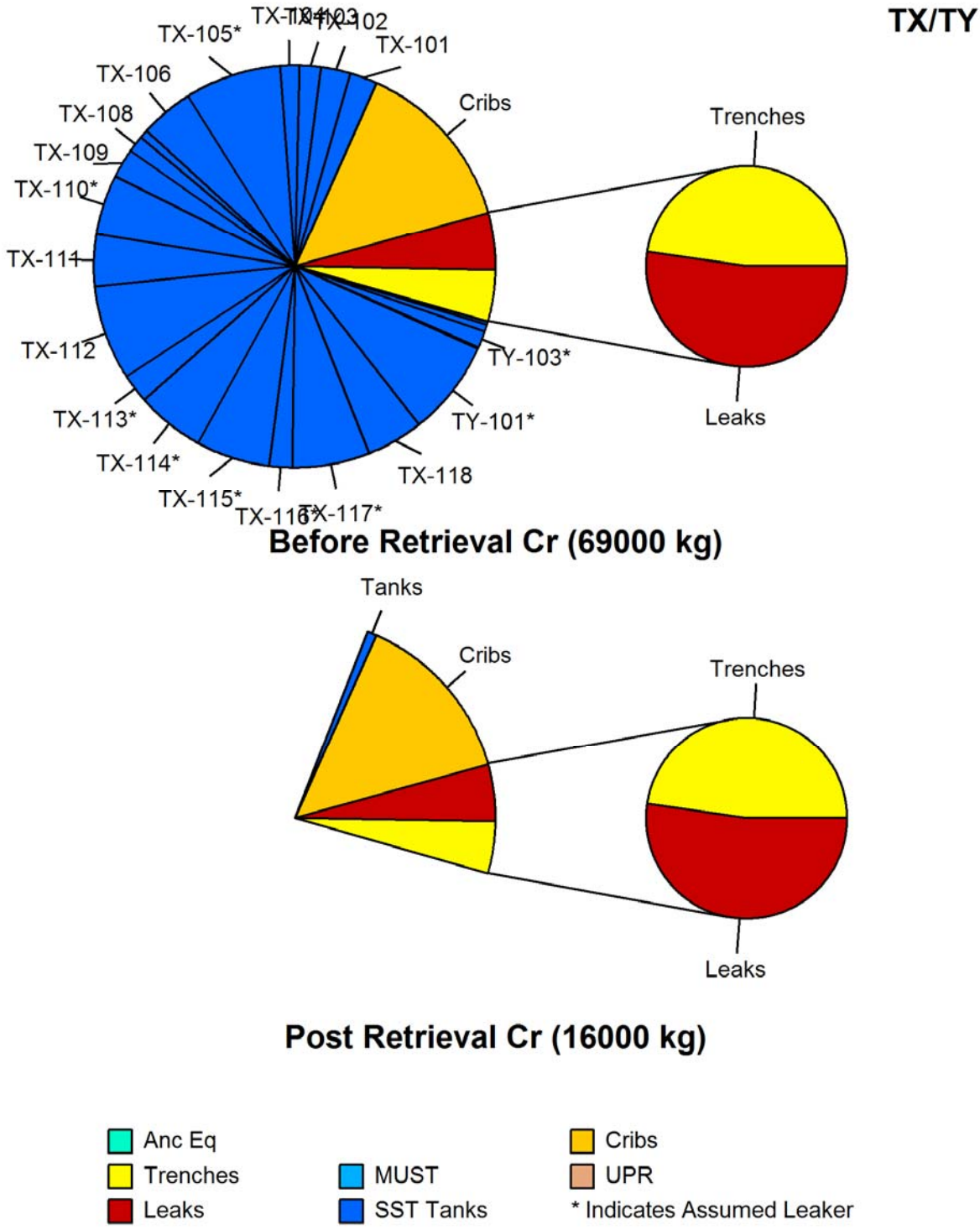


Figure E.4-5. TX-TY Tank and Waste Farms Evaluation Unit Inventory Estimates for Chromium Before and After 99% Retrieval

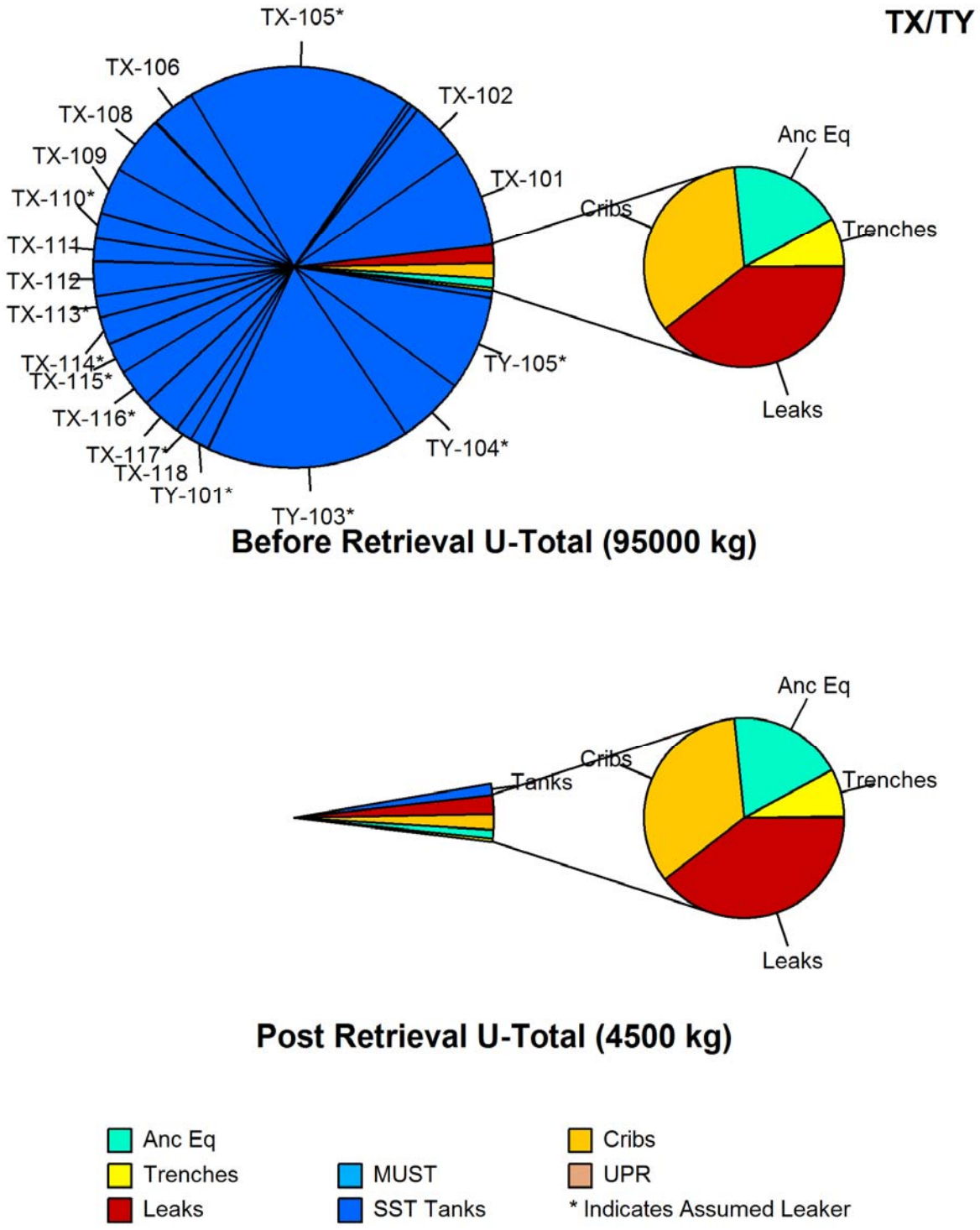


Figure E.4-6. TX-TY Tank and Waste Farms Evaluation Unit Inventory Estimates for U(tot) Before and After 99% Retrieval

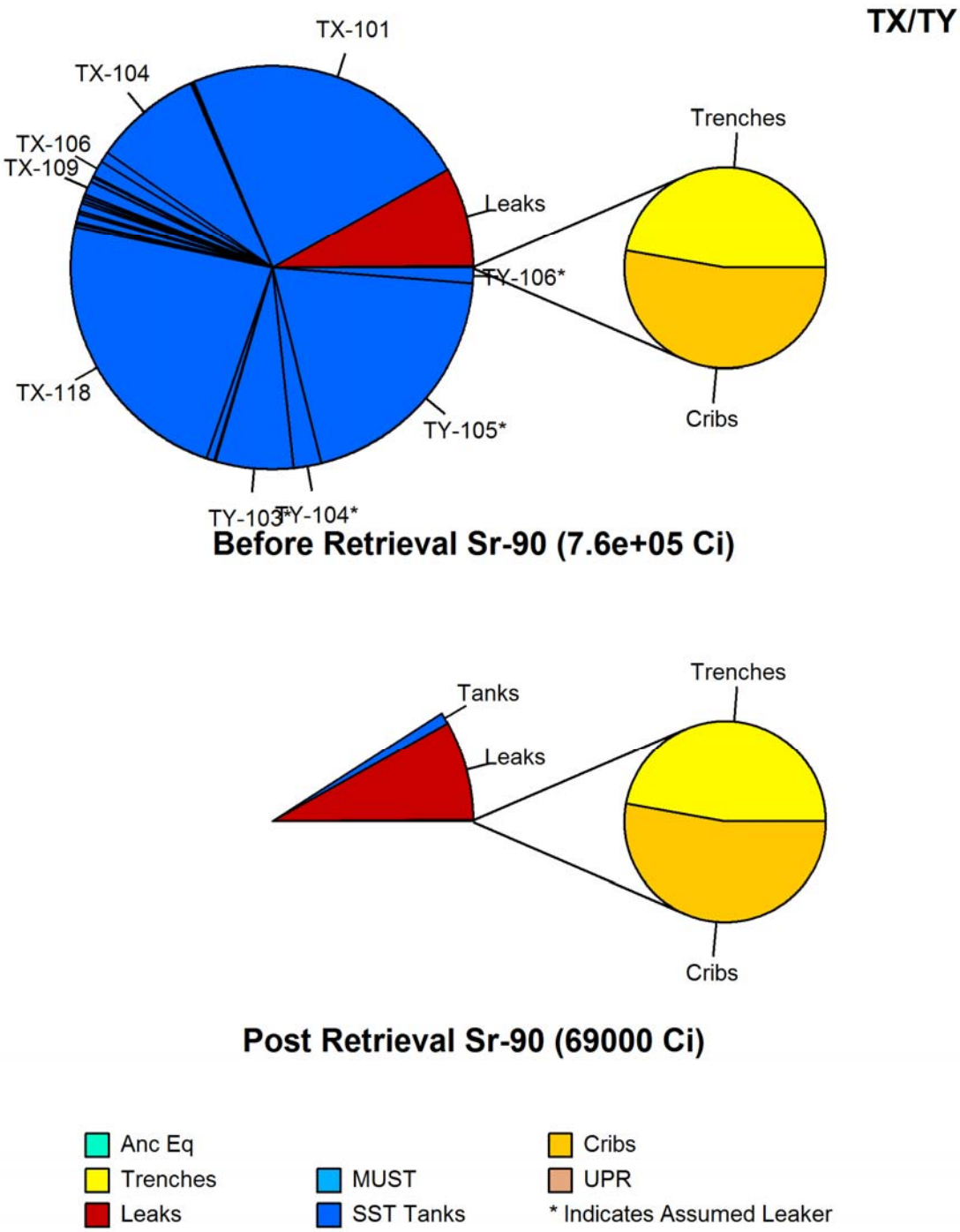


Figure E.4-7. TX-TY Tank and Waste Farms Evaluation Unit Inventory Estimates for Sr-90 Before and After 99% Retrieval

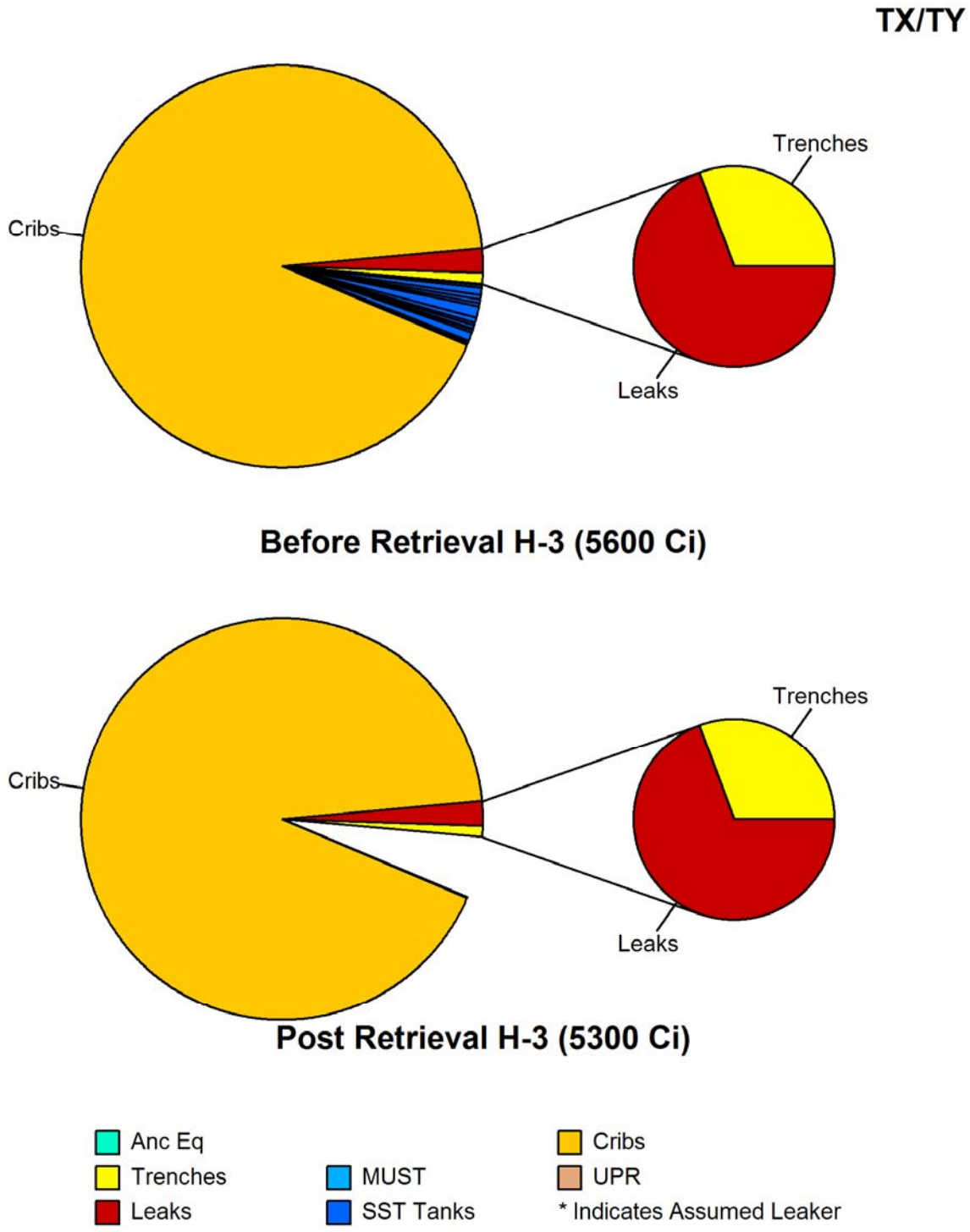


Figure E.4-8. TX-TY Tank and Waste Farms Evaluation Unit Inventory Estimates for Tritium (H-3) Before and After 99% Retrieval

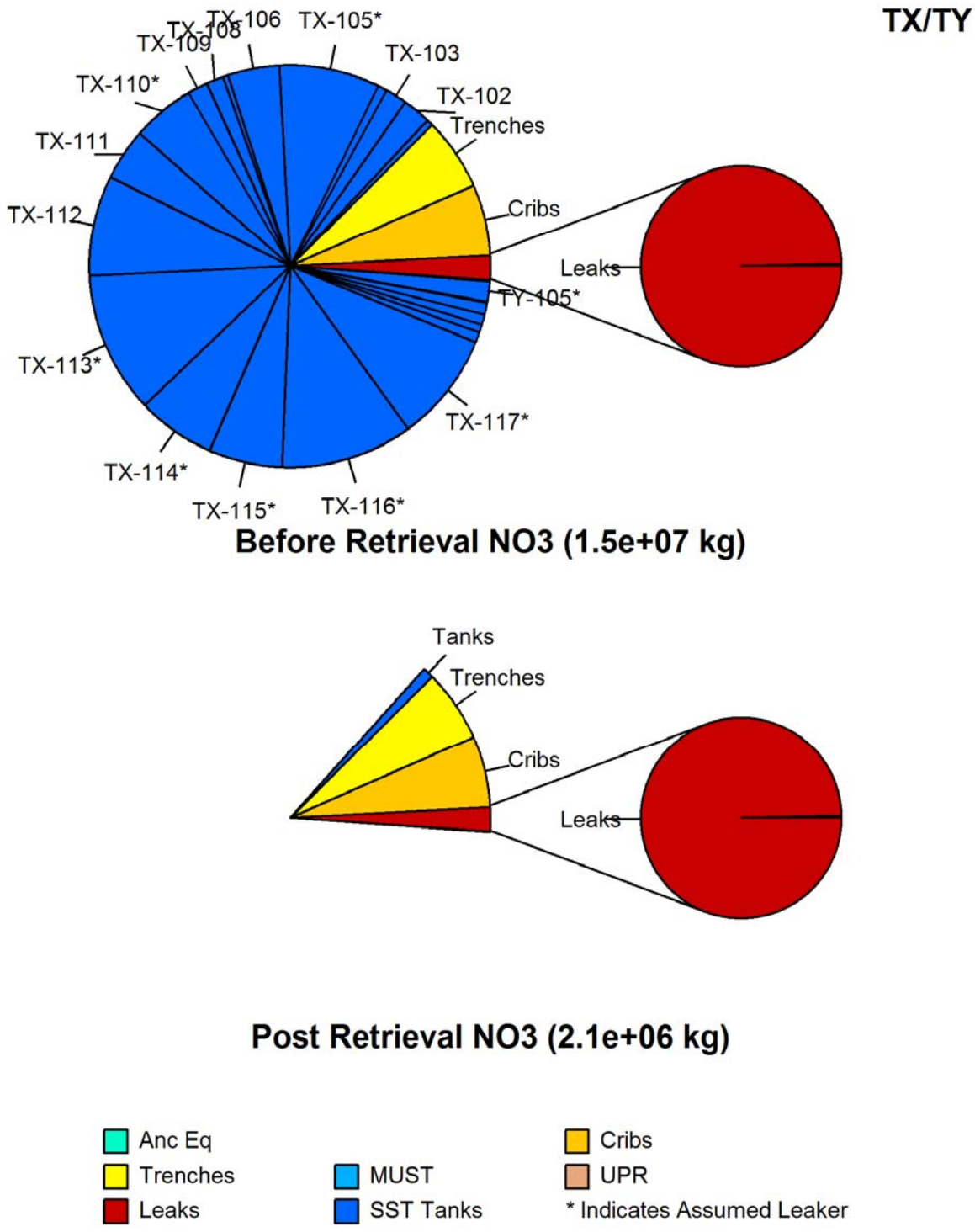


Figure E.4-9. TX-TY Tank and Waste Farms Evaluation Unit Inventory Estimates for Nitrate (NO3) Before and After 99% Retrieval

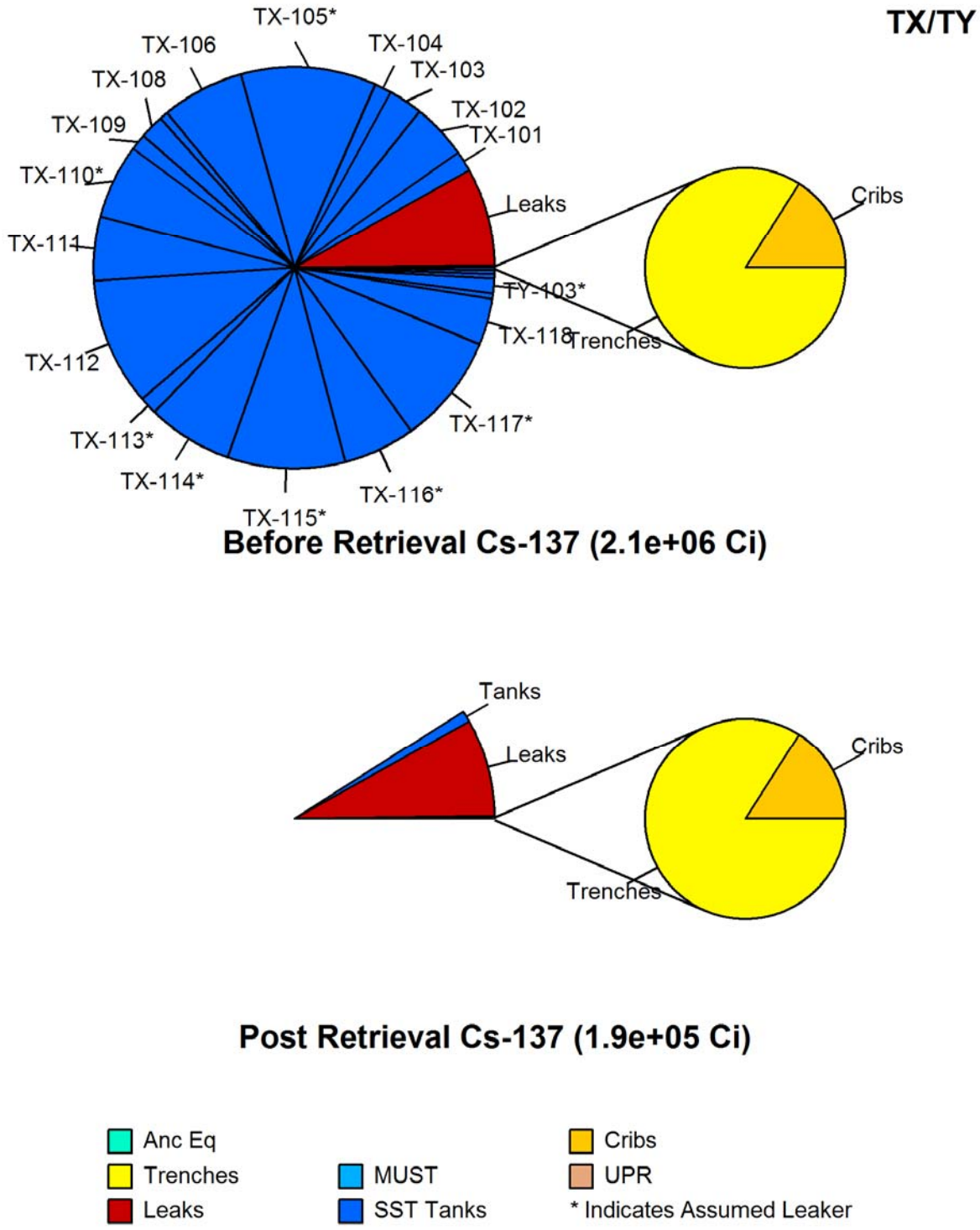


Figure E.4-10. TX-TY Tank and Waste Farms Evaluation Unit Inventory Estimates for Cs-137 Before and After 99% Retrieval

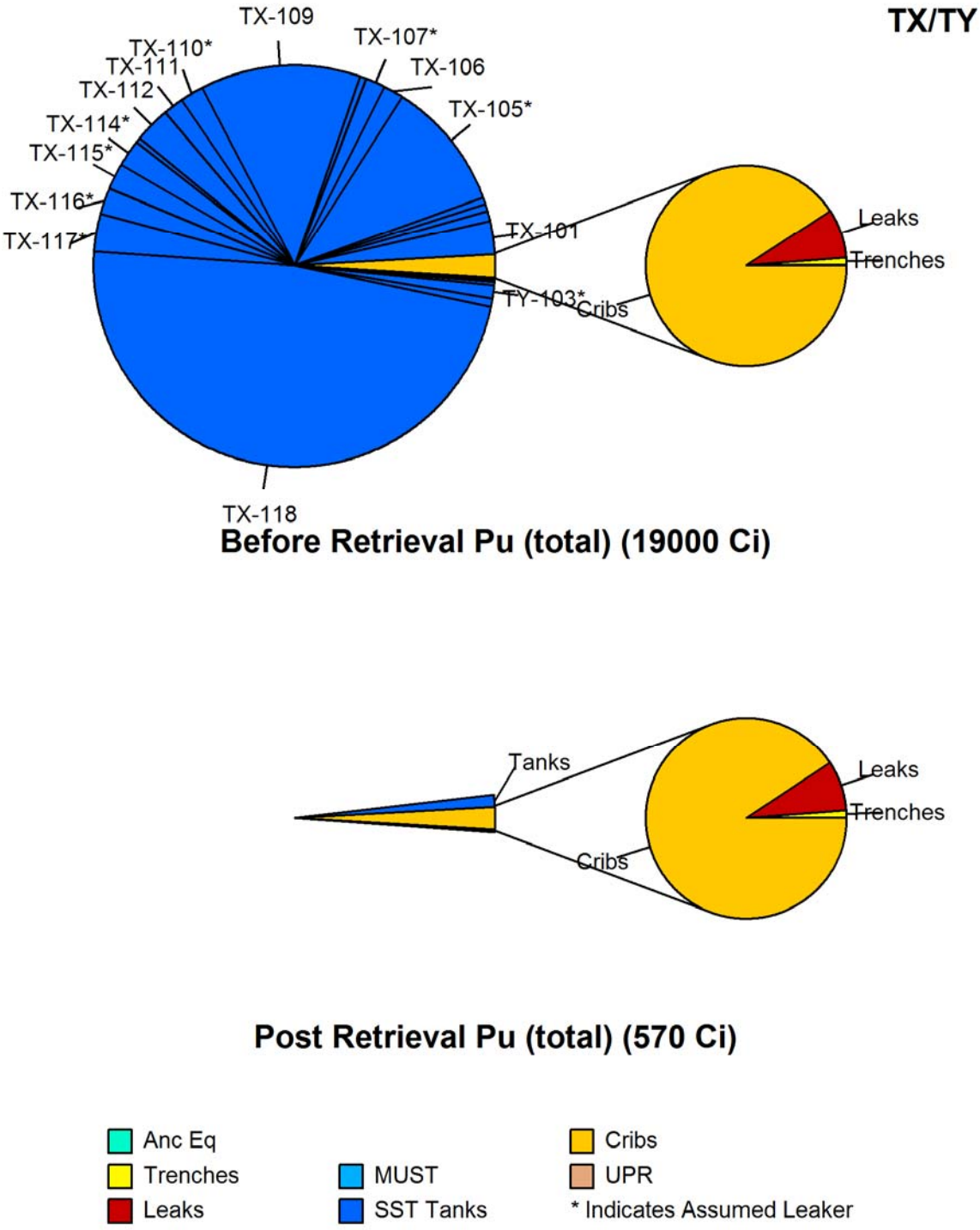


Figure E.4-11. TX-TY Tank and Waste Farms Evaluation Unit Inventory Estimates for Plutonium (total) Before and After 99% Retrieval

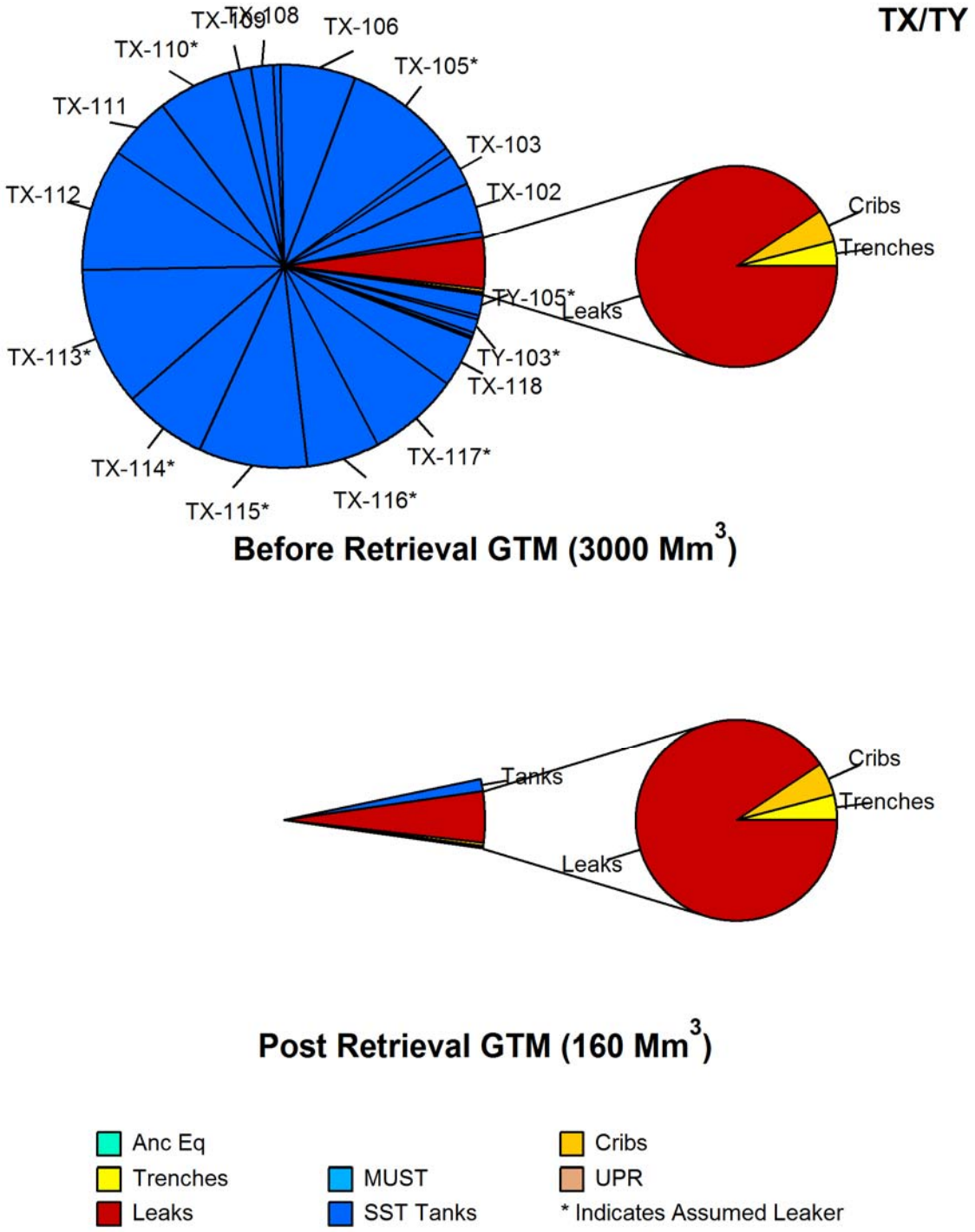


Figure E.4-12. TX-TY Tank and Waste Farms Evaluation Unit Maximum Groundwater Threat Metric (GTM) of the I-129 and Tc-99 Estimates Before and After 99% Retrieval

E.4.6. POTENTIAL RISK/IMPACT PATHWAYS AND EVENTS

CURRENT CONCEPTUAL MODEL

A common safety analysis was performed for all the single- and double-shell tanks including pathways and barriers (safety scenarios that dominate risk, safety systems and controls, barriers to release, failure mechanisms, pathways and receptors, time frames for exposure). See Section E.1.6 in Appendix E.1 for details.

POPULATIONS AND RESOURCES CURRENTLY AT RISK OR POTENTIALLY IMPACTED

Facility Worker, Co-located Person, and Public

A common analysis was performed for the Facility Worker, Co-located Person, and Public. See Section E.1.6 (Appendix E.1) for details.

Groundwater and Vadose Zone

The groundwater plumes for the Group A and B primary contaminants (i.e., Tc-99, I-129, and chromium) associated with the TX-TY Tank and Waste Farms EU and liquid waste disposal facilities are described in Section E.4.5 and further details are provided in the Appendix D.6 for the CP-GW-2 EU (200-ZP GWIA).

As shown in Table E.4-7 (Section E.4.5), the vadose zone (VZ) GTM values for the Group A and B primary contaminants translate into ratings from *Not Discernible* (*ND*) for total uranium and Sr-90 (where the ratings would be *Low* after the Active Cleanup period to account for uncertainties as described in Section E.4.5) to *Medium* for C-14 and I-129 to *High* for Tc-99, carbon tetrachloride, and chromium (total and hexavalent) for the TX-TY Tank and Waste Farms EU. Thus the overall rating for groundwater impact from vadose zone sources is *High*.

Columbia River

As described in Section E.4.5, no plumes associated with the TX-TY Tank and Waste Farms EU currently intersect the Columbia River above benthic or riparian standards, which corresponds to *Not Discernible* ratings. The large dilution effect of the Columbia River results in a rating of *Not Discernible* for the free-flowing ecology.

Additional information concerning potential threats to the Columbia River from TX-TY Tank Farm and liquid waste disposal facilities is provided in Appendix D.6 for the CP-GW-2 EU (200-ZP GWIA).

Ecological Resources

- No species of concern were found within the EU.
- Much of the EU (~55 acres) is graveled, or has been previously disturbed by ongoing operations and the installation and operation of various pump and treat wells and remaining habitat occurs in strips and patches surrounded by roads and infrastructure.
- Wildlife sign observed during the October field survey included coyote tracks, rabbit tracks, small mammal burrows, and harvester ant hills; previous surveys identified side-blotched lizard, western meadowlark, rock dove, and northern pocket gopher in the vicinity.
- The TX-TY Tank and Waste Farms EU is adjacent and contiguous to other tank farms and waste site EUs.

- Level 3 habitat within the EU does not connect to any level 2 or level 3 habitat lying outside the 200 West Area. Potential loss of level 2 and level 3 habitats within the EU would not be likely to affect habitat connectivity at the landscape scale.

Cultural Resources

- The 241 TY and 241 TX Waste Disposal Tank Farm are contributing properties within the Manhattan Project and Cold War Era Historic District, with documentation required, are located within the TX-TY Tank and Waste Farms EU.
- Segment C, a non-contributing portion of a National Register-eligible historic/ethnohistoric Trail/Road passes through the TX-TY Tank and Waste Farms EU.
- Portions of the Hanford Site Plant Railroad, a contributing property within the Manhattan Project and Cold War Era Historic District, with documentation required are located inside the TX-TY Tank and Waste Farms EU.

Archaeological sites and TCPs located within 500 meters of the EU

- One isolated find and one site associated with the Pre-Hanford Farming Landscape and one isolated find associated with the Native American Precontact and Ethnohistoric Landscape are located within 500 meters of the TX-TY Tank and Waste Farms EU. None of these items are considered to be eligible to the National Register of Historic Places.

Closest Recorded TCP

There are two TCPs that have been recorded that are associated with the Native American Precontact and Ethnohistoric Landscape that are visible form the TX-TY Tank and Waste Farms EU.

CLEANUP APPROACHES AND END-STATE CONCEPTUAL MODEL

Selected or Potential Cleanup Approaches

A common analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

Contaminant Inventory Remaining at the Conclusion of Planned Active Cleanup Period

See Section E.4.5 including Table E.4-2 and Figure E.4-3 through Figure E.4-11 for the inventory information after planned 99% retrieval. Furthermore, a more general analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

Risks and Potential Impacts Associated with Cleanup

A common analysis was performed for all the single- and double-shell tanks for workers and the Public. See Section E.1.6 (Appendix E.1) for details.

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

Facility Worker, Co-located Person, and Public

A common analysis was performed for the Facility Worker, Co-located Person, and Public. See Section E.1.6 (Appendix E.1) for details.

Groundwater

As described in Section E.4.5, there will be a continuing impact during this period to groundwater (as a protected resource) from those mobile TX-TY Tank Farm primary contaminants currently with plumes

that exceed thresholds. These impacts are described in Appendix D.6 for the CP-GW-2 EU (200-ZP GWIA).

Furthermore, there are primary (e.g., tank wastes) and secondary contaminant sources (legacy source sites) in the vadose zone that pose risk to groundwater. The vadose zone (VZ) GTM values for the Group A and B primary contaminants for the TX-TY Tank Farm EU translate to ratings of *Not Discernible* (*ND*) for total uranium and Sr-90[75], *Medium* for C-14 and I-129, and *High* for Tc-99, carbon tetrachloride, and chromium (total and hexavalent). As indicated in Section E.4.5, the Sr-90 (with an inventory that would translate to a *Very High* rating all other things being equal) or total uranium (that would correspond to a *Medium* rating) is unlikely to impact the groundwater in sufficient quantity to exceed the drinking water standard and thus neither is a future threat. The overall rating is *High* and be related to Tc-99, carbon tetrachloride, and chromium (total and hexavalent) in the vadose zone.

The 200 West Area P&T system is assumed to be operational during this evaluation period, which will be treating groundwater contamination in the area.

It is considered unlikely that additional groundwater resources would be impacted as a result of either interim remedial actions (e.g., pump and treat) or final closure activities (that are not covered in the Ecological or Cultural Resources results).

Columbia River

As described in Section E.4.5, the impacts to the Columbia River benthic, riparian, and free-flowing ecology for the Active Cleanup and Near-term, Post Cleanup periods are rated as *Not Discernible*. Additional information on groundwater plumes and potential threats associated with the T Tank Farm and liquid waste disposal facilities are described in Appendix D.6 for the CP-GW-2 EU (200-ZP GWIA).

It is considered unlikely that additional benthic or riparian resources would be impacted as a result of either interim remedial actions (e.g., pump and treat) or final closure activities (that are not covered in the Ecological or Cultural Resources results).

Ecological Resources

See Section E.1.6 (Appendix E.1) for details.

Cultural Resources

See Section E.1.6 (Appendix E.1) for details.

ADDITIONAL RISKS AND POTENTIAL IMPACTS IF CLEANUP IS DELAYED

A common analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

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

A common analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

[75] Note that no appreciable uranium or Sr-90 plume would be expected in the next 150 years due to transport considerations; however, these may impact groundwater after the 150-year period. Thus a *Low* rating would apply after the Active Cleanup period to account for uncertainties.

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

Table E.4-8. Summary of Populations and Resources at Risk or Potentially Impacted after Cleanup

Population or Resource		Impact Rating	Comments
Human	Facility Worker	Low	Workers will be low risk from exposure to direct radiation and waste contaminants after waste retrieval, grouting, and capping.
	Co-located Person	Low	These persons will be at low risk from exposure to direct radiation and waste contaminants after waste retrieval, grouting, and capping.
	Public	Not Discernible	The Tank Farms will be in secure and controlled areas that prevent intentional and inadvertent intruders. No complete groundwater pathway and no impact from air pathway.
Environmental	Groundwater (A&B) from vadose zone[a]	*Low* (Sr-90, U(tot)) *Medium* (C-14, I-129) *High* (Tc-99, CCl_4, Cr(tot), Cr-VI) **Overall**: *High*	Current GTM values for Group A and B primary contaminants (Table E.4-7): *ND* (U(tot), Sr-90), *Medium* (C-14, I-129) and *High* (Tc-99, CCl4, and total / hexavalent chromium). Sr-90 and U(tot) (which otherwise would have *Very High* and *Medium* ratings, respectively) not likely to impact groundwater (Section E.4.5). These assigned *Low* ratings here to address uncertainty. Insufficient predicted impact from decay (since Tc-99, CCl_4, and total / hexavalent chromium are risk drivers) or changes in recharge rates to adjust ratings. Treatment in 200 West P&T Facility does not change vadose zone threats.
	Columbia River from vadose zone[a]	Benthic: Not Discernible Riparian: Not Discernible Free-flowing: Not Discernible **Overall**: Not Discernible	TC&WM EIS screening results indicate that exposure to radioactive and chemical contaminants from peak groundwater discharge below benchmarks for both benthic and riparian receptors (Section E.4.5). Dilution factor of greater than 100

Population or Resource		Impact Rating	Comments
			million between River and upwellings.
	Ecological Resources[b]	ND to Low	It will be capped, which results in less frequent monitoring, but monitoring activities can cause some disruption and disturbance to EU and buffer areas. Remediation may improve habitat through re-vegetation (and increased monitoring may lead to increases in exotic species, and changes in species composition).
Social	Cultural Resources[b]	**Native American:** Direct: Known Indirect: Known **Historic Pre-Hanford:** Direct: Known Indirect: Known **Manhattan/Cold War**: Direct: None Indirect: None	Permanent indirect effects to viewshed are possible from capping. Permanent effects may be possible due to presence of contamination if capping occurs. No other expected cultural resources impacts.

a. Groundwater threat for Group A and B contaminants remaining in the vadose zone or to the Columbia River for all primary contaminants. Threats from existing plumes associated with the TX-TY Tank and Waste Farms EU are described in Section E.4.5 and Appendix D.6 (CP-GW-2) for the 200-ZP Groundwater Interest Area.

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

As described in Section E.4.5, the TC&WM ecological screening analysis indicate that that exposure to radioactive contaminants from peak groundwater discharge was below screening levels at the Columbia River near-shore region, indicating there should be no expected adverse effects from radionuclides. Furthermore, results of the corresponding TC&WM screening evaluation for chemicals indicated that predicted chromium and nitrate concentrations could exceed screening values (i.e., Hazard Quotient of unity) in the near-shore region. However, the predicted nitrate peak concentration was in the past and would be unlikely to exceed human or aquatic standards in the future. For chromium the long travel time from 200-West to the Columbia River likely indicates that little chromium predicted to impact the near-shore region would be from 200-West sources (including the TX-TY Tank and Waste Farms EU), which would also likely lead to insignificant impacts from the TX-TY Tank and Waste Farms EU.

For more information, see Section E.1.6 (Appendix E.1).

E.4.7. SUPPLEMENTAL INFORMATION AND CONSIDERATIONS

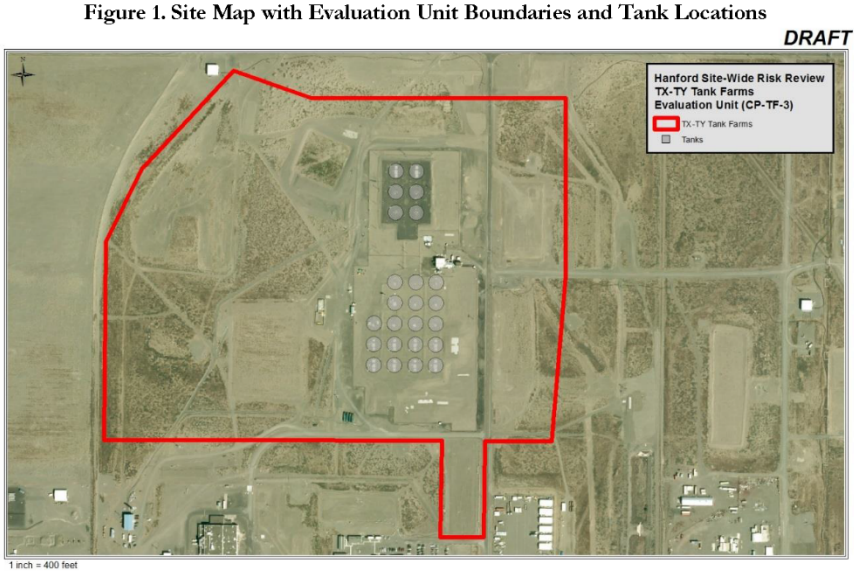
A common analysis was performed for all the single- and double-shell tanks. See Section E.1.7 (Appendix E.1) for details.

E.4.8. ATTACHMENT – TX-TY TANK FARMS EVALUATION UNIT WIDS REVIEW

Hanford Site-Wide Risk Review

Evaluation Unit:	TX-TY Tank Farms
ID:	CP-TF-3
Group:	Tank Farm
Operable Unit Cross-Walk:	WMA TX/TY
	200-DV-1
	200-WA-1
Related EU:	CP-LS-7
	CP-GW-2
Sites & Facilities:	TX-TY tank farms, ancillary structures, associated liquid waste sites, and soils contamination. Includes 242-T Evaporator.
Key Data Sources Docs:	RPP-13033
	RPP-23405
	RPP-23752
	RPP-40545
	RPP-PLAN-40145

Figure 1. Site Map with Evaluation Unit Boundaries and Tank Locations



Attached:

- Waste Site and Facility List
- Site Map with Evaluation Unit Boundaries and Associated Waste Sites
- Site Map with Evaluation Unit Boundaries and Associated Facilities

Prepared by: AMG, 08/29/2014
Reviewed by: GVL, 08/29/2014
Revisions: AMG, 09/10/2014

Hanford Site-Wide Risk Revew
CP-TF-3 (TX-TY Farms)
Waste Site and Facility List

Site Code	Name, Aliases, Description	Site Status	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation
200-W-106	200-W-106; Soil Contamination Area Adjacent to 200-W-55 Dump Site	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	200-WA-1	
200-W-129-PL	200-W-129-PL; Encased Pipeline from 241-T-151 and 241-T-152 to 241-TX-155 Diversion Box; Lines V399, V405 and V411	Inactive	Encased Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-W-130-PL	200-W-130-PL; Lines V445, V663, V601 and V416 and Spare Lines V662, V663, V682 and V683; Pipelines from 241-T-151 and 241-T-152 Diversion Boxes to 241-U-151 Diversion Box	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-W-131-PL	200-W-131-PL; Spur to 241-TX Tank Farm; V601	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-W-165-PL	200-W-165-PL; Pipeline from Tank 241-TX-112 to 207-T Retention Basin	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-W-166-PL	200-W-166-PL; Pipeline from 242-T Evaporator Building to the 207-T Retention Basin	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-W-167-PL	200-W-167-PL; Pipeline from 242-T Evaporator to 207-T Retention Basin	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-W-175-PL	200-W-175-PL; Line V681; Pipeline to Route Waste from 241-T-112 to 216-TY-201 Flush Tank and 216-T-26, 216-T-27 and 216-T-28 Cribs	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200 W 176 PL	200-W-176-PL; Encased Transfer Lines Between 241-TX-153 Diversion Box and 241-TX-155 Diversion Box; Lines V396, V397, V401, V403, V407, V409, and V413	Inactive	Encased Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-W-177-PL	200-W-177-PL; Direct Buried Tank Farm Lines Between 241-TXR-151 and 241-TX-155 Diversion Boxes; Lines V7616 and V7653	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-W-178-PL	200-W-178-PL; Lines HSW-202 and HSW-203; Pipeline from 241-Z to 244-TX DCRT	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-W-188-PL	200-W-188-PL; Waste Distribution Line from 216-TY-201 Flush Tank to 216-T-26, 216-T-27 and 216-T-28 Cribs and Truck Unloading Station Line	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-W-191-PL	200-W-191-PL; Encased Transfer Line Between 241-TX-155 and 241-TY-153 Diversion Boxes; Lines V402, V406, V408 and V412	Inactive	Encased Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-W-213-PL	200-W-213-PL; Lines V795, V606 and V605; Pipelines from 241-TX-153 Diversion Box and 241-TX-302A to 216-T-19 Crib	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-W-232	200-W-232; 2607-WT Replacement Septic Tank and Dry Well	Inactive	Septic Tank	Septic System	TBD	X
200-W-48	200-W-48; 241-TX 90-Day Waste Accumulation Area	Inactive	Storage Pad (<90 day)	Storage Pad	Not Applic	
200-W-55	200-W-55; Dumping Area North of 231-Z	Inactive	Dumping Area	Burial Ground	200-WA-1	
200-W-63	200-W-63; Contaminated Concrete Pad	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	200-WA-1	
200-W-78-PL	200-W-78-PL; 6025; 7624 and 7630; Lines 6012; Pipeline Between 241-TX/TY and 241-T Tank Farms	Inactive	Encased Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-W-82	200-W-82; Crib Unloading Station; Truck Unloading Station, Risers East of 216-TY-201 and 216-T-26, 216-T-27 and 216-T-28 Cribs	Inactive	Product Piping	Pipeline and associated valves, etc.	200-WA-1	
200-W-92	200-W-92; Contaminated Mound of Soil and Debris; Soil Mound West of 241-TY Tank Farm	Inactive	Dumping Area	Burial Ground	200-WA-1	
200-W-94	200-W-94; Contaminated Soil at 241-TX/TY Tank Farm	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	WMA TX/TY	
216-T-13	216-T-13; 269-W Decontamination Pit or Trench; 269-W Regulated Garage; 269-W Regulated Garage Decontamination Pit; 216-T-12	Inactive	Trench	Crib - Subsurface Liquid Disposal Site	200-WA-1	
216-T-18	216-T-18; 241-T-17 Crib; Scavenged TBP Waste; Test Crib for 221-U Building; 216-T-17	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	200-DV-1	
216-T-19	216-T-19; 216-T-19TF; 216-TX-1; 241-TX-153 Crib and Tile Field; 241-TX-3	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	200-DV-1	
216-T-21	216-T-21; 216-TX-1 Grave; 216-TX-3; 241-TX-1 Trench	Inactive	Trench	Crib - Subsurface Liquid Disposal Site	200-DV-1	

Note that only those waste sites with a WIDS (Waste Information Data System) Classification of "Accepted" are shown, along with non-duplicate facilities, identified via the Hanford Geographic Information System (HGIS).

Hanford Site-Wide Risk Revew
CP-TF-3 (TX-TY Farms)
Waste Site and Facility List

Site Code	Name, Aliases, Description	Site Status	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation
216-T-22	216-T-22; 216-TX-2 Grave; 216-TX-4; 241-TX-2 Trench	Inactive	Trench	Crib - Subsurface Liquid Disposal Site	200-DV-1	
216-T-23	216-T-23; 216-TX-3 Grave; 216-TX-5; 241-TX-3 Grave; 241-TX-3 Trench	Inactive	Trench	Crib - Subsurface Liquid Disposal Site	200-DV-1	
216-T-24	216-T-24; 216-TX-4 Grave; 216-TX-6; 241-TX-4 Trench	Inactive	Trench	Crib - Subsurface Liquid Disposal Site	200-DV-1	
216-T-25	216-T-25; 216-TX-5 Grave; 216-TX-7; 241-TX-5 Trench	Inactive	Trench	Crib - Subsurface Liquid Disposal Site	200-DV-1	
216-T-26	216-T-26; 216-TX-1 Crib; 216-TY-1 Cavern; 216-TY-1 Crib; 241-TX-1 Cavern	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	200-DV-1	
216-T-27	216-T-27; 216-TX-2 Cavern; 216-TX-2 Crib; 216-TY-2 Cavern; 216-TY-2 Crib	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	200-WA-1	
216-T-28	216-T-28; 216-TX-3 Cavern; 216-TX-3 Crib; 216-TY-3 Cavern; 216-TY-3 Crib	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	200-WA-1	
216-T-31	216-T-31; 216-T-31 French Drain	Inactive	French Drain	Crib - Subsurface Liquid Disposal Site	200-WA-1	
216-TY-201	216-TY-201; IMUST; Inactive Miscellaneous Underground Storage Tank; Supernatant Disposal Flush Tank	Inactive	Settling Tank	Underground Storage Tank	200-IS-1	
241 TX 101	241 TX 101; 241 TX TK 101	Inactive	Single Shell Tank	Underground Storage Tank	WMA TX/TY	
241-TX-102	241-TX-102; 241-TX-TK-102	Inactive	Single-Shell Tank	Underground Storage Tank	WMA TX/TY	
241-TX-103	241-TX-103; 241-TX-TK-103	Inactive	Single-Shell Tank	Underground Storage Tank	WMA TX/TY	
241-TX-104	241-TX-104; 241-TX-TK-104	Inactive	Single-Shell Tank	Underground Storage Tank	WMA TX/TY	
241-TX-105	241-TX-105; 241-TX-TK-105	Inactive	Single-Shell Tank	Underground Storage Tank	WMA TX/TY	
241-TX-106	241-TX-106; 241-TX-TK-106	Inactive	Single-Shell Tank	Underground Storage Tank	WMA TX/TY	
241-TX-107	241-TX-107; 241-TX-TK-107	Inactive	Single-Shell Tank	Underground Storage Tank	WMA TX/TY	
241-TX-108	241-TX-108; 241-TX-TK-108	Inactive	Single-Shell Tank	Underground Storage Tank	WMA TX/TY	
241-TX-109	241-TX-109; 241-TX-TK-109	Inactive	Single-Shell Tank	Underground Storage Tank	WMA TX/TY	
241-TX-110	241-TX-110; 241-TX-TK-110	Inactive	Single-Shell Tank	Underground Storage Tank	WMA TX/TY	
241-TX-111	241-TX-111; 241-TX-TK-111	Inactive	Single-Shell Tank	Underground Storage Tank	WMA TX/TY	
241-TX-112	241-TX-112; 241-TX-TK-112	Inactive	Single-Shell Tank	Underground Storage Tank	WMA TX/TY	
241-TX-113	241-TX-113; 241-TX-TK-113	Inactive	Single-Shell Tank	Underground Storage Tank	WMA TX/TY	
241-TX-114	241-TX-114; 241-TX-TK-114	Inactive	Single-Shell Tank	Underground Storage Tank	WMA TX/TY	
241-TX-115	241-TX-115; 241-TX-TK-115	Inactive	Single-Shell Tank	Underground Storage Tank	WMA TX/TY	
241-TX-116	241-TX-116; 241-TX-TK-116	Inactive	Single-Shell Tank	Underground Storage Tank	WMA TX/TY	
241-TX-117	241-TX-117; 241-TX-TK-117	Inactive	Single-Shell Tank	Underground Storage Tank	WMA TX/TY	
241-TX-118	241-TX-118; 241-TX-TK-118	Inactive	Single-Shell Tank	Underground Storage Tank	WMA TX/TY	
241-TX-153	241-TX-153; 241-TX-153 Diversion Box	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA TX/TY	
241-TX-302A	241-TX-302A; 241-TX-302-A Catch Tank; IMUST; Inactive Miscellaneous Underground Storage Tank; Lines V627 and V628	Inactive	Catch Tank	Underground Storage Tank	WMA TX/TY	
241-TX-302XB	241-TX-302XB; IMUST; Inactive Miscellaneous Underground Storage Tank; 241-TX-302B Catch Tank; 241-TX-302-X; 241-TX-302-X (B)	Inactive	Catch Tank	Underground Storage Tank	WMA TX/TY	
241-TXR-151	241-TXR-151; 241-TXR-151 Diversion Box; Line 7765	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA TX/TY	
241-TXR-152	241-TXR-152; 241-TXR-152 Diversion Box; Line 7053	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA TX/TY	
241-TXR-153	241-TXR-153; 241-TXR-153 Diversion Box; Line 7253	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA TX/TY	
241-TY-101	241-TY-101; 241-TY-TK-101	Inactive	Single-Shell Tank	Underground Storage Tank	WMA TX/TY	
241-TY-102	241-TY-102; 241-TY-TK-102	Inactive	Single-Shell Tank	Underground Storage Tank	WMA TX/TY	
241-TY-103	241-TY-103; 241-TY-TK-103	Inactive	Single-Shell Tank	Underground Storage Tank	WMA TX/TY	
241-TY-104	241-TY-104; 241-TY-TK-104	Inactive	Single-Shell Tank	Underground Storage Tank	WMA TX/TY	

Note that only those waste sites with a WIDS (Waste Information Data System) Classification of "Accepted" are shown, along with non-duplicate facilities, identified via the Hanford Geographic Information System (HGIS).

Hanford Site-Wide Risk Revew
CP-TF-3 (TX-TY Farms)
Waste Site and Facility List

Site Code	Name, Aliases, Description	Site Status	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation
241-TY-105	241-TY-105; 241-TY-TK-105	Inactive	Single-Shell Tank	Underground Storage Tank	WMA TX/TY	
241-TY-106	241-TY-106; 241-TY-TK-106	Inactive	Single-Shell Tank	Underground Storage Tank	WMA TX/TY	
241-TY-153	241-TY-153; 241-TY-153 Diversion Box	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA TX/TY	
241-TY-302A	241-TY-302A; 241-TY-302-A Catch Tank; IMUST; Inactive Miscellaneous Underground Storage Tank; Line V651	Inactive	Catch Tank	Underground Storage Tank	WMA TX/TY	
241-TY-302B	241-TY-302B; 241-TY-302-B Catch Tank; IMUST; Inactive Miscellaneous Underground Storage Tank	Inactive	Catch Tank	Underground Storage Tank	WMA TX/TY	
242-T	242-T; 242-T Evaporator Facility; 241-T Evaporator	Inactive	Evaporator	Process Building	WMA TX/TY	
242-T-135	242-T-135; IMUST; Inactive Miscellaneous Underground Storage Tank	Inactive	Storage Tank	Underground Storage Tank	WMA TX/TY	
242-T-151	242-T-151; 242-T-151 Diversion Box. Line V830	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA TX/TY	
242-TA-R1	242-TA-R1; IMUST; Inactive Miscellaneous Underground Storage Tank; Receiver Tank TK-R1; Receiver TK-Vault; Z Waste; 242-TA; 242-TA Receiver Tank Vault	Inactive	Receiving Vault	Underground Storage Tank	WMA TX/TY	
244-TX DCRT	244-TX DCRT; 244-TX Double-Contained Receiver Tank; 244-TX Receiver Tank; 244-TX Receiver Vessel; 244-TX RT; 244-TX-TK/SMP	Inactive	Receiver Tank	Underground Storage Tank	WMA TX/TY	
244-TXR VAULT	244-TXR VAULT; 244-TXR Vault (Tanks TXR-001, -002, -003); IMUST; Inactive Miscellaneous Underground Storage Tank; 241-TXR-244; 244-TXR	Inactive	Receiving Vault	Underground Storage Tank	WMA TX/TY	
2607-WT	2607-WT; 241-T-601 Control Bldg. Tile Field	Inactive	Septic Tank	Septic System	WMA TX/TY	X
2607-WTX	2607-WTX	Inactive	Septic Tank	Septic System	WMA TX/TY	X
UPR-200-W-100	UPR-200-W-100; 105-TX to 118-TX Process Line Leak; UN-200-W-100; UN-216-W-8	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-W-12	UPR-200-W-12; Ground Contamination Near 242-T	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-W-126	UPR-200-W-126; Contamination Release Inside 241-TX Tank Farm	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-W-129	UPR-200-W-129; Contamination Release Inside 241-TX Tank Farm	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-W-14	UPR-200-W-14; Waste Line Leak at 242-T Evaporator; UN-200-W-14	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	200-WA-1	
UPR-200-W-149	UPR-200-W-149; 241-TX-107 Leak	Inactive	Unplanned Release	Unplanned Release - Subsurface	Not Applic	
UPR-200-W-150	UPR-200-W-150; 241-TY-103 Leak	Inactive	Unplanned Release	Unplanned Release - Subsurface	Not Applic	
UPR-200-W-151	UPR-200-W-151; 241-TY-104 Leak	Inactive	Unplanned Release	Unplanned Release - Subsurface	Not Applic	
UPR-200-W-152	UPR-200-W-152; 241-TY-105 Leak	Inactive	Unplanned Release	Unplanned Release - Subsurface	Not Applic	
UPR-200-W-153	UPR-200-W-153; 241-TY-106 Leak	Inactive	Unplanned Release	Unplanned Release - Subsurface	Not Applic	
UPR-200-W-167	UPR-200-W-167; Contamination Migration from 241-TY; UN-216-W-32	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	200-IS-1	
UPR-200-W-17	UPR-200-W-17; Contamination Spread form 241-TX-106 Pump Removal; UN-200-W-17	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-W-99	UPR-200-W-99; 241-153-TX Diversion Box Contamination Spread; UN-200-W-99; UN-216-W-7	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	200-WA-1	
241TX701	LAUNDRY STORAGE FACILITY	ACTIVE	BUILDING	Infrastructure Building		X
242T271	242T CONTROL BUILDING PASSAGEWAY	ACTIVE	BUILDING	Infrastructure Building		X
242T601	CHEMICAL MAKEUP BUILDING	ACTIVE	BUILDING	Process Building		
242T701	TX/TY COMPRESSED AIR STATION	INACTIVE	STRUCTURE	Infrastructure Building		X
242TA	WASTE RECEIVING VAULT	INACTIVE	STRUCTURE	Process Building		
242TB	VENT HOUSE	INACTIVE	BUILDING	Process Building		
242TC	TANK FARM MICROCOMPUTER EQUIPMENT BLDG	ACTIVE	BUILDING	Infrastructure Building		X
244TX	SALT WELL RECEIVER VAULT	ACTIVE	STRUCTURE	Process Building		

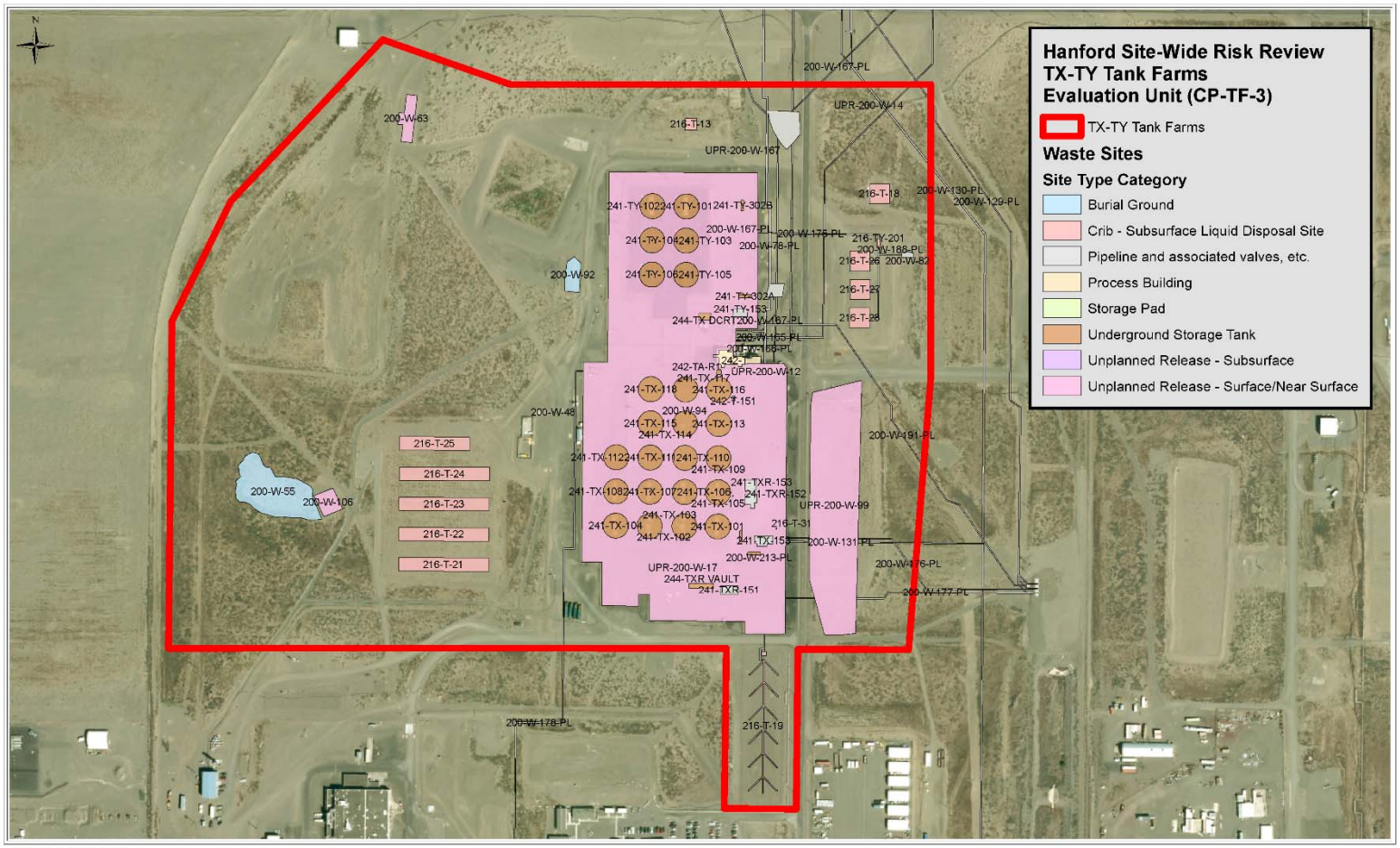
Note that only those waste sites with a WIDS (Waste Information Data System) Classification of "Accepted" are shown, along with non-duplicate facilities, identified via the Hanford Geographic Information System (HGIS).

Hanford Site-Wide Risk Revew
CP-TF-3 (TX-TY Farms)
Waste Site and Facility List

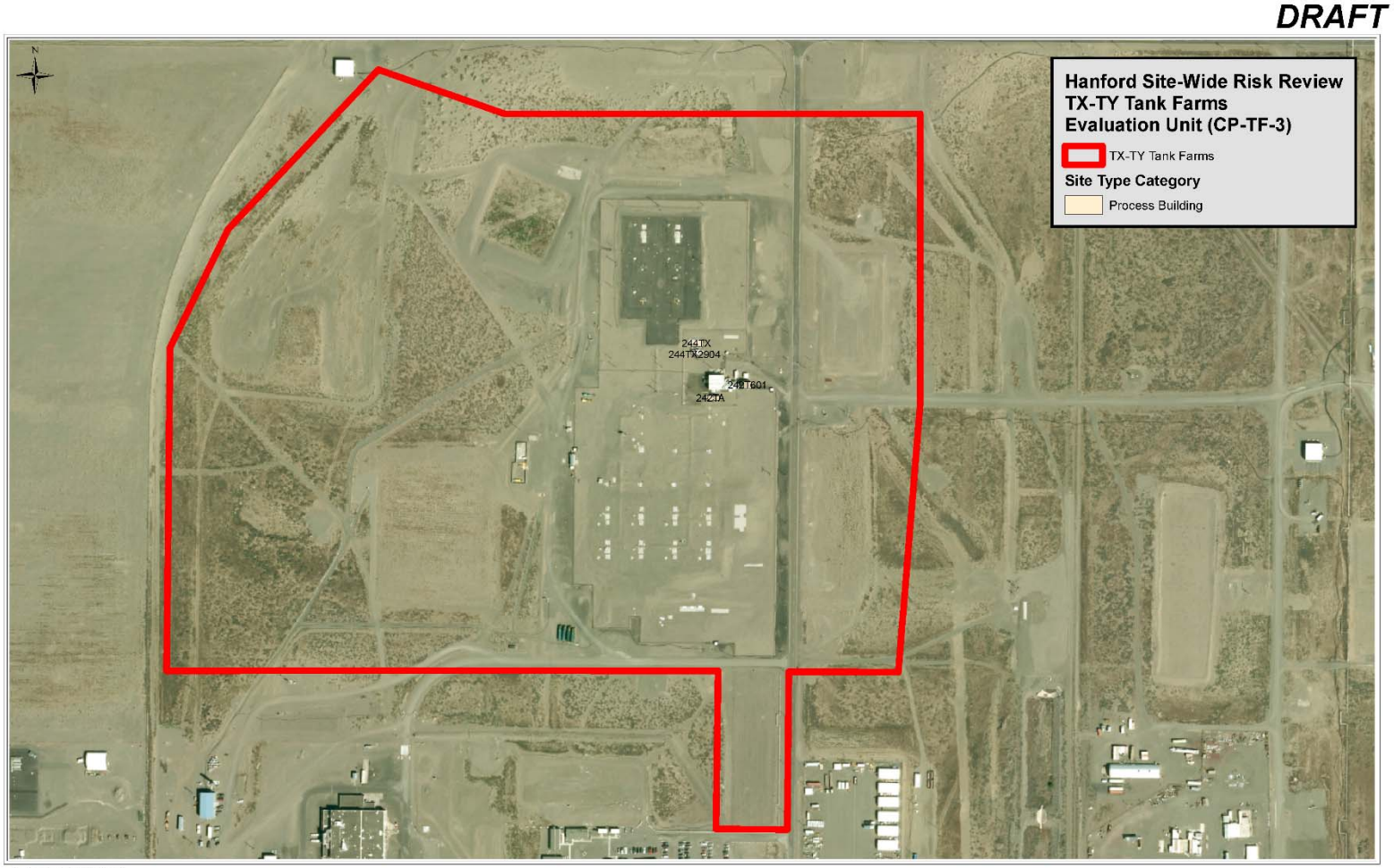
Site Code	Name, Aliases, Description	Site Status	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation
244TX271	ELECTRICAL INSTRUMENTATION CONTROL BLDG	ACTIVE	BUILDING	Infrastructure Building		X
244TX2904	SALT WELL RECEIVER FLUSH PIT	INACTIVE	BUILDING	Process Building		
2724TX	RAD MONITORING AND PROTECTIVE CLOTHING BLDG	INACTIVE	BUILDING	Infrastructure Building		X
2724TXA	RAD MONITORING AND PROTECTIVE CLOTHING BLDG	INACTIVE	BUILDING	Infrastructure Building		X
2724TXB	RAD MONITORING AND PROTECTIVE CLOTHING BLDG	INACTIVE	BUILDING	Infrastructure Building		X
MO817	CHANGE TRAILER AT TX TANK FARM	ACTIVE	BUILDING	Infrastructure Building		X

Note that only those waste sites with a WIDS (Waste Information Data System) Classification of "Accepted" are shown, along with non-duplicate facilities, identified via the Hanford Geographic Information System (HGIS).

DRAFT



1 inch = 400 feet


DRAFT
Hanford Site-Wide Risk Review
TX-TY Tank Farms
Evaluation Unit (CP-TF-3)
TX-TY Tank Farms
Site Type Category
Process Building
244TX
244TX2904
241T601
241TA
1 inch = 400 feet

APPENDIX E.5

Tank Waste and Farm

CP-TF-4 (U Tank Waste and Farm)
Evaluation Unit Summary Template

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PART E.5. CP-TF-4 U SINGLE-SHELL TANK WASTE AND FARM (200-W)

E.5.1. EXECUTIVE SUMMARY

Much of the information related to the U Tank and Waste Farms Evaluation Unit (EU) is organized around the corresponding Waste Management Area (namely WMA U) that regulated under the Resource Conservation and Recovery Act of 1976 (RCRA) as codified in 40 CFR Part 265, Subpart F and Washington's Hazardous Waste Management Act (HWMA, RCW 70.105) and its implementing requirements in the Washington State dangerous waste regulations (WAC 173-303-400) (PNNL-13612).

EU LOCATION

South-Central part of 200-West on the Hanford Reservation; Central Plateau

RELATED EUS

T Tank Waste and Farms (CP-TF-1), S-SX Tank Waste and Farms (CP-TF-2), TX-TY Tank Waste and Farms (CP-TF-3), A-AX Tank Waste and Farms (CP-TF-5), B-BX-BY Tank Waste and Farms (CP-TF-6), C Tank Waste and Farms (CP-TF-7), 200-East DST Waste and Farms (CP-TF-8), 200-West DST Waste and Farms (CP-TF-9), 200-E Groundwater Plumes (CP-GW-1), 200-W Groundwater Plumes (CP-GW-2), and 200 Area Waste Transfer Pipeline (CP-LS-7)

PRIMARY CONTAMINANTS, CONTAMINATED MEDIA AND WASTES

The TC&WM EIS describes tank wastes as including radioactive (tritium or H-3, C-14, Sr-90, Tc-99, I-129, Cs-137, U-233, U-234, U-235, U-238, Np-237, Pu-239, and Pu-240)[76] and non-radioactive contaminants (chromium, mercury, nitrate, lead, total uranium, and PCBs) of potential concern (DOE/EIS-0391 2012, Appendix D). The tank wastes contain saltcake, sludge, and supernatant phases. Contaminated media related to the U Tank Farm include ancillary equipment and surrounding vadose zone (including cribs and trenches) down to the saturated zone (for some mobile contaminants) from past and current discharges. The Interim Record of Decision for the 200-UP-1 Operable Unit (OU) (EPA 2012) associated with WMA U identifies I-129, Tc-99, tritium, uranium, nitrate, and chromium as tank waste constituents that must be addressed in cleanup; carbon tetrachloride is also listed but is not a tank waste. The 2015 Groundwater Monitoring Report (DOE/RL-2016-09, Rev. 0) lists tank wastes including chromium, nitrate, I-129, Tc-99, H-3, and uranium and the carbon tetrachloride (non-tank) waste for the 200-UP groundwater interest area (GWIA) that is used to geographically represent contaminant migration from the 200-UP-1 OU for monitoring purposes.

After evaluating the contaminants associated with U Tank Farm tanks, ancillary equipment, legacy sources, and contaminated vadose zone, the primary contaminants from the tank wastes that drive human health risk to groundwater for the U Tank and Waste Farms Evaluation Unit are: Tc-99 and nitrate. Those primary contaminants that may drive risk from groundwater discharge to the Columbia River are nitrate and chromium; however, any impacts are highly uncertain (see Section E.2.1). Cs-137

[76] Other isotopes considered include U-232 and U-236 and Pu-238, Pu-241, and Pu-242 to be consistent with other EUs. These additional uranium and plutonium isotopes are included in the totals presented but are not used for rating because 1) uranium toxicity impacts (represented by total uranium drives corresponding risks and 2) plutonium has been found relatively immobile in the Hanford subsurface and has not been identified as a risk driver for groundwater impacts.

and Sr-90 are important from a safety standpoint and uranium isotopes, plutonium isotopes, and tritium are iconic constituents; these contaminants are included in the inventory summary even though they are not considered risk drivers for impacts to or from groundwater in this review. Carbon tetrachloride is not a tank waste and thus is captured in Appendix D.6 for the CP-GW-2 EU (200-UP GWIA).

BRIEF NARRATIVE DESCRIPTION

Waste Management Area U (WMA U) occupies approximately 30,000 m^2 and contains 16 underground single-shell tanks (SSTs) in the U Tank Farm in additional to ancillary equipment (e.g., diversion boxes, pumps, valves, and pipes). The U Tank Farm contains 12 carbon steel tanks (U-101 through U-112) with capacities of 533 kgal and four smaller (55-kgal) tanks (U-201 through U-204). The U Tank Farm was constructed in 1943-44 (PNNL-13612, p. 4) and were in operation essentially continually from 1946 to 1980 (PNNL-13282, p. 2.1). The U Tank Farm tanks began receiving metal waste from the bismuth phosphate process in B and T Plants; most of the metal waste was later removed and recycled through U Plant to remove uranium. REDOX wastes and other wastes were then received and transferred among the tanks and other Tank Farms.

Waste was cascaded among the WMA U waste tanks; however, it appears none was released to cribs or ditches in the area. The 216-U-3 French drain (located south of WMA U) received 7.9×10^6 L of liquid from steam condensers on waste tanks in WMA U and likely contains nitrate and minor amounts of fission products and actinides. Trenches located west of WMA U received waste (primarily carbon tetrachloride and nitrate) from the Plutonium Finishing Plant and initially connected with the 216-U-10 Pond.

Four unplanned releases have been documented in or near WMA U with unknown waste volumes. Three unplanned releases may have significant impacts are beta contamination in diversion boxes east of WMA U, a “violent chemical reaction” in a vault that spread first-cycle metal waste contaminants over an unspecified area, and a ruptured waste line at tank U-103 (PNNL-13282, p. 2.3).

Four of the tanks in the WMA (U-101, U-104, U-110, and U-112) are “assumed leakers” (Templeton 2016, p. 23) ranging from 5,000-8,100 gallons (U-110 in 1975) to 55,000 gallons (U-104 in 1961).

The SSTs in WMA U have been interim stabilized (i.e., liquid transferred to DSTs to <50 kgal drainable interstitial liquid and <5 kgal of supernatant), including the four “assumed leakers”. The 216-U-13 trench (that never received tank waste) was stabilized by removing contaminated soil and backfilling with clean soil.

SUMMARY TABLES OF RISKS AND POTENTIAL IMPACTS TO RECEPTORS

Table E.5-1 provides a summary of nuclear and industrial safety related consequences from CP-TF-4 (U Tank and Waste Farms EU) to humans and impacts to important physical Hanford Site resources. Receptors are described in Section E.1.6 (Appendix E.1).

Table E.5-1. CP-TF-4 (U Tank Farm) impact Rating Summary for Human Health (unmitigated basis with mitigated basis provided in parentheses (e.g., "High (Low)").

Population or Resource		Evaluation Time Period Active Cleanup (to 2064) **Current Condition:** Maintenance & Monitoring (M&M)	**From Cleanup Actions:** Retrieval & Closure
Human Health	Facility Worker[b]	***M&M***: Low-High[d] (Low-High)[d] ***Soil***: Not Discernible (ND)-High (ND-Low)	***Preferred method*****:** High (Low) ***Alternative***: High (Low)
	Co-located Person[b]	***M&M***: Low-Moderate (Low) ***Soil*****:** ND (ND)	***Preferred method*****:** Low-Moderate (Low) ***Alternative***: Low-Moderate (Low)
	Public[b]	***M&M***: Low (Low) ***Soil*****:** ND (ND)	***Preferred method*****:** Low (Low) ***Alternative***: Low (Low)
Environmental	Groundwater (A&B) from vadose zone[c]	*Low* – All PCs[f] **Overall**: *Low*	*Low* – All PCs[f] **Overall**: *Low*
	Columbia River from vadose zone[c]	Benthic: ND Riparian: ND Free-flowing: ND **Overall**: ND	Benthic: ND Riparian: ND Free-flowing: ND **Overall**: ND
	Ecological Resources[e]	ND to Low	Low to Medium
Social	Cultural Resources[a,e]	**Native American:** Direct: Unknown Indirect: Known **Historic Pre-Hanford:** Direct: Unknown Indirect: Unknown **Manhattan/Cold War:** Direct: Known Indirect: Unknown	**Native American:** Direct: Unknown Indirect: Known **Historic Pre-Hanford:** Direct: Unknown Indirect: Unknown **Manhattan/Cold War:** Direct: Known Indirect: Unknown

a. A rating for cultural resources is 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.

b. Evaluated in Section E.1.6 (Appendix E.1).

c. Groundwater threat for Group A and B contaminants remaining in the vadose zone or to the Columbia River for all primary contaminants. Threats from existing plumes associated with the U Tank and Waste Farms EU are described in Section E.5.5 and Appendix D.6 (CP-GW-2) for the 200-UP Groundwater Interest Area. Groundwater in the area is being treated using the U Plant area P&T system that has extracted uranium and Tc-99 (of those PCs in the table related to the CP-TF-3 vadose zone) (DOE/RL-2016-09, Rev. 0); however, groundwater treatment does not impact the vadose zone source or threat.

d. Industrial safety consequences range from low to high (based on the evaluation scale used) for both mitigated (with controls) and unmitigated (without controls). Mitigated radiological and toxicological consequences to facility workers are high (unmitigated) and low (mitigated).

e. 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.

f. The large amount of Sr-90 disposed of in the U Tank and Waste Farms EU would translate to a *High* rating (based on the groundwater threat metric or GTM); however, there is no current Sr-90 plume in the 200-UP GWIA and it would likely require more than 150 years to reach groundwater in a sufficient amount to exceed the drinking water standard over an appreciable area (Section E.5.5). The uranium inventory would translate to a *Low* rating, but also is unexpected to reach groundwater in 150 years. Total uranium and Sr-90 are given *Not Discernible* (*ND*) ratings for the Active Cleanup period and *Low* ratings afterwards to account for uncertainties in the evaluation. Thus uranium and Sr-90 are not considered risk drivers for the U Tank and Waste Farms EU.

SUPPORT FOR RISK AND IMPACT RATINGS FOR EACH POPULATION OR RESOURCE

Human Health

The current and cleanup-related consequences related to work being conducted at the Tank Farms in the 200 Areas (Hanford Central Plateau) was evaluated in Section E.1.6 (Appendix E.1).

Groundwater, Vadose Zone, and Columbia River

Current

U Tank Farm contaminants are currently impacting the vadose zone and groundwater (where at least one CP-TF-4 source is suspected of being able to contribute mobile contaminants to groundwater (DOE/RL-92-16, Rev. 0)), and treatment is not predicted to decrease concentrations to below thresholds before active cleanup commences. Secondary sources in the vadose also threaten to continue to impact groundwater in the future, including the Active Cleanup period, although all ratings are determined to be *Low*. As described in the TC&WM EIS (and summarized in Section E.5.5), there appeared to be sufficiently large expected impacts from recharge rate on peak concentrations in the groundwater and near-shore region of the Columbia River during and after cleanup to modify ratings; however, the *Low* rating is maintained to help address uncertainties.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

See Section E.1.1.

Ecological Resources

Current

There are some level 3 resources in EU (16%) and in buffer area (18%). People and trucks are present, which could lead to increases in exotic species and changes in species diversity in level 3 resource areas of EU and buffer.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

Potential for continual disturbance levels with increasing number of trucks – results may cause changes in abundance and diversity in level 3 resource areas.

Cultural Resources

Current
Manhattan Project/Cold War significant resources have already been mitigated. Area is very disturbed and there are no known recorded archaeological resources within the EU. Traditional cultural places are visible from EU.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches
Because area has not been investigated either on the surface or subsurface, archaeological investigations may need to occur within pockets of undisturbed land if any prior to remediation. Potential for intact archaeological material to be present is very low.

Considerations for Timing of the Cleanup Actions

See Section E.1.1 (Appendix E.1).

Near-Term, Post-Cleanup Risks and Potential Impacts

See Section E.1.1 (Appendix E.1).

E.5.2. ADMINISTRATIVE INFORMATION

OU AND/OR TSDF DESIGNATION(S)

The U Tank and Waste Farms Evaluation Unit (EU), denoted *CP-TF-4 – U Tank Waste and Farms*, consists of 12 waste tanks, ancillary structures, associated liquid waste sites, and soils contamination; much of this EU is contained within Waste Management Area U (WMA U). Waste Management Area (WMA) U is regulated under the Resource Conservation and Recovery Act (RCRA) as modified in 40 CFR Part 265, Subpart F and Washington State's Hazardous Waste Management Act (HWMA, RCW 70.105 and its implementing requirements in the Washington State dangerous waste regulations [WAC 173-303-400]) (PNNL-13612).

COMMON NAME(S) FOR EU

There is no common name for the U Tank and Waste Farms EU because the EU is comprised of elements from other waste management units including Waste Management Area U (WMA U) that includes the 241-U (or U) Tank Farm. The Tank Farm contains 16 waste tanks (U-101 through U-112 and U-201 through U-204). These tanks often are designated as 241-U-101 through 241-U-112 and 241-U-201 through 241-U-204 or 241-U-TK-101 through 241-U-TK-112 and 241-U-TK-201 through 241-U-TK-204. Other components in the EU (including associated legacy waste sites) are listed below in the *Primary EU Source Components* section.

KEY WORDS

U Tank Farm, 241-U Tank Farm, waste tanks, tank farm, Waste Management Area U, WMA U

REGULATORY STATUS

Regulatory Basis

DOE is the responsible agency for the closure of all single-shell tank (SST) waste management areas (WMAs) through post closure, in close coordination with other closure and cleanup activities of the Hanford Central Plateau. Washington State has a program that is authorized under RCRA and

implemented through the HWMA and its associated regulations; Ecology is the lead regulatory agency responsible for the closure of the SST system. Please refer to Section E.1.2 (Appendix E.1) for more information.

Applicable Regulatory Documentation

The relationship among the tank waste retrieval work plans (TWRWP) and the overall single-shell tank (SST) waste retrieval and closure process is described in Appendix I of the Hanford Federal Facility Agreement and Consent Order (HFFACO), along with requirements for the content of TWRWPs. In 2000 WMA U was determined to have affected groundwater quality (PNNL-13282). A groundwater quality assessment plan was written (PNNL-13612) describing the monitoring activities used in deciding whether WMA U has affected groundwater.

Applicable Consent Decree or TPA Milestones

Federal Facility Agreement and Consent Order, 1989 and amended through June 16, 2014: Milestone M-045-00; Lead Agency Ecology: *Complete the closure of all Single Shell Tank Farms by 01/31/2043*

RISK REVIEW EVALUATION INFORMATION

Completed: Revised August 26, 2015

Evaluated by: K. G. Brown

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

E.5.3. SUMMARY DESCRIPTION

CURRENT LAND USE

DOE Hanford Site for industrial use. All current land-use activities in the 200-West Area are *industrial* in nature (EPA 2012).

DESIGNATED FUTURE LAND USE

Industrial-Exclusive. All four land-use scenarios listed in the Comprehensive Land Use Plan (CLUP) indicate that the 200-West Area (of which U Tank and Waste Farms EU is a part) is denoted *Industrial-Exclusive* (DOE/EIS-0222-F). An industrial-exclusive area is “suitable and desirable for treatment, storage, and disposal of hazardous, dangerous, radioactive, and nonradioactive wastes” (DOE/EIS-0222-F).

PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

The legacy source sites associated with the U Tank and Waste Farms EU are enumerated in Attachment Section E.5.8. To summarize, four unplanned releases have been documented in or near WMA U with unknown waste volumes (PNNL-13282).

Waste Tanks and Ancillary Equipment

The 16 waste tanks in the T Tank and Waste Farms EU are:

- (241-)U-101 (241-U-TK-101)
- (241-)U-102 (241-U-TK-102)
- (241-)U-109 (241-U-TK-109)
- (241-)U-110 (241-U-TK-110)

- (241-)U-103 (241-U-TK-103)
- (241-)U-104 (241-U-TK-104)
- (241-)U-105 (241-U-TK-105)
- (241-)U-106 (241-U-TK-106)
- (241-)U-107 (241-U-TK-107)
- (241-)U-108 (241-U-TK-108)
- (241-)U-111 (241-U-TK-111)
- (241-)U-112 (241-U-TK-112)
- (241-)U-201 (241-U-TK-201)
- (241-)U-202 (241-U-TK-202)
- (241-)U-203 (241-U-TK-203)
- (241-)U-204 (241-U-TK-204)

The ancillary equipment included in the U Tank and Waste Farms EU is listed in Attachment Section E.5.8 and consists of pipelines, diversion boxes, and catch tanks.

Groundwater Plumes

The U Tank and Waste Farms EU is in the 200-UP groundwater interest area (GWIA). The current 200-UP GWIA plumes associated with the U Tank and Waste Farms EU that exceed water quality standards are nitrate and Tc-99 (DOE/RL-2016-09, Rev. 0). There are current plumes in the 200-UP GWIA for carbon tetrachloride, chromium, tritium, I-129, and uranium; however, these plumes are not associated with the U Tank and Waste Farms EU. An interim remedial action P&T system operated in 1985 to remove uranium from the 216-U-1 and 216-U-2 cribs and a pilot-scale treatability test (using P&T) was operated adjacent to the 216-U-17 crib in 1995-97. An interim action groundwater extraction and treatment system was operated from 1997-2012 to treat uranium and Tc-99 (and secondary contaminants). The final ROD for the 200-UP-1 OU will be pursued when future groundwater impacts are adequately understood and potential technologies to treat I-129 are completed (EPA 2012).

See Appendix D.6 for the CP-GW-2 EU (and 200-UP GWIA) for additional details.

Operating Facilities

Because of the prohibition on waste additions to the Hanford SSTs,[77] the U Tank and Waste Farms EU components are not considered Operating Facilities for this review. See Section E.1.4 (Appendix E.1) for details.

D&D of Inactive Facilities

Not Applicable.

LOCATION AND LAYOUT MAPS

A series of maps are used to illustrate the location of the components within the CP-TF-4 EU and the U Tank and Waste Farms EU relative to the Hanford Site. Figure E.2-1 shows the relationship between the 200-W (200 West) Area (where the U Tank Farm and Waste management Area U are located) and the Hanford Site. Figure E.5-1 illustrates the U Tank and Waste Farms EU boundary. Figure E.5-2 shows a detailed view of the waste tanks, ancillary equipment, and legacy source units in the U Tank and Waste Farms EU.

[77] Berman presentation on July 29, 2009, titled "Hanford Single-Shell Tank Integrity Program." Available at www.em.doe.gov.

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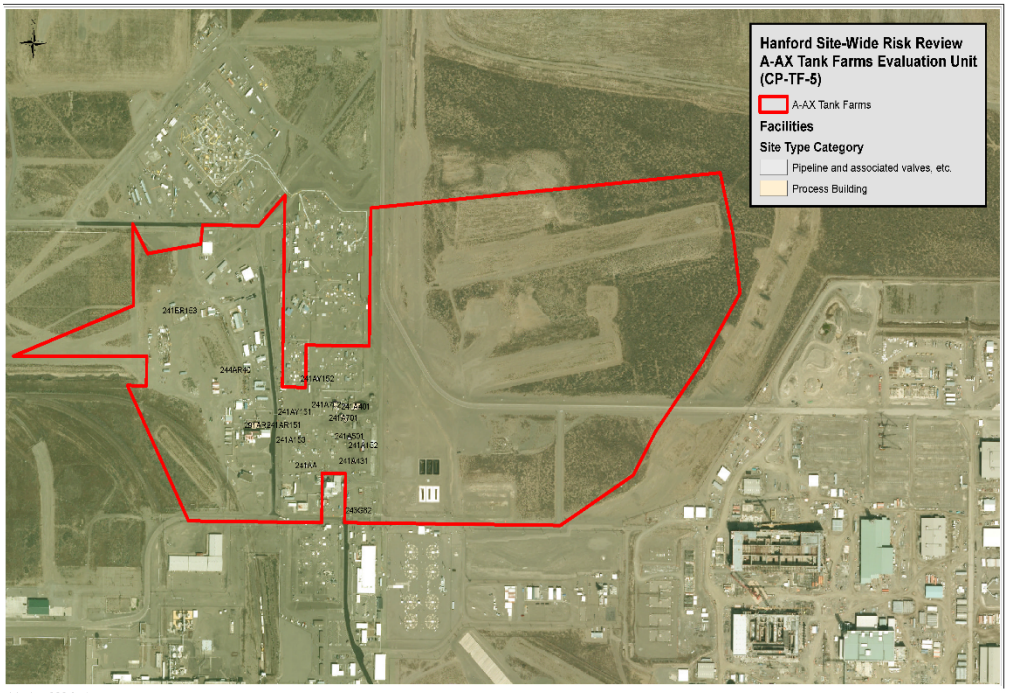
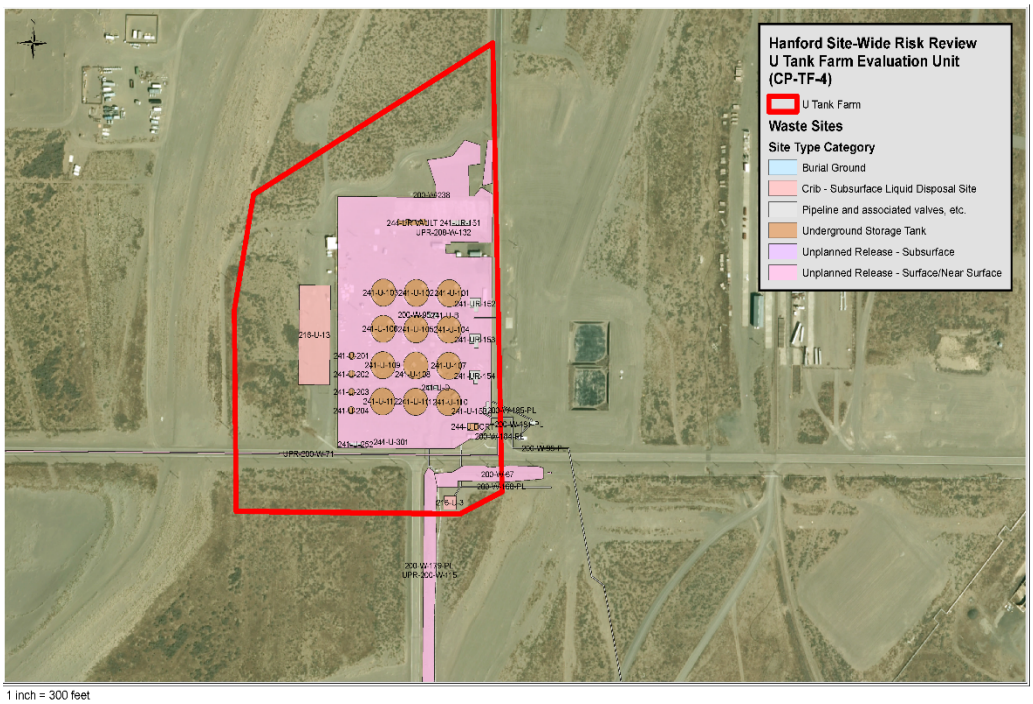


1 inch = 600 feet

Figure E.5-1. Polygon representing the boundary of the U TF Evaluation Unit (Attachment Section E.5.8).

DRAFT



1 inch = 300 feet

Figure E.5-2. Hanford U Tank and Waste Farms Evaluation Unit including tanks, legacy source units, and ancillary equipment (Attachment Section E.5.8).

E.5.4. UNIT DESCRIPTION AND HISTORY

EU FORMER / CURRENT USES

Waste Management Area U (WMA U) occupies approximately 30,000 m^2 and contains 16 underground single-shell tanks (SSTs) in the U Tank Farm in additional to ancillary equipment (e.g., diversion boxes, pumps, valves, and pipes). The U Tank Farm contains 12 carbon steel tanks (U-101 through U-112) with capacities of 533 kgal and four smaller (55-kgal) tanks (U-201 through U-204). The U Tank Farm was constructed in 1943-44 (PNNL-13612, p. 4) and were in operation essentially continually from 1946 to 1980 (PNNL-13282, p. 2.1). The U Tank Farm tanks began receiving metal waste from the bismuth phosphate process in B and T Plants; most of the metal waste was later removed and recycled through U Plant to remove uranium. REDOX wastes and other wastes were then received and transferred among the tanks and other Tank Farms resulting in a complex intermingling of tank wastes; natural processes resulted in settling, stratification, and segregation of waste components. The SSTs in WMA U have been interim stabilized (i.e., liquid transferred to DSTs to <50 kgal drainable interstitial liquid and <5 kgal of supernatant); the tanks are currently awaiting retrieval and closure.

LEGACY SOURCE SITES

Waste was cascaded among the WMA U waste tanks; however, it appears none was intentionally released to cribs or ditches in the area. Trenches located west of WMA U received waste (primarily carbon tetrachloride and nitrate) from the Plutonium Finishing Plant and not from the U Tank Farm. Thus the contamination in the legacy source sites (in this case, near-tank soil) associated with the U Tank and Waste Farms EU comes from unintentional discharges of U Tank Farm wastes.

Four unplanned releases have been documented in or near WMA U with unknown waste volumes. Three unplanned releases may have significant impacts are beta contamination in diversion boxes east of WMA U, a “violent chemical reaction” in a vault that spread first-cycle metal waste contaminants over an unspecified area, and a ruptured waste line at tank U-103 (PNNL-13282, p. 2.3).

From historic monitoring activities, there are four “assumed” leakers[78] (U-101, U-104, U-110, and U-112) in the U Tank Farm with leaks that range from 5,000-8,100 gallons (U-110 in 1975) to 55,000 gallons (U-104 in 1961) (Templeton 2016).

WASTE TANKS

See Section E.5.5 for details.

GROUNDWATER PLUMES

The groundwater plumes (Tc-99 and nitrate) considered to be associated with the U Tank Farm and co-located liquid waste disposal facilities are described in Section E.5.5 with additional information in Appendix D.6 for the CP-GW-2 EU (200-UP GWIA). One site within the CP-TF-4 EU, the 216-U-13 Trench, is suspected of being able to contribute mobile contaminants to the saturated zone (i.e., representing migration of contaminants from the waste site to the uppermost aquifer) (DOE/RL-92-16, Rev. 0, Table 2-2) although other CP-TF-3 sources likely contribute. Note that no source inventory was provided for carbon tetrachloride (CCl_4) (not a tank waste); the CCl_4 plume near the U Tank and Waste Farms EU is not associated with the U Tank and Waste Farms EU legacy sites (DOE/RL-2016-09, Rev. 0).

[78] Tanks that are either known or suspected of leaking at any time (including the present) are denoted “assumed leakers” (Weyns 2014).

D&D OF INACTIVE FACILITIES – NOT APPLICABLE

OPERATING FACILITIES – NOT APPLICABLE

Because of the prohibition on waste additions to the Hanford SSTs,[79] the U Tank and Waste Farms EU components are not considered Operating Facilities for this Review.

ECOLOGICAL RESOURCES SETTING

Landscape Evaluation and Resource Classification

Approximately 63% of the EU consists of level 0 habitat with graveled and bare surface conditions (Appendix J, Table 2, p. J-96). Small areas of level 2 (3.6 acres) and level 3 habitat resources (3.5 acres) exist around the perimeter of the EU and are part of larger patches of habitat that extend into the adjacent landscape buffer area as seen in (Appendix J, Figure 12, p. J-96).

The amount and proximity of the biological resources to the EU was examined within the adjacent landscape buffer area radiating approximately 459 m from the geometric center of the EU (equivalent to 163.3 acres). About half of the combined total area (EU and adjacent landscape buffer area) is classified as level 0 or 1 habitat, with level 2 habitat resources comprising 32.6% and level 3 and above resources comprising 16.5% of the area at the landscape level.

Field Survey

The fenced portion of the U Tank Farm consists of graveled surfaces and tank farm infrastructure. Some level 2 habitat resources remain at the perimeters of the EU outside the fenced area. Pedestrian surveys of the habitat areas were conducted, and the canopy cover of dominant vegetation was estimated visually (Appendix J, Table 1, p. J-95).

Based on the field surveys, two small patches of habitat within the EU were re-classified from level 2 to level 3 because the understory was primarily native bunchgrasses with a mix of climax and successional species in the shrub layer.

Wildlife observations made during the October survey within the habitat along the borders of the EU included coyote tracks (*Canis latrans*), small mammal burrows, and harvester ant hills. These observations agreed with sign noted in previous PNNL ECAP surveys of habitat within and around the EU. Those surveys also identified side-blotch lizard (*Uta stansburiana*), northern pocket gopher (*Thomomys talpoides*), lark sparrow (*Chondestes grammacus*), western kingbird (*Tyrannus verticalis*), Say's phoebe (*Sayornis saya*), American kestrel (*Falco sparverius*), western meadowlark (*Sturnella neglecta*), and mourning dove (*Zenaida macroura*).

CULTURAL RESOURCES SETTING

Cultural resources that are located in the U Tank and Waste Farms EU are limited to the National Register-eligible 244UR Waste Disposal Vault a contributing property within the Manhattan Project and Cold War Era. All documentation has been addressed as described in the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan* (DOE/RL-97-56). None of the U Tank and Waste Farms EU has been inventoried for archaeological resources. Closure and remediation of the tank farms located within the 200-West DSTs has been addressed in an NHPA Section 106 review completed. There is a possibility that intact archaeological material is present in the areas that have not been

[79] Berman presentation on July 29, 2009, titled "Hanford Single-Shell Tank Integrity Program." Available at www.em.doe.gov.

inventoried for archaeological resources (both on the surface and in the subsurface), particularly if undisturbed soil deposits exist within U Tank and Waste Farms EU.

Three National Register-eligible properties associated with the Manhattan Project/Cold War Era Landscape (Hanford Site Plant Railroad with documentation required and the 2727WA Sodium Storage Building and the 2727W also a Sodium Storage Building both with no documentation required are located within 500 meters of the U Tank and Waste Farms EU. All three have also been documented as described in the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan* (DOE/RL-97-56).

Historic maps indicate that there is no evidence of historic settlement in the U Tank and Waste Farms EU. Geomorphology and extensive ground disturbance further indicate a low potential for the presence of intact archaeological sites associated with all three landscapes to be present subsurface within the U Tank and Waste Farms EU. Because none of the U Tank and Waste Farms EU has been investigated for archaeological sites and pockets of undisturbed soil may exist, it may be appropriate to conduct 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 associated with these landscapes (e.g. East Benton Historical Society, the Franklin County Historical Society, Prosser Cemetery Association, the Reach and B-Reactor Museum Association) may need to occur. Indirect effects are always possible when TCPs are known to be located in the general vicinity. 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.

E.5.5. WASTE AND CONTAMINATION INVENTORY

Table E.5-2 provides inventory estimates of the various source components associated with the U Tank and Waste Farms EU including tank wastes and ancillary equipment, legacy sources including leaks, cribs, trenches, unplanned releases (UPRs), vadose zone sources, saturated zone (plume) estimates, treatment amounts, and remaining vadose zone estimates (i.e., the difference of the vadose zone estimates and the saturated zone and treatment estimates)[80]. This information is further summarized in Figure E.5-3 through Figure E.5-11 before and after planned 99% retrieval[81].

For example, the major sources for Tc-99 and I-129 before retrieval are the U Tank Farm tanks with ancillary equipment being a distant second. The maximum groundwater threat metric (GTM) (Figure E.5-

[80] The basis for the saturated and vadose zone estimates are provided in Chapter 6 of the Methodology Report (CRESP 2015a) and examples are provided in the demonstration section for the 200-UP-1 Operable Unit that corresponds to the 200-UP GWIA. These estimates tend to have very high associated uncertainties.

[81] According to the Tri-Party Agreement (Ecology, EPA, and DOE, 1998), retrieval limits for residual wastes are 360 ft^3 and 30 ft^3 for 100-Series and 200-Series tanks, respectively, corresponding to the 99% waste retrieval goal as defined in TPA Milestone M-45-00. For purposes of this Review the 99% and 90% Retrieval Scenarios reflect assumptions described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 and apply only to tank volumes and inventories. They are calculated assuming retrieval of a fully mixed tank of homogeneous composition. For tanks that have been declared "Retrieval Completed" or "Retrieved to Limit of … Technologies" (Templeton, AM 2016, page 9, partially duplicated in Table E.1-7), no further retrieval for either the 99% or 90% retrieval scenario is assumed. This includes tank 241-S-112 and all C Tank Farm tanks except 241-C-105. For tanks that are currently undergoing retrieval (tanks 241-AY-102 and 241-C-105), a retrieval amount equivalent to the 99% and 90% retrieval volumes described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 are calculated.

12)[82] is dominated by the U Tank Farm wastes before retrieval and by tank wastes, ancillary equipment, and past leaks after planned retrieval. After planned retrieval, ancillary equipment and past leaks dominate the U Tank and Waste Farms EU legacy sources for Tc-99 and I-129. This is also true for chromium, uranium, Sr-90, nitrate, Cs-137, and plutonium isotopes. For H-3 the cribs, ancillary equipment, and past leaks provide the majority of the legacy source.

CONTAMINATION WITHIN PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

The estimated U Tank Farm inventory for the Legacy / Vadose Zone Source Sites (i.e., cribs, trenches, and soil contaminated by tank leaks and unplanned releases) is summarized in Table E.5-2 and further described in Figure E.5-3 through Figure E.5-11 before and after planned 99% retrieval (which will have no impact on the current legacy source site inventories). These values constitute estimates of the initial amounts of contaminants discharged to the vadose zone that are then used to estimate the remaining inventory in the vadose zone as described below (i.e., by difference using the process described in Chapter 6 of the Methodology Report (CRESP 2015a) as revised for the 2015 groundwater monitoring results (DOE/RL-2016-09, Rev. 0) as described in Appendix D.1). These estimates necessarily have large associated uncertainties.

Waste Tanks and Ancillary Equipment

The estimated total inventory for all the U Tank Farm High Level Waste Tanks and Ancillary Equipment is provided in Table E.5-2 for both the 90% and planned 99% retrieval scenarios. The tank-by-tank inventories are provided in Table E.5-3 through Table E.5-6. Safety-related information (i.e., hydrogen generation rates and times to the lower flammability limit are also provided in Table E.5-3. The inventories for the various contaminant in the U Tank Farm tanks vary over several orders of magnitude as does the GTM. This information is further summarized in Figure E.5-3 through Figure E.5-11 before and after planned 99% retrieval and for the maximum GTM in Figure E.5-12.

Vadose Zone Contamination

The estimated inventories for the vadose zone, saturated zone, and treatment amounts are found in Table E.5-7. These inventories represent the vadose zone contamination *outside* the tanks and ancillary equipment (i.e., that are generally available for transport through the environment). These are used to estimate the inventory remaining in the vadose zone using the process described in Chapter 6 of the Methodology Report (CRESP 2015a) as modified for the 2015 groundwater results (Appendix D.1). The focus in this section will be on the Group A and B contaminants in the vadose zone due to their mobility and persistence and potential threats to groundwater. To summarize (where current 200-UP plumes for carbon tetrachloride, chromium, I-129, and uranium are not associated with U Tank and Waste Farms EU waste sites):

- *Tc-99* – There are current plumes in the vicinity that are associated with U Tank and Waste Farms EU sources. The vadose zone inventory is dominated by ancillary equipment and past leaks.
- *I-129 and chromium* – There are current plumes in the vicinity; however, none are associated with U Tank and Waste Farms EU sources (and none are expected during the evaluation period based on the TC&WM EIS screening groundwater analysis (Section E.2.5)). The vadose zone inventory is dominated by ancillary equipment and past leaks.

[82] Maximum of the GTMs for Tc-99 and I-129 only.

- *Sr-90 and uranium* – There is no current plume for Sr-90. The vadose zone inventory is dominated by ancillary equipment and past leaks. Thus the majority of the Sr-90 originally discharged into the vadose zone would have had to travel through much of the vadose zone to impact groundwater. Using an analysis similar to that in Section E.2.5 for Sr-90 in the WMA T (200-West), a Sr-90 plume is not expected in the next 150 years due to retardation in the vadose zone or afterwards due to radioactive decay (+97% reduction in Sr-90 inventory). A similar case was made in Section E.2.5 for total uranium. Thus Sr-90 and total uranium are not considered significant threats to the Hanford groundwater during the first 150 years.

Using the process outlined in Chapter 6 of the Methodology Report (CRESP 2015a) as revised for the 2015 groundwater monitoring results (Appendix D.1), the vadose zone inventories in Table E.5-2 are estimated by difference and used to calculate Groundwater Threat Metric (GTM) values for the Group A and B contaminants remaining in the vadose zone as illustrated in Table E.5-7. Note that the vadose zone (VZ) ratings are *ND* for total uranium and Sr-90 (where the inventories for Sr-90 and total uranium would have translated to a *High* and *Low* rating, respectively, all other things being equal) and *Low* for the other primary contaminants (i.e., C-14, Tc-99, I-129, and total and hexavalent chromium). U Tank and Waste Farms EU sources are a minor contributor to the nitrate plume in the 200-UP IA (estimated to be 1% of the 5.7 km^2 200-UP nitrate plume area) leading to a *Low* rating for nitrate. Thus the overall rating is *Low*.

Groundwater Plumes

Legacy waste sites within the CP-TF-4 EU are suspected of be able to contribute mobile contaminants to the saturated zone (DOE/RL-92-16, Rev. 0) and 200-ZP plumes have been linked to CP-TF-4 sources (DOE/RL-2016-09, Rev. 0). In general groundwater plumes are evaluated in separate EUs; however, those portions of groundwater plumes that can be associated with the TF EU (i.e., a plume with sources associated with the TF EU) will be evaluated to provide a better idea of the saturated zone versus remaining vadose zone threats to groundwater. The estimated inventory for the saturated zone contamination is provided in Table E.5-2 where Photoshop was used to estimate the fraction of the plumes considered associated with the U Tank and Waste Farms EU (Attachment 6-4 in the Methodology Report (CRESP 2015a) as revised to accommodate the 2015 groundwater monitoring results described in Appendix D.1[83]). This information is also used to estimate amounts treated and remaining in the vadose zone. For the groundwater plumes described in the 200-UP GWIA (DOE/RL-2016-09, Rev. 0), apportionment of plumes and ratings from the Group A and B primary contaminants to the U Tank and Waste Farms EU would be as follows:

- Uranium -- There is a plume in the OU, but no major sources related to the Tank and Waste Farms EUs; thus there is no portion of the uranium plume considered associated with the U Tank and Waste Farms EU.
- *Chromium* – There are plumes in the OU; however, the plumes (including the one near the U Tank and Waste Farms EU) are not considered associated with the U Tank and Waste Farms EU.
- *Tc-99* – There are plumes in the OU; the single plume near the U Tank and Waste Farms EU is considered associated with the EU, and the area of this plume is 7% of the area (Appendix D.1).

[83] From the graphic map files provided by PNNL, the Photoshop Magic Wand Tool was used to select areas representing plumes and then the "Record Measurements" Tool was used to provide relative areal extents. A Custom Measurement Scale was set to that of the map.

- *I-129* – There are plumes in the OU; however, the plumes in the 200-UP GWIA originated from U Plant and REDOX Plant waste sites and thus no portion of the I-129 plume considered associated with the U Tank and Waste Farms EU.
- *Carbon tetrachloride* – The carbon tetrachloride plume is managed in the 200-ZP GWIA (Appendix D.6). Furthermore, there are no sources of carbon tetrachloride related to this EU.

The groundwater plumes associated with the U Tank Farm and co-located liquid waste disposal facilities are described in detail in the Appendix D.6 for the CP-GW-2 EU (200-UP GWIA). Note that nitrate, chromium (total and hexavalent), and I-129 (*Medium*) are the risk drivers for the 200-UP GW IA; however, there are no *major* U TF EU sources associated with these plumes (i.e., less than 7% of the total plume areas), and the remaining vadose zone sources would drive the risks associated with the U TF EU.

Impact of Recharge Rate and Radioactive Decay on Groundwater Ratings

The TC&WM EIS screening groundwater transport analysis (Appendix O, DOE/EIS-0391 2012) indicates that there is a significant impact of emplacing the engineered surface barrier (and resulting reduction of infiltrating water) on the predicted peak groundwater concentrations at the U Barrier[84]. To summarize, the results for Central Plateau sources including those in addition to the U Tank and Waste Farms EU (Appendix O, DOE/EIS-0391 2012) include:

- Tc-99 peak concentration is 9830 pCi/L (CY 3985) for the No Action Alternative versus 259 pCi/L (CY 3296) for the Landfill Scenarios where the threshold value is 900 pCi/L.
- Nitrate and uranium peak concentrations were all lower than standards for both the No Action and Landfill Scenarios.
- No values are reported at the U Barrier for Sr-90 and various other contaminants for either scenario, which indicates that the appropriate sources were not considered in the analysis, or peak fluxes that were less than 1×10^{-8} Ci/yr for radioactive contaminants, or 1×10^{-8} g/yr for chemical contaminants (Appendix O, DOE/EIS-0391 2012, p. O-2).

The predicted peak concentrations at the U Barrier for the Landfill Scenarios remain below threshold values during the TC&WM EIS evaluation period (10,000 years) and thus the saturated zone ratings for the Active and Near-term Post-Cleanup periods would be *Not Discernible* for Sr-90 and total uranium or *Low* for the other primary contaminants with reported inventories for this period (where the *Low* rating was ascribed to Sr-90 and total uranium after the Active Cleanup period to account for uncertainty)[85].

Columbia River

The process illustrated in Chapter 6 of the Methodology Report (CRESP 2015a) as revised for the 2015 groundwater and Columbia River results (Appendix D.1) is used to evaluate potential impacts to the Columbia River. Note that the evaluation of potential benthic and riparian impacts has a common thread up to the point when the shoreline impact (benthic) or riparian zone impact area is used to define ratings. Thus a common evaluation for the benthic and riparian zone is performed here. Since the U and

[84] The barrier represents the edge of the infiltration barrier to be constructed over disposal areas that are within 100 meters [110 yards] of facility fence lines (DOE/EIS-0391 2012). The U Barrier is the closest to the U Tank and Waste Farms EU. Despite including sources other than those for the U Tank and Waste Farms EU, the analysis in the TC&WM EIS was considered a reasonable source of information to assess the impact of the engineered surface barrier emplacement.

[85] Analyses specific to each Tank Farm or Central Plateau EU are not available; thus the aggregate screening analysis provided in the TC&WM EIS was used as an indication.

S-SX Tank and Waste Farms EUs are proximate (200-W) and share the 200-UP GWIA, the results for potential impacts to the Columbia River for the U Tank and Waste Farms EU are the same for the S-SX Tank and Waste Farms EU.

Benthic and Riparian Zone – Current Impacts

As described in in Section E.3.5, current impacts from the S-SX and U Tank and Waste Farms EUs to the Columbia River benthic and riparian ecology would be rated as *Not Discernible*.

Benthic and Riparian Zone – Active Cleanup and Near-term, Post Cleanup

Based on a very similar analysis to that in Section E.3.5 for CP-TF-2 (S-SX Tank and Waste Farms EU also in 200-West), the impacts to the Columbia River benthic and riparian ecology for the Active Cleanup and Near-term, Post Cleanup periods are also rated as *Not Discernible*.

Benthic and Riparian Zone – Long-term

As described in Section E.3.5, there should be no expected adverse effects from radionuclides for Columbia River benthic and riparian receptors over the time period evaluated (10,000 years).

Only chromium and nitrate would be predicted to exceed relevant thresholds (WM&TC EIS). However, the screening results indicate that future nitrate peak concentration (and discharge) appear to not exceed either the drinking water standard or ambient water quality criterion in the next 10,000 years. Furthermore, any chromium predicted to reach the Columbia River from U Tank Farm sources would likely lead to insignificant long-term impacts to the benthic and riparian ecology.

Threats to the Columbia River Free-flowing Ecology

As described in Section E.2.5, the large dilution effect of the Columbia River on the contamination from the seeps and groundwater upwellings results in *Not Discernible* ratings for the Active Cleanup and Near-term, Post Cleanup periods and insignificant long-term impacts to the free-flowing ecology for all contaminants.

Potential Impact of Recharge Rate on Threats to the Columbia River

The alternatives evaluation in the TC&WM EIS suggests that remedial actions (e.g., surface barrier emplacement that would decrease recharge in the areas near the Tank Farms) would appear to have significant impacts on the predicted long-term peak concentrations in the near-shore area (benthic and riparian receptors) of the Columbia River. However, this would not alter the ratings for this time period since they are already *Not Discernible* (ND).

Facilities for D&D – Not Applicable

Operating Facilities – Not Applicable

Because of the prohibition on waste additions to the Hanford SSTs,[86] the U Tank and Waste Farms EU components are not considered Operating Facilities for this Review.

[86] Berman presentation on July 29, 2009, titled "Hanford Single-Shell Tank Integrity Program." Available at www.em.doe.gov.

Table E.5-2. Summary Table of Infrastructure and Subsurface Contamination Inventory for the U Tank and Waste Farms Evaluation Unit (CP-TF-4) [a,b]

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[c]	99% Retrieval Scenario[c]
Infrastructure (Tanks and Ancillary Equipment)				
Tank Waste	Waste (kGal)	2928	292.8	29.28
	Sludge (kGal)	502	50.2	5.02
	Saltcake (kGal)	2418	241.8	24.18
	Supernatant (kGal)	8	0.8	0.08
Tank Waste (rad)	Am-241 (Ci)	2700	270	27
	C-14 (Ci)	46	4.6	0.46
	Co-60 (Ci)	130	13	1.3
	Cs-137 (Ci)	1700000	170000	17000
	Eu-152 (Ci)	17	1.7	0.17
	Eu-154 (Ci)	1600	160	16
	H-3 (Ci)	190	19	1.9
	I-129 (Ci)	1.6	0.16	0.016
	Ni-59 (Ci)	45	4.5	0.45
	Ni-63 (Ci)	4100	410	41
	Pu (total) (Ci)	4200	420	42
	Sr-90 (Ci)	620000	62000	6200
	Tc-99 (Ci)	1600	160	16
	U (total) (Ci)	33	3.3	0.33
Tank Waste (non-rad)	Cr (kg)	48000	4800	480
	Hg (kg)	27	2.7	0.27
	NO3 (kg)	4200000	420000	42000
	Pb (kg)	5800	580	58
	U (total) (kg)	41000	4100	410

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[(c)]	99% Retrieval Scenario[(c)]
Ancillary Equipment (rad)	C-14 (Ci)	2.8	2.8	2.8
	Cs-137 (Ci)	18000	18000	18000
	H-3 (Ci)	11	11	11
	I-129 (Ci)	0.036	0.036	0.036
	Pu (total) (Ci)	30	30	30
	Sr-90 (Ci)	7000	7000	7000
	Tc-99 (Ci)	19	19	19
	U (total) (Ci)	0.3	0.3	0.3
Ancillary Equipment (non-rad)	Cr (kg)	400	400	400
	Hg (kg)	0.2	0.2	0.2
	NO3 (kg)	42000	42000	42000
	Pb (kg)	84	84	84
	U (total) (kg)	380	380	380
Vadose Zone Source (Leaks and Intentional Discharges into Cribs and Trenches)				
Leaks (rad)	C-14 (Ci)	0.16	0.16	0.16
	Cs-137 (Ci)	8600	8600	8600
	H-3 (Ci)	6.4	6.4	6.4
	I-129 (Ci)	0.0045	0.0045	0.0045
	Pu (total) (Ci)	1.4	1.4	1.4
	Sr-90 (Ci)	580	580	580
	Tc-99 (Ci)	3.6	3.6	3.6
	U (total) (Ci)	0.12	0.12	0.12
Leaks (non-rad)	Cr (kg)	160	160	160
	Hg (kg)	0.072	0.072	0.072
	NO3 (kg)	12000	12000	12000
	Pb (kg)	0.84	0.84	0.84
	U (total) (kg)	180	180	180

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[(c)]	99% Retrieval Scenario[(c)]
Cribs (rad)	Co-60 (Ci)	6.40E-07	6.40E-07	6.40E-07
	Cs-137 (Ci)	3.40E-07	3.40E-07	3.40E-07
	H-3 (Ci)	23	23	23
	Pu (total) (Ci)	0.00078	0.00078	0.00078
	Sr-90 (Ci)	1.40E-07	1.40E-07	1.40E-07
	Tc-99 (Ci)	0.00059	0.00059	0.00059
	U (total) (Ci)	0.012	0.012	0.012
Cribs (non-rad)	Cr (kg)	0.39	0.39	0.39
	Hg (kg)	0.016	0.016	0.016
	NO3 (kg)	310	310	310
	Pb (kg)	0.0041	0.0041	0.0041
	U (total) (kg)	17	17	17
Trenches (rad)	Am-241 (Ci)	2.70E-06	2.70E-06	2.70E-06
	C-14 (Ci)	1.10E-06	1.10E-06	1.10E-06
	Co-60 (Ci)	3.80E-07	3.80E-07	3.80E-07
	Cs-137 (Ci)	0.017	0.017	0.017
	Eu-152 (Ci)	2.70E-08	2.70E-08	2.70E-08
	Eu-154 (Ci)	2.10E-06	2.10E-06	2.10E-06
	H-3 (Ci)	1.80E-05	1.80E-05	1.80E-05
	I-129 (Ci)	7.70E-09	7.70E-09	7.70E-09
	Ni-59 (Ci)	1.00E-07	1.00E-07	1.00E-07
	Ni-63 (Ci)	9.30E-06	9.30E-06	9.30E-06
	Pu (total) (Ci)	2.50E-05	2.50E-05	2.50E-05
	Sr-90 (Ci)	0.17	0.17	0.17
	Tc-99 (Ci)	7.50E-06	7.50E-06	7.50E-06
	U (total) (Ci)	0.00037	0.00037	0.00037
Trenches (non-rad)	Cr (kg)	4.7	4.7	4.7

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[(c)]	99% Retrieval Scenario[(c)]
	NO3 (kg)	110	110	110
	U (total) (kg)	0.54	0.54	0.54
UPR (rad)	Am-241 (Ci)	0.0089	0.0089	0.0089
	C-14 (Ci)	0.00086	0.00086	0.00086
	Co-60 (Ci)	0.00093	0.00093	0.00093
	Cs-137 (Ci)	52	52	52
	Eu-152 (Ci)	8.00E-05	8.00E-05	8.00E-05
	Eu-154 (Ci)	0.0059	0.0059	0.0059
	H-3 (Ci)	0.051	0.051	0.051
	I-129 (Ci)	2.50E-05	2.50E-05	2.50E-05
	Ni-59 (Ci)	0.00027	0.00027	0.00027
	Ni-63 (Ci)	0.024	0.024	0.024
	Pu (total) (Ci)	0.015	0.015	0.015
	Sr-90 (Ci)	5	5	5
	Tc-99 (Ci)	0.023	0.023	0.023
	U (total) (Ci)	0.0013	0.0013	0.0013
UPR (non-rad)	Cr (kg)	0.38	0.38	0.38
	Hg (kg)	0.00061	0.00061	0.00061
	NO3 (kg)	23	23	23
	U (total) (kg)	1.9	1.9	1.9
Vadose Zone (from Vadose Zone Sources)				
VZ Remaining (rad)	Am-241 (Ci)	0.0089	0.0089	0.0089
	C-14 (Ci)	0.16	0.16	0.16
	Co-60 (Ci)	0.00093	0.00093	0.00093
	Cs-137 (Ci)	8600	8600	8600
	Eu-152 (Ci)	8.00E-05	8.00E-05	8.00E-05
	Eu-154 (Ci)	0.0059	0.0059	0.0059

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[c]	99% Retrieval Scenario[c]
	H-3 (Ci)	29	29	29
	I-129 (Ci)	0.0045	0.0045	0.0045
	Ni-59 (Ci)	0.00027	0.00027	0.00027
	Ni-63 (Ci)	0.024	0.024	0.024
	Pu (total) (Ci)	1.4	1.4	1.4
	Sr-90 (Ci)	580	580	580
	Tc-99 (Ci)	2.7	2.7	2.7
	U (total) (Ci)	0.14	0.14	0.14
VZ Remaining (non-rad)	Cr (kg)	170[d]	170[d]	170[d]
	Cr-VI (kg)	170[d]	170[d]	170[d]
	Hg (kg)	0.088	0.088	0.088
	Pb (kg)	0.85	0.85	0.85
	U (total) (kg)	200	200	200
VZ Treatment (rad)	Tc-99 (Ci)	0.33	0.33	0.33
VZ Treatment (non-rad)	NO3 (kg)	4500	4500	4500
Saturated Zone (from Vadose Zone Sources)				
SZ Inventory (rad)	Tc-99 (Ci)	0.52	0.52	0.52
SZ Inventory (non-rad) (A and B)[e]	NO3 (kg)	190000	190000	190000

a. Tanks (SST and DST): Best Basis Inventory (BBI) February 2017; Ancillary Equipment (Anc Eq): Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix D; Unplanned Releases (UPRs): Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0); Ponds: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0); Cribs: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0); Trenches: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0) and Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix S; Leaks: Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix D; MUSTs: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0) and Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix S.

b. All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

c. 99% and 90% Retrieval Scenarios reflect assumptions described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 and apply only to tank volumes and inventories. They are calculated assuming retrieval of a fully mixed tank of homogeneous composition. For tanks that have been declared "Retrieval Completed" or "Retrieved to Limit of … Technologies" (Templeton, AM 2016, page 9, partially duplicated in Table E.1-7), no further retrieval for either the 99% or 90% retrieval scenario is assumed. This includes tank 241-S-112 and all C Tank Farm tanks except 241-C-105. For tanks that are currently undergoing retrieval (tanks 241-AY-102 and 241-C-105), a retrieval amount equivalent to the 99% and 90% retrieval volumes described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 are calculated.

d. Differences in inventories for Cr vs Cr-IV are due to differing Water Quality Standards (WQS) and thus plume extents: 100 mg/L for total chromium vs 48 mg/L for chromium (VI). The difference is not distinguishable within the number of significant digits (2) displayed.

e. Nitrate assessment not updated for 2015 groundwater monitoring results (DOE/RL-2016-09, Rev. 0) because the Group A and B drive risk to groundwater.

Table E.5-3. Current Bulk Inventory and Steady State Flammability Results (by Tank) for the U Tank Farm (CP-TF-4)

Tank ID	Tank Type	Capacity (kGal)[a]	Sludge (kGal)[a]	Saltcake (kGal)[a]	Supernatant (kGal)[a]	HGR (ft^3/d)[b]	Days to 25% LFL Barometric[c]	Days to 25% LFL Zero Ventilation[d]
U-101	SST	530	23	0	0	0.4	NA	>1826
U-102	SST	530	43	283	1	1.2	NA	504
U-103	SST	530	12	404	1	1.4	NA	312
U-104	SST	530	54	0	0	0.4	NA	>1826
U-105	SST	530	32	321	0	1.2	NA	494
U-106	SST	530	0	168	2	1.1	NA	702
U-107	SST	530	15	279	0	0.7	NA	975
U-108	SST	530	29	404	0	1.1	NA	452
U-109	SST	530	35	366	0	0.83	NA	583
U-110	SST	530	176	0	0	0.66	NA	1249
U-111	SST	530	26	193	0	0.64	NA	1217
U-112	SST	530	45	0	0	0.41	NA	>1826
U-201	SST	55	4	0	1	0.031	NA	>1826
U-202	SST	55	4	0	1	0.031	NA	>1826
U-203	SST	55	2	0	1	0.03	NA	>1826
U-204	SST	55	2	0	1	0.073	NA	951

a. Volumes from the Waste Tank Summary Report for Month Ending November 30, 2016 (Templeton, AM 2016).

b. Hydrogen generation rate (ft^3/d) (RPP-5926 Rev. 17). Note in 2001 all 24 tanks were removed from the flammable gas watch list (including T-110 in the T Tank and Waste Farms EU) (Johnson, et al. 2001, p. iii).

c. Time (in days) to 25% of the Lower Flammability Limit (LFL) under a barometric (barom) breathing scenario (RPP-5926, Rev. 17). “NA” indicates that the headspace will not reach specified flammability level.

d. Time (in days) to 25% of the LFL under a zero ventilation scenario (RPP-5926, Rev. 17).

Table E.5-4. Current Primary Contaminant Inventory (by Tank) for the U Tank Farm (CP-TF-4) [a]

Tank ID	Baseline Status[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)
U-101	2001	3.1	0.11	NR[c]	0.022	6700	0.01	0.45	0.88
U-102	2001	240	4.4	NR	17	270000	2.2	130	20
U-103	2001	200	6.5	NR	13	240000	2.2	130	19
U-104	2001	0.29	0.03	NR	0.00011	46	0.0019	0.11	1.1
U-105	2001	810	6.7	NR	22	280000	4.1	550	31
U-106	2001	680	2.2	NR	34	130000	0.42	440	6.2
U-107	2001	420	6.5	NR	5.5	130000	0.64	39	24
U-108	2001	95	8.1	NR	24	310000	3.3	74	38
U-109	2001	53	7	NR	8.1	230000	2.9	180	29
U-110	2001	84	0.34	NR	0.85	19000	0.061	3.4	0.74
U-111	2001	140	3.5	NR	2.5	120000	1.1	55	6.8
U-112	2001	1	0.14	NR	0.24	8200	0.013	0.73	6.4
U-201	2001	0.039	0.01	NR	2.30E-02	170	2.60E-05	0.0012	1.10E+00
U-202	2001	0.04	0.0068	NR	1.40E-02	130	0.000024	0.001	1.00E+00
U-203	2001	0.022	0.005	NR	7.70E-03	99	0.000017	0.00076	7.40E-01
U-204	2001	0.23	0.0035	NR	7.10E-03	60	0.000011	0.00047	4.60E-01

a. From Best Basis Inventory (BBI) Summary (February 2017). All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

b. This is the "Baseline Status" date as reported in the BBI (February 2017) as "Baselined 2001." It should not be necessarily be considered the decay date for isotope inventories.

c. NR = Not reported for this EU

Table E.5-5. Current Primary Contaminant Inventory[a] and Groundwater Threat Metric (by Tank) for the U Tank Farm (CP-TF-4)

Tank ID	I-129 (Ci)	Ni-59 (Ci)	Ni-63 (Ci)	Pu (total) (Ci)[b]	Sr-90 (Ci)	Tc-99 (Ci)	U (total) (Ci)[c]	GTM (Mm3)[d]
U-101	0.0031	0.51	42	9.6	43000	1.9	0.45	2.1
U-102	0.17	11	960	470	160000	160	1.9	180
U-103	0.22	6	550	230	50000	230	1.4	260
U-104	0.00083	0.0087	0.73	1.5	530	0.73	1.8	0.81
U-105	0.24	5.2	470	1300	23000	240	10	270
U-106	0.1	2.7	250	480	54000	110	0.71	120
U-107	0.23	2.4	220	660	3700	240	0.79	260
U-108	0.27	7	640	410	19000	280	3.3	310
U-109	0.24	5.2	470	58	14000	250	0.42	270
U-110	1.30E-02	2.4	210	330	170000	11	10	12
U-111	1.20E-01	2.3	200	220	38000	120	0.94	140
U-112	2.70E-03	5.50E-01	48	7.3	45000	3.6	0.6	4
U-201	7.30E-06	3.40E-02	3	0.072	2.7	1.40E-01	2.40E-04	1.50E-01
U-202	6.60E-06	3.10E-02	2.7	0.085	0.99	1.30E-01	0.00022	1.40E-01
U-203	0.000033	2.20E-02	2	0.034	1.4	9.90E-02	0.000075	1.10E-01
U-204	3.00E-06	1.40E-02	1.2	1	30	3.60E-02	0.0075	4.00E-02

a. From Best Basis Inventory (BBI) Summary (February 2017). All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

b. Sum of plutonium isotopes 238, 239, 240, 241, and 242

c. Sum of uranium isotopes 232, 233, 234, 235, 236, and 238

d. The Groundwater Threat Metric (GTM) shown for tanks is equal to the maximum of the GTM for Tc-99 and I-129.

Table E.5-6. Current Primary Contaminant Inventory (by Tank) for the U Tank Farm (CP-TF-4) [a]

Tank ID	CCl4 (kg)	CN (kg)	Cr (kg)	Cr-VI (kg)	Hg (kg)	NO3 (kg)	Pb (kg)	TBP (kg)	TCE (kg)	U (total) (kg)
U-101	NR[b]	NR	410	NR	3.6	16000	9.2	NR	NR	670
U-102	NR	NR	4900	NR	8.7	530000	150	NR	NR	1900
U-103	NR	NR	6600	NR	3	500000	200	NR	NR	1200
U-104	NR	NR	12	NR	0.35	710	0	NR	NR	2700
U-105	NR	NR	5300	NR	0.94	640000	460	NR	NR	12000
U-106	NR	NR	2200	NR	0.72	200000	280	NR	NR	550
U-107	NR	NR	5600	NR	0.64	640000	200	NR	NR	630
U-108	NR	NR	10000	NR	1.6	730000	3200	NR	NR	3600
U-109	NR	NR	7400	NR	1.4	600000	130	NR	NR	350
U-110	NR	NR	670	NR	0.46	41000	840	NR	NR	15000
U-111	NR	NR	5200	NR	2.8	330000	130	NR	NR	1000
U-112	NR	NR	130	NR	3.1	19000	79	NR	NR	870
U-201	NR	NR	13	NR	0.00099	880	2.5	NR	NR	0.26
U-202	NR	NR	11	NR	0.00072	840	2.9	NR	NR	0.23
U-203	NR	NR	9.6	NR	0.00045	810	1.7	NR	NR	0.11
U-204	NR	NR	3.2	NR	0.0018	350	59	NR	NR	11

a. From Best Basis Inventory (BBI) Summary (February 2017). All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

b. NR = Not reported for this EU

Table E.5-7. Summary of the Evaluation of Current Threats to Groundwater as a Protected Resource from Remaining Vadose Zone (VZ) Contamination associated with the U Tank and Waste Farms Evaluation Unit (CP-TF-4)

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} [d]	VZ GTM (Mm^3)	VZ Rating[e]
C-14	A	2000 pCi/L	0.23	0	1.84	1.61E-01 Ci	---	---	1.61E-01 Ci	8.04E-02	*Low*
I-129	A	1 pCi/L	0.23	0.2	1.84	4.53E-03 Ci	---	---	4.53E-03 Ci	1.74E+00	*Low*
Sr-90	B	8 pCi/L	0.23	22	1.84	5.84E+02 Ci	---	---	5.84E+02 Ci	4.13E+02	*ND*[f]
Tc-99	A	900 pCi/L	0.23	0	1.84	3.59E+00 Ci	5.21E-01 Ci	3.30E-01 Ci	2.74E+00 Ci	3.05E+00	*Low*
CCl_4[g]	A	5 µg/L	0.23	0	1.84	---	---	---	---	---	*ND*
Cr	B	100 µg/L	0.23	0	1.84	1.67E+02 kg	---	---	1.67E+02 kg	1.67E+00	*Low*
Cr-VI	A	48 µg/L[b]	0.23	0	1.84	1.67E+02 kg	---	---	1.67E+02 kg	3.47E+00	*Low*
TCE	B	5 µg/L	0.23	2	1.84	---	---	---	---	---	*ND*
U(tot)	B	30 µg/L	0.23	0.8	1.84	2.01E+02 kg	---	---	2.01E+02 kg	9.05E-01	*ND*[f]

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

b. "Model Toxics Control Act−Cleanup" (WAC 173-340) Method B groundwater cleanup level for hexavalent chromium. Other WQS values represent drinking water standards.

c. Treatment amounts from the 2015 Hanford Annual Groundwater Report (DOE/RL-2016-09, Rev. 0). Contamination in the 200-UP GWIA near the CP-TF-4 sites isbeing treated using the U Plant area P&T system.

d. The remaining vadose zone inventory is estimated by difference (CRESP 2015a; Appendix D.1) and thus has a high associated uncertainty.

e. Groundwater Threat Metric rating based on Table 6-3, Methodology Report (CRESP 2015a; Appendix D.1).

f. As discussed in Section E.5.5, no appreciable total uranium or Sr-90 plume would be expected in the next 150 years due to transport and decay (Sr-90) considerations. Thus the *Low* rating would apply to the period *after* the Active Cleanup to account for uncertainties.

g. Carbon tetrachloride is managed in the 200-ZP-1 Operable Unit (Appendix D.6 for CP-GW-2).

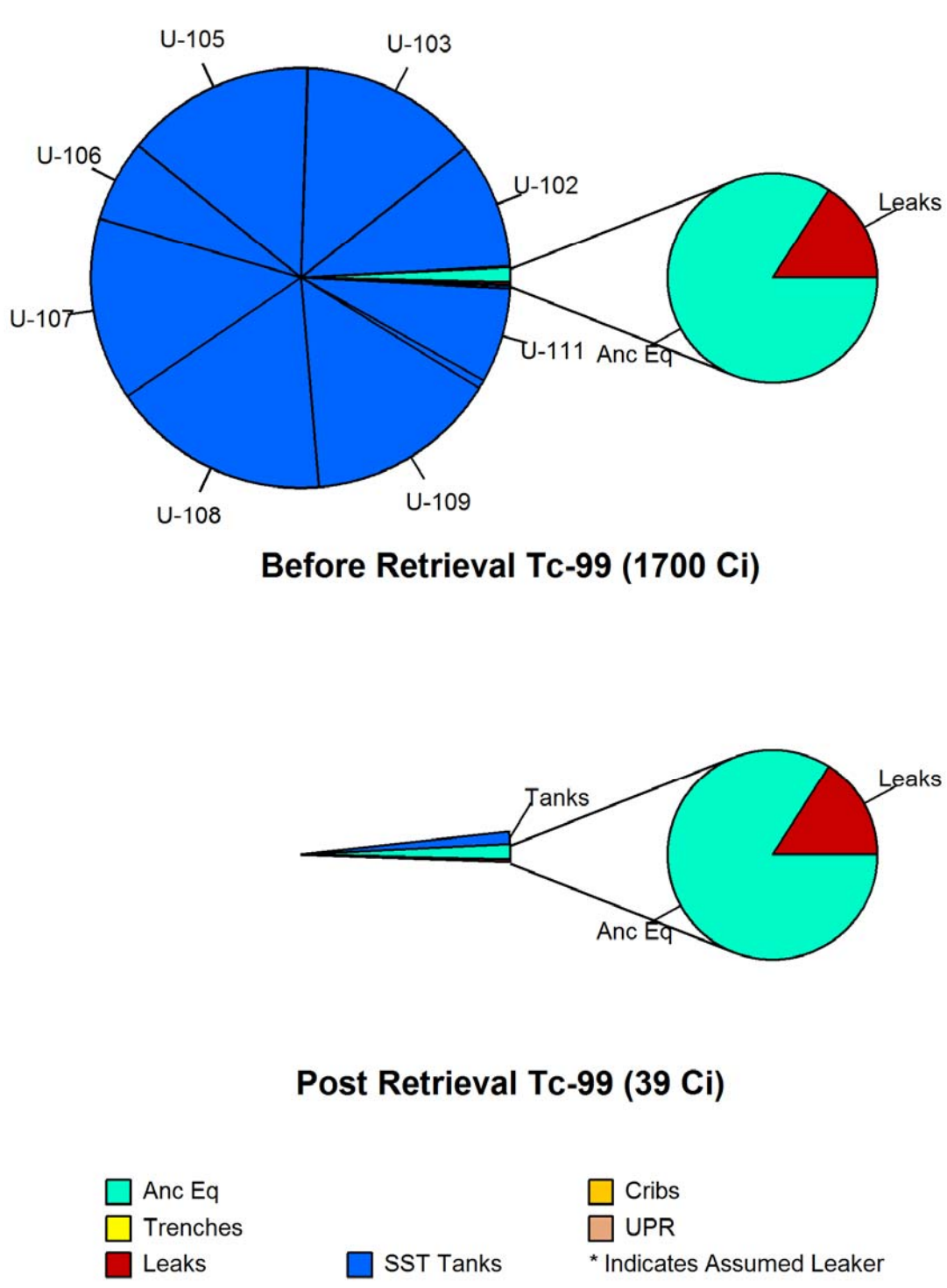


Figure E.5-3. U Tank and Waste Farms Evaluation Unit Inventory Estimates for Tc-99 Before and After 99% Retrieval

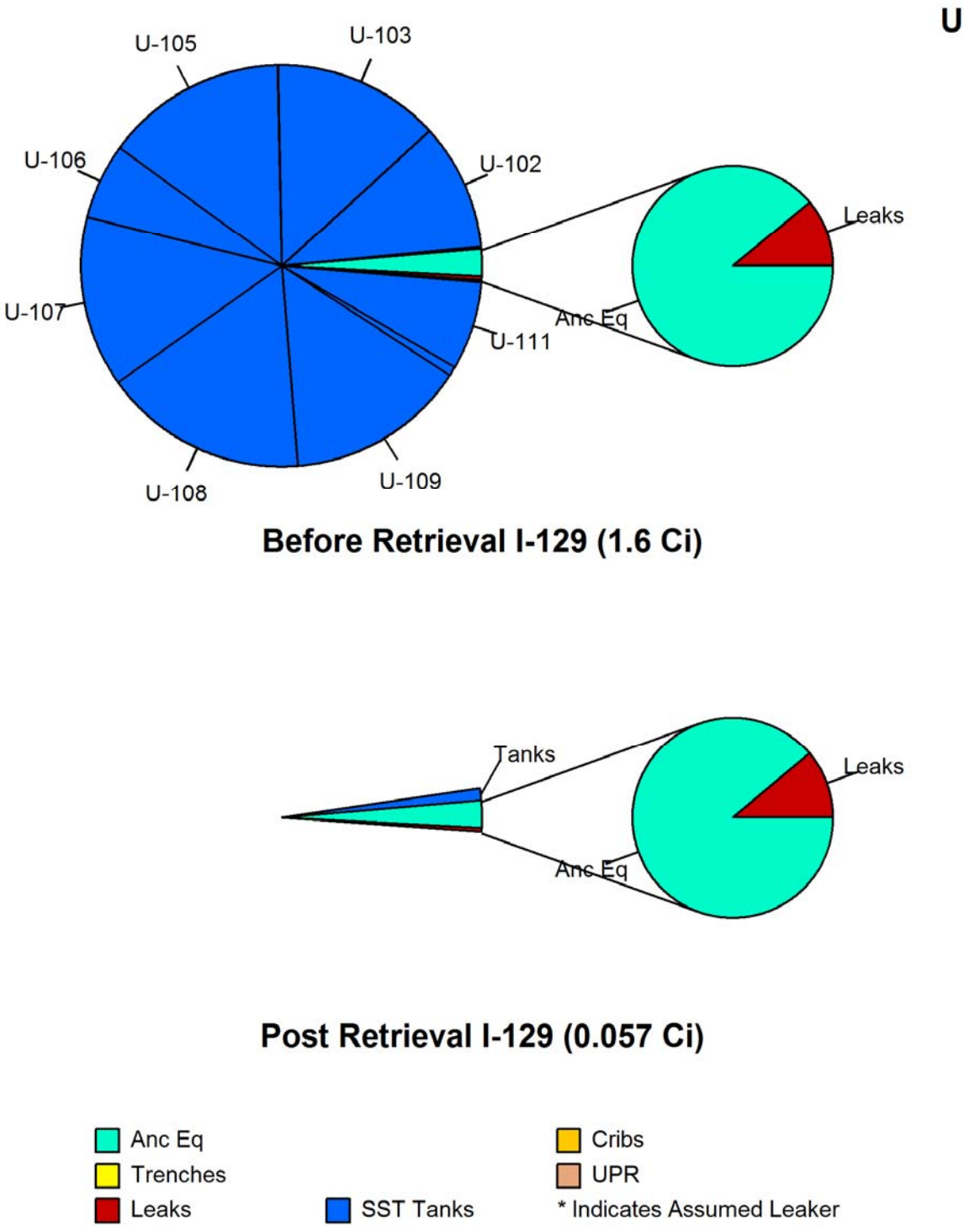


Figure E.5-4. U Tank and Waste Farms Evaluation Unit Inventory Estimates for I-129 Before and After 99% Retrieval

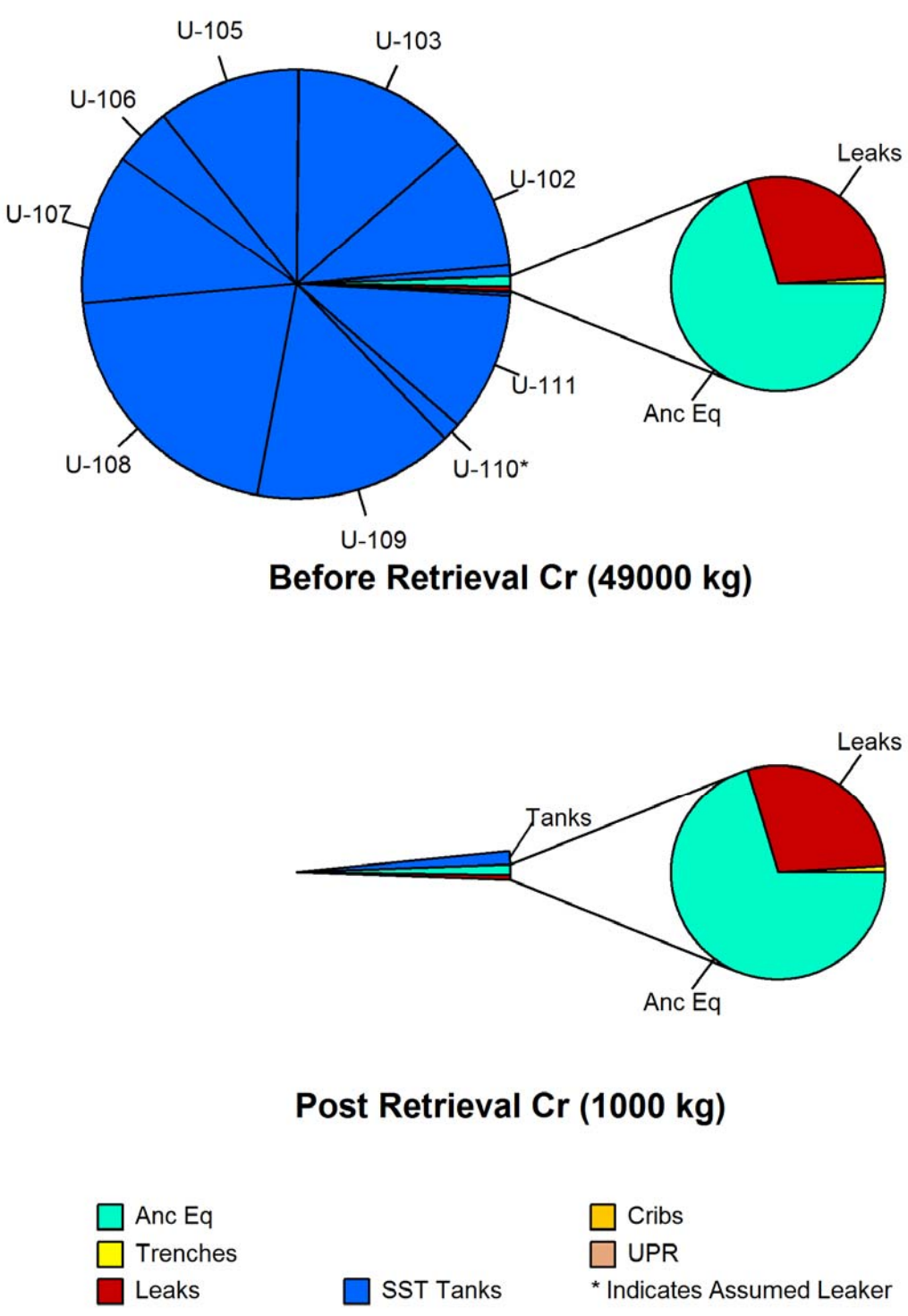


Figure E.5-5. U Tank and Waste Farms Evaluation Unit Inventory Estimates for Chromium Before and After 99% Retrieval

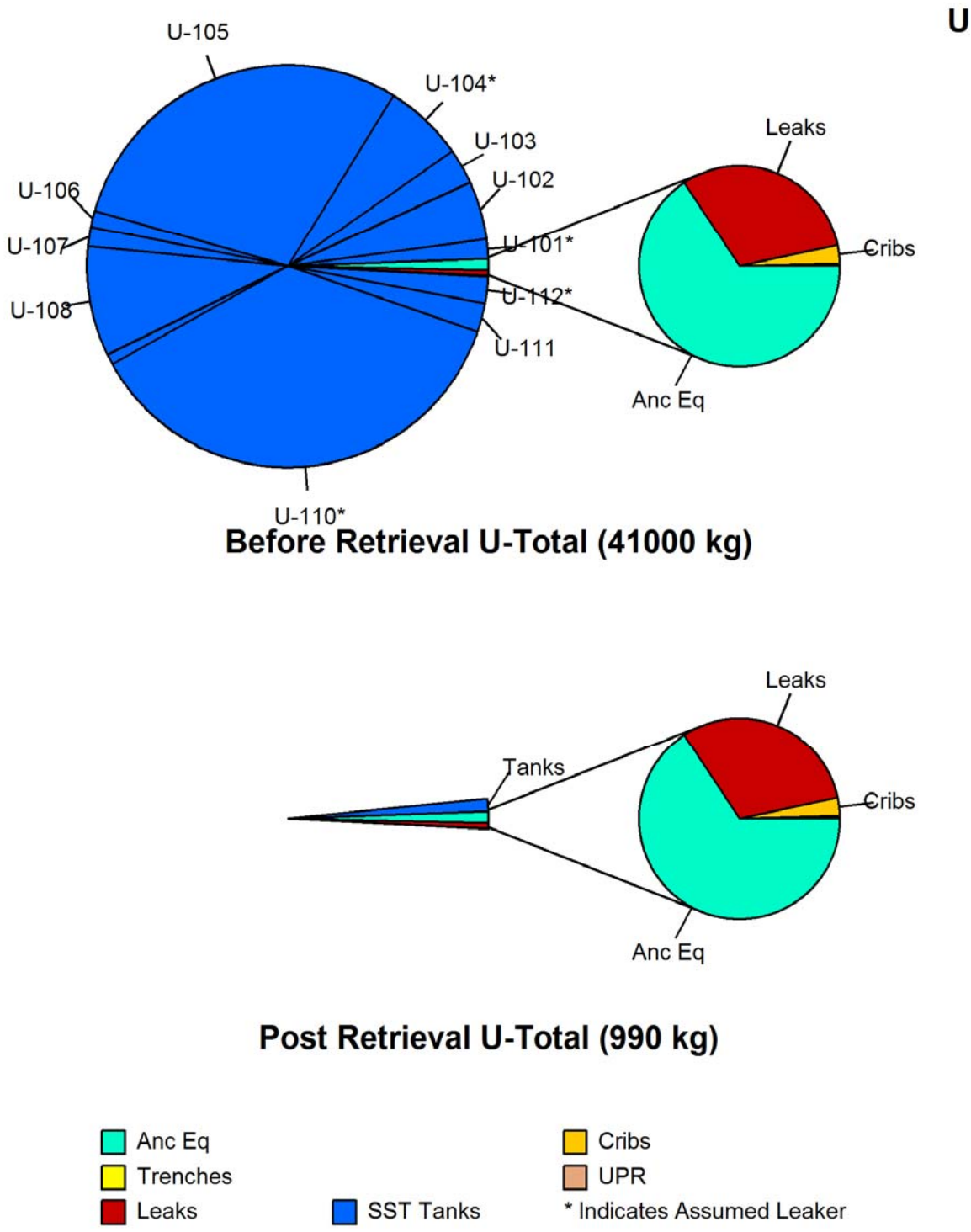


Figure E.5-6. U Tank and Waste Farms Evaluation Unit Inventory Estimates for U(tot) Before and After 99% Retrieval

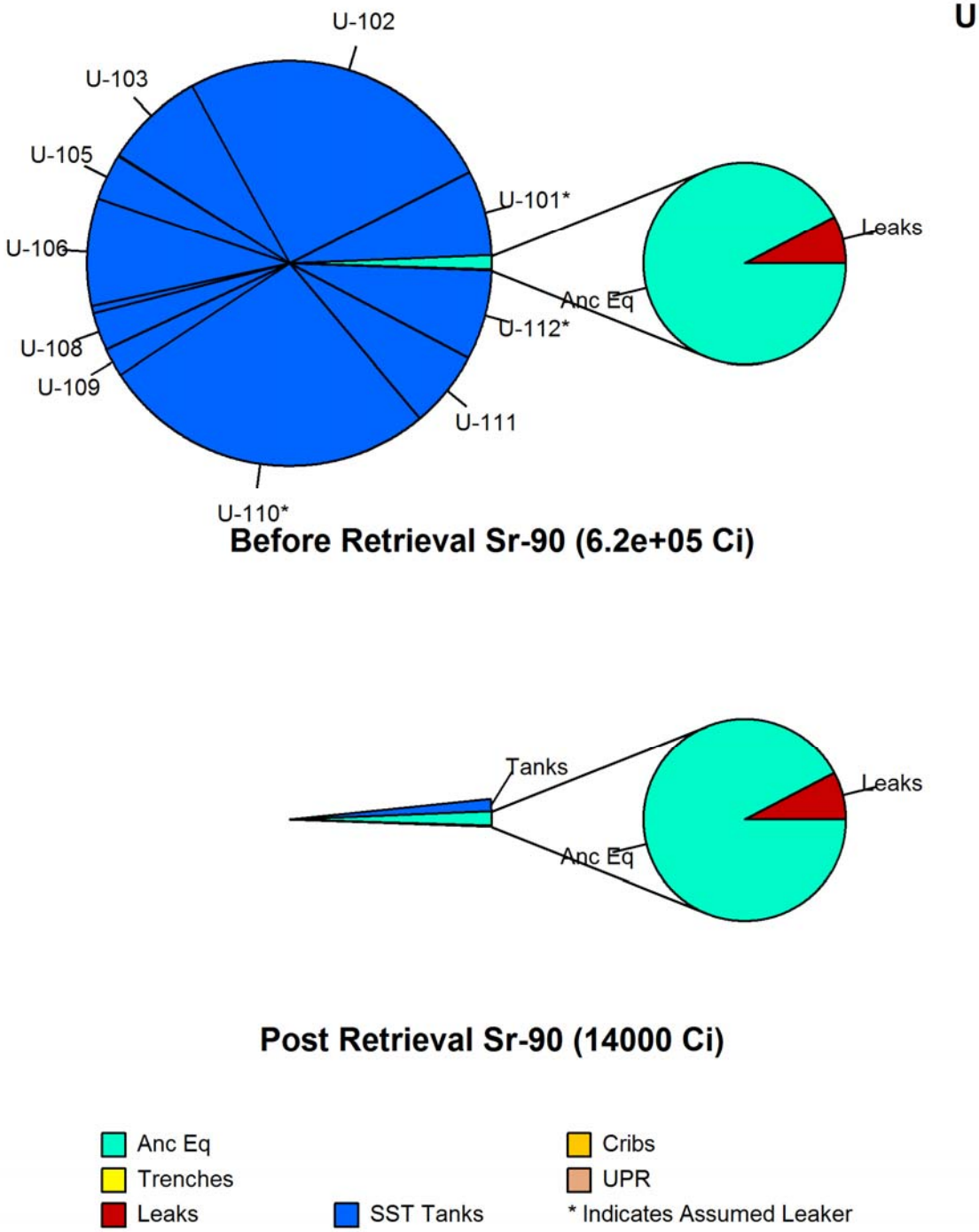


Figure E.5-7. U Tank and Waste Farms Evaluation Unit Inventory Estimates for Sr-90 Before and After 99% Retrieval

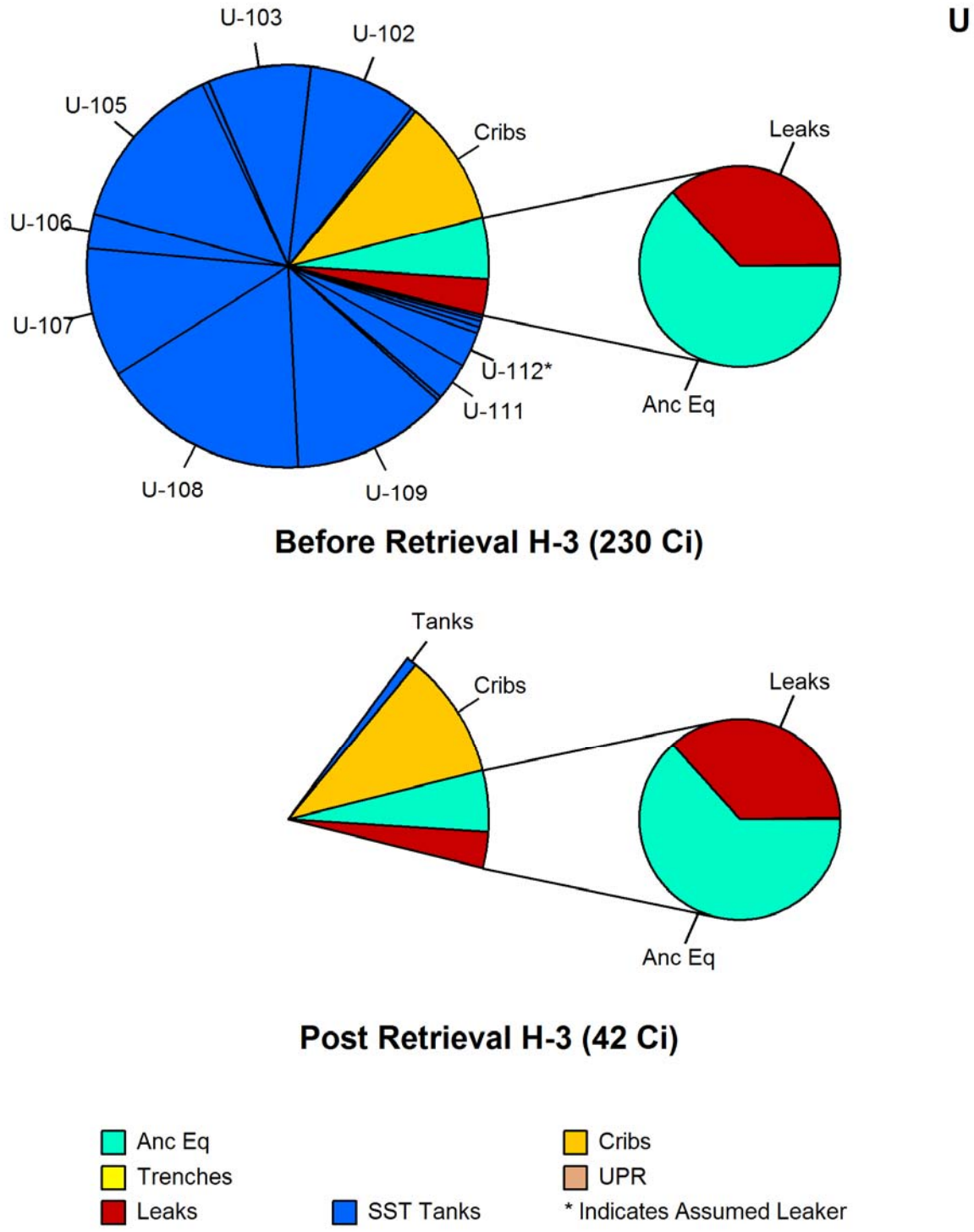


Figure E.5-8. U Tank and Waste Farms Evaluation Unit Inventory Estimates for Tritium (H-3) Before and After 99% Retrieval

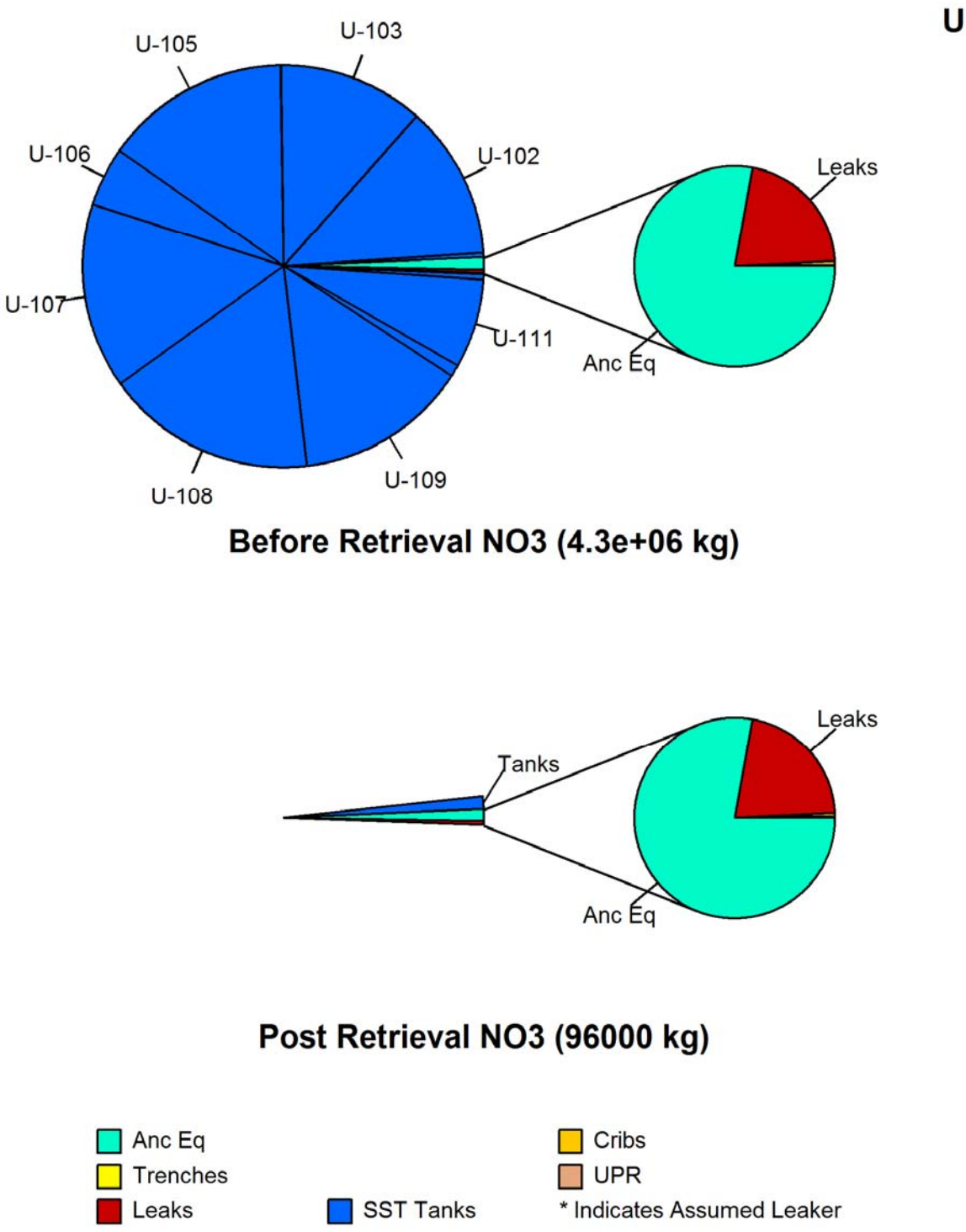


Figure E.5-9. U Tank and Waste Farms Evaluation Unit Inventory Estimates for Nitrate (NO3) Before and After 99% Retrieval

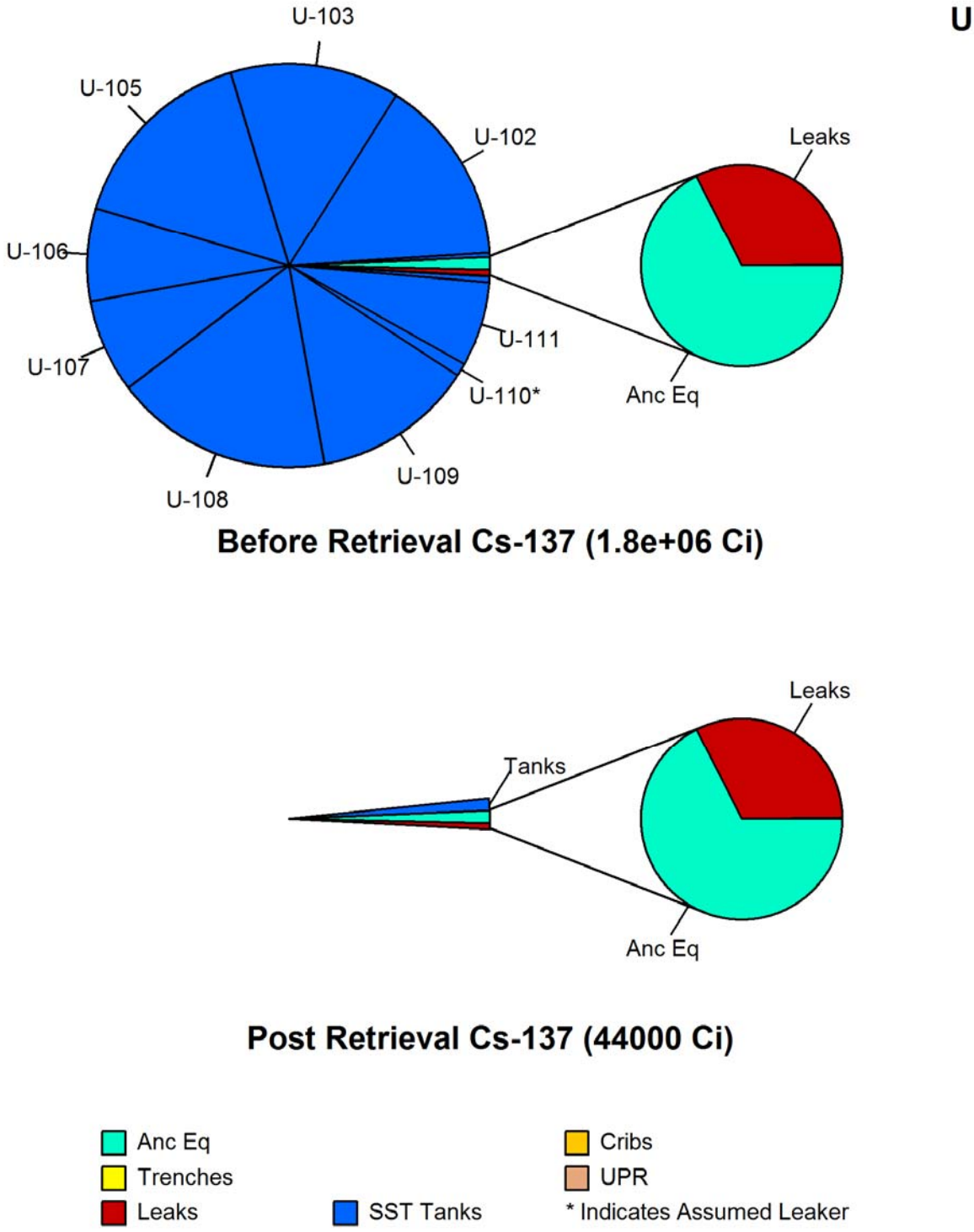


Figure E.5-10. U Tank and Waste Farms Evaluation Unit Inventory Estimates for Cs-137 Before and After 99% Retrieval

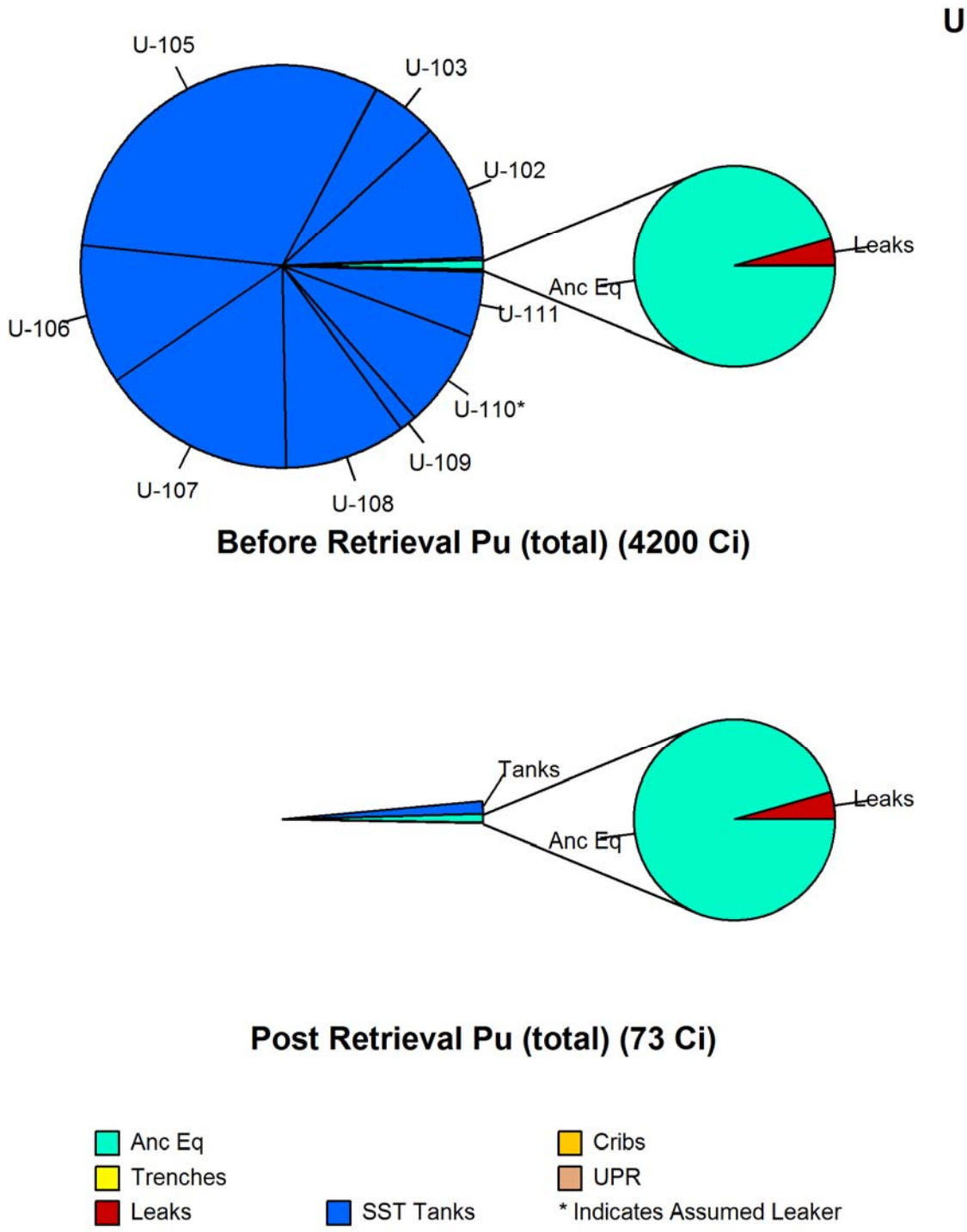


Figure E.5-11. U Tank and Waste Farms Evaluation Unit Inventory Estimates for Plutonium (total) Before and After 99% Retrieval

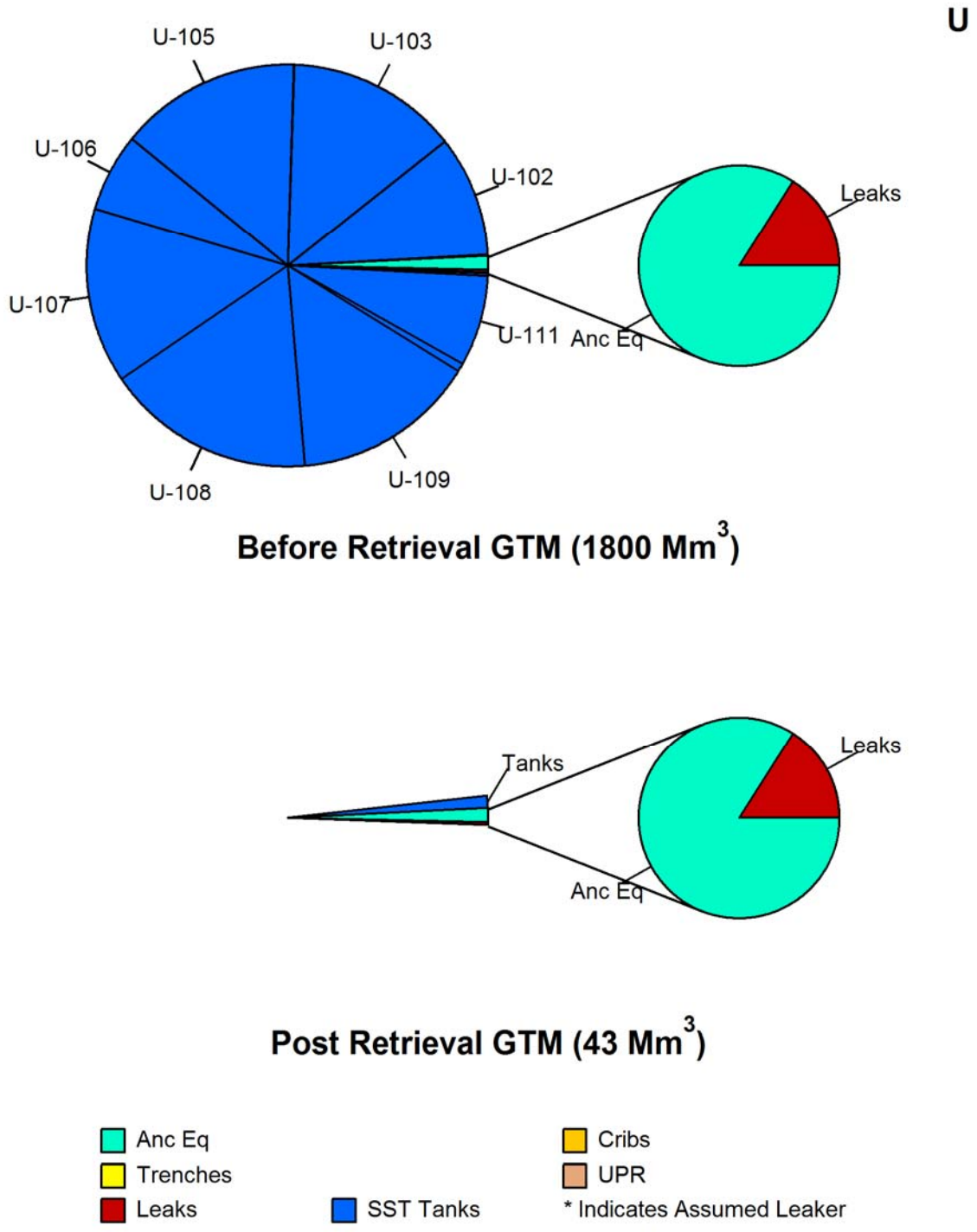


Figure E.5-12. U Tank and Waste Farms Evaluation Unit Maximum Groundwater Threat Metric (GTM) of I-129 and Tc-99 Estimates Before and After 99% Retrieval

E.5.6. POTENTIAL RISK/IMPACT PATHWAYS AND EVENTS

CURRENT CONCEPTUAL MODEL

A common safety analysis was performed for all the single- and double-shell tanks including pathways and barriers (safety scenarios that dominate risk, safety systems and controls, barriers to release, failure mechanisms, pathways and receptors, time frames for exposure). See Section E.1.6 in Appendix E.1 for details.

POPULATIONS AND RESOURCES CURRENTLY AT RISK OR POTENTIALLY IMPACTED

Facility Worker, Co-located Person, and Public

A common analysis was performed for the Facility Worker, Co-located Person, and Public. See Section E.1.6 (Appendix E.1) for details.

Groundwater and Vadose Zone

The groundwater plumes (nitrate and Tc-99) considered associated with the U Tank and Waste Farms EU and liquid waste disposal facilities are described in Section E.5.5 and further details including ratings are provided in Appendix D.6 for the CP-GW-2 EU (200-UP GWIA).

As shown in Table E.5-7 (Section E.5.5), the vadose zone (VZ) GTM values for the Group A and B primary contaminants translate into ratings of *Not Discernible* (*ND*) for total uranium and Sr-90 (which has an inventory that would translate to a *High* rating but appears relatively immobile in the area as described in Section E.5.5) and *Low* for uranium, C-14, Tc-99, chromium (total and hexavalent), and I-129 for the U Tank and Waste Farms EU. As described in section E.5.5, the rating for nitrate is *Low*. Thus the overall rating for potential groundwater impact from vadose zone sources is *Low*.

Columbia River

As described in Section E.5.5, no plumes associated with the U Tank and Waste Farms EU currently intersect the Columbia River above benthic or riparian standards, which corresponds to *Not Discernible* ratings. The large dilution effect of the Columbia River results in a rating of *Not Discernible* for the free-flowing ecology.

Additional information concerning potential threats to the Columbia River from U Tank Farm and liquid waste disposal facilities is provided in Appendix D.6 for the CP-GW-2 EU.

Ecological Resources

- The fenced portion of the U Tank Farm consists of graveled surfaces and tank farm infrastructure (>60%). Level 2 and level 3 habitat resources remain at the perimeters of the EU outside the fenced area (~18% each).
- Wildlife observations made during the October survey within the habitat along the borders of the EU included coyote tracks, small mammal burrows, and harvester ant hills, which were also observed in previous surveys along with northern pocket gopher sign, side-blotched lizards, and 6 migratory bird species.
- Approximately 3.5 acres of level 3 habitat exist within the U Tank and Waste Farms EU; total loss of this habitat within the EU would result in a change of approximately 2% at the landscape level evaluated for this unit.

- The remaining level 2 and level 3 habitats within the EU are fragmented and isolated from habitat surrounding the 200 West Area.
- Individual species occurrences of Piper's daisy lie just outside the perimeter of the EU, but would not be expected to be impacted by clean up actions for U Tank Farm.
- Loss of level 2 and level 3 habitat within the U Tank and Waste Farms EU would not be expected to affect habitat connectivity outside the 200 West Area.

Cultural Resources

- There are no known recorded archaeological sites or TCPs located within the U Tank and Waste Farms EU.
- The 244UR Waste Disposal Vault a contributing property within the Manhattan Project and Cold War Era Historic District, with documentation required, is located within the U Tank and Waste Farms EU.

Archaeological sites and TCPs located within 500 meters of the EU

- The 2727WA Sodium Storage Building and the 2727W also a Sodium Storage Building contributing properties within the Manhattan Project and Cold War Era Historic District, with no documentation required are located within the vicinity of the U Tank and Waste Farms EU.
- The Hanford Site Plant Railroad, a contributing property within the Manhattan Project and Cold War Era Historic District, with documentation required is located in the vicinity of the U Tank and Waste Farms EU.

Recorded TCPs Visible from the EU

- There are two recorded TCPs associated with the Native American Precontact and Ethnographic Landscape that are visible from the U Tank and Waste Farms EU.

CLEANUP APPROACHES AND END-STATE CONCEPTUAL MODEL

Selected or Potential Cleanup Approaches

A common analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

Contaminant Inventory Remaining at the Conclusion of Planned Active Cleanup Period

See Section E.5.5 including Table E.5-2 and Figure E.5-3 through Figure E.5-11 for the inventory information after planned 99% retrieval. Furthermore, a more general analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

Risks and Potential Impacts Associated with Cleanup

A common analysis was performed for all the single- and double-shell tanks for workers and the Public. See Section E.1.6 (Appendix E.1) for details.

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

Facility Worker, Co-located Person, and Public

A common analysis was performed for the Facility Worker, Co-located Person, and Public. See Section E.1.6 (Appendix E.1) for details.

Groundwater

As described in Section E.5.5, there will be a continuing impact during this period to groundwater (as a protected resource) from mobile U Tank Farm primary contaminants currently with plumes that exceed thresholds. These impacts are described in Appendix D.6 for the CP-GW-2 EU (200-UP GWIA).

Furthermore, there are primary (e.g., tank wastes) and secondary contaminant sources (legacy source sites) in the vadose zone that pose risk to groundwater. The vadose zone (VZ) GTM values for the Group A and B primary contaminants for the U Tank and Waste Farms EU translate to ratings of *Not Discernible* (because of the large potential impact of recharge rates) to *Low* (uncertainty). As indicated in Section E.5.5, total uranium or Sr-90 are unlikely to impact the groundwater in sufficient quantities to exceed the drinking water standard and thus are not considered future threats[87]. These ratings correspond to an overall rating of *Low* for both the Active and Near-term, Post-Cleanup periods to account for uncertainties.

The 200-West Area pump-and-treat system is assumed to be operational during this evaluation period, which will be treating groundwater contamination.

It is considered unlikely that additional groundwater resources would be impacted as a result of either interim remedial actions (e.g., pump and treat) or final closure activities (that are not covered in the Ecological or Cultural Resources results).

Columbia River

As described in Section E.5.5, the impacts to the Columbia River benthic, riparian, and free-flowing ecology for the Active Cleanup and Near-term, Post Cleanup periods are rated as *Not Discernible*. Additional information on groundwater plumes and potential threats associated with the U Tank Farm and liquid waste disposal facilities are described in Appendix D.6 for the CP-GW-2 EU (200-UP GWIA).

It is considered unlikely that additional benthic or riparian resources would be impacted as a result of either interim remedial actions (e.g., pump and treat) or final closure activities (that are not covered in the Ecological or Cultural Resources results).

Ecological Resources

See Section E.1.6 (Appendix E.1) for details.

Cultural Resources

See Section E.1.6 (Appendix E.1) for details.

ADDITIONAL RISKS AND POTENTIAL IMPACTS IF CLEANUP IS DELAYED

A common analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

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

A common analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

[87] Note that no appreciable uranium or Sr-90 plume would be expected in the next 150 years due to transport considerations; however, these may impact groundwater after the 150-year period. Thus a *Low* rating would apply after the Active Cleanup period to account for uncertainties.

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

Table E.5-8. Summary of Populations and Resources at Risk or Potentially Impacted after Cleanup

Population or Resource		Impact Rating	Comments
Human	Facility Worker	Low	Workers will be low risk from exposure to direct radiation and waste contaminants after waste retrieval, grouting, and capping.
	Co-located Person	Low	These persons will be at low risk from exposure to direct radiation and waste contaminants after waste retrieval, grouting, and capping.
	Public	Not Discernible (ND)	The Tank Farms will be in secure and controlled areas that prevent intentional and inadvertent intruders. No complete groundwater pathway and no impact from air pathway.
Environmental	Groundwater (A&B) from vadose zone[(a)]	*Low* (All PCs with reported inventories) **Overall**: *Low*	Current GTM values for Group A and B primary contaminants (Table E.5-7): *ND* (Sr-90, U(tot)) and *Low* (C-14, Tc-99, I-129, and Cr(tot), Cr-VI). Sr-90 and U(tot) not likely to impact groundwater (Section E.5.5) and assigned *Low* ratings to address uncertainties. Sufficiently large predicted impact from changes in recharge rates to adjust ratings but were not to account for uncertainties. Groundwater treatment in 200-UP would not impact vadose zone threat or rating.
	Columbia River from vadose zone[(a)]	Benthic: Not Discernible Riparian: Not Discernible Free-flowing: Not Discernible **Overall**: Not Discernible	TC&WM EIS screening results indicate that exposure to radioactive and chemical contaminants from peak groundwater discharge below benchmarks for both benthic and riparian receptors (Section E.5.5). Dilution factor of greater than 100 million between River and upwellings.

Population or Resource		Impact Rating	Comments
	Ecological Resources[(b)]	ND to Low	It will be capped, which results in less frequent monitoring, but monitoring activities can cause some disruption and disturbance to EU and buffer resources. Remediation may improve habitat through re-vegetation.
Social	Cultural Resources[(b)]	**Native American:** Direct: Unknown Indirect: Known **Historic Pre-Hanford:** Direct: Unknown Indirect: Unknown **Manhattan/Cold War**: Direct: None Indirect: None	Permanent indirect effects to viewshed are possible from capping. Permanent effects may be possible due to presence of contamination if capping occurs. No other expected cultural resources impacts.

a. Groundwater threat for Group A and B contaminants remaining in the vadose zone or to the Columbia River for all primary contaminants. Threats from existing plumes associated with the U Tank and Waste Farms EU are described in Section E.5.5 and Appendix D.6 (CP-GW-2) for the 200-UP Groundwater Interest Area.

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

As described in Section E.5.5, the TC&WM ecological screening analysis indicate that that exposure to radioactive contaminants from peak groundwater discharge was below screening levels at the Columbia River near-shore region, indicating there should be no expected adverse effects from radionuclides. Furthermore, results of the corresponding TC&WM screening evaluation for chemicals indicated that predicted chromium and nitrate concentrations could exceed screening values (i.e., Hazard Quotient of unity) in the near-shore region. However, the predicted nitrate peak concentration was in the past and would be unlikely to exceed human or aquatic standards in the future. For chromium the long travel time from 200-West to the Columbia River likely indicates that little chromium predicted to impact the near-shore region would be from 200-West sources (including the U Tank and Waste Farms EU), which would also likely lead to insignificant impacts from the U Tank and Waste Farms EU.

For more information, see Section E.1.6 (Appendix E.1).

E.5.7. SUPPLEMENTAL INFORMATION AND CONSIDERATIONS

A common analysis was performed for all the single- and double-shell tanks. See Section E.1.7 (Appendix E.1) for details.

E.5.8. ATTACHMENT – U TANK AND WASTE FARMS EVALUATION UNIT WIDS REVIEW

Hanford Site-Wide Risk Review

Evaluation Unit:	U Tank Farm
ID:	CP-TF-4
Group:	Tank Farm
Operable Unit Cross-Walk:	WMA U 200-WA-1
Related EU:	CP-LS-7 CP-GW-2
Sites & Facilities:	U tank farm, ancillary structures, associated liquid waste sites, and soils contamination
Key Data Sources Docs:	RPP-13033 RPP-23405 RPP-40545 RPP-PLAN-40145 RPP-10435

Figure 1. Site Map with Evaluation Unit Boundaries and Tank Locations

Attached:

- Waste Site and Facility List
- Site Map with Evaluation Unit Boundaries and Associated Waste Sites
- Site Map with Evaluation Unit Boundaries and Associated Facilities

Prepared by: AMG, 08/29/2014
Reviewed by: GVL, 08/29/2014
Revisions: AMG, 09/10/2014

Hanford Site-Wide Risk Review
CP-TF-4 (U Tank Farm)
Waste Site and Facility List

Site Code	Name, Aliases, Description	Site Status	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation
200-W-168-PL	200-W-168-PL; 216-U-3 Crib and 216-U-14 Ditch Pipelines	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-W-179-PL	200-W-179-PL; Lines SL100, SL101, SN216/281 and DR327; Pipelines Between 241-S-152 Diversion Box and 241-U Tank Farm	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-W-181-PL	200-W-181-PL; Lines V426, V427 and V428/V461; Transfer Lines Between 241-U-152 and 241-U-153 Diversion Boxes	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-W-184-PL	200-W-184-PL; 241-U-152 and 241-U-153 Diversion Boxes to 241-U-301 Catch Tank; Drain Lines from 241-U-151; Line V478	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-W-185-PL	200-W-185-PL; Lines V450 and V451; Transfer Lines Between 241-U-151 and 241-U-153 Diversion Boxes	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-W-238	200-W-238; Large Diameter French Drain North of 241-U	Inactive	French Drain	Crib - Subsurface Liquid Disposal Site	TBD	
200-W-4	200-W-4; U-Farm Landfill	Inactive	Burial Ground	Burial Ground	Not Applic	
200-W-67	200-W-67; Contaminated Soil at the Corner of Cooper and 16th Street	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	200-WA-1	
200-W-95	200-W-95; Contaminated Soil at 241-U Tank Farm; Contamination Migration Beyond the 241-U fence	Inactive	Contamination Migration	Unplanned Release - Surface/Near Surface	WMA U	
200-W-98-PL	200-W-98-PL; Encased Pipeline from 240-S-151 to 241-U-153 Diversion Box; V458, V459, and V460	Inactive	Encased Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
216-U-13	216-U-13; 216-U-13 Cribs; Vehicle Steam Cleaning Pit	Inactive	Trench	Crib - Subsurface Liquid Disposal Site	200-WA-1	
216-U-3	216-U-3; 216-U-3 French Drain; 216-U-11	Inactive	French Drain	Crib - Subsurface Liquid Disposal Site	200-WA-1	
241-U-101	241-U-101; 241-U-TK-101	Inactive	Single-Shell Tank	Underground Storage Tank	WMA U	
241-U-102	241-U-102; 241-U-TK-102	Inactive	Single-Shell Tank	Underground Storage Tank	WMA U	
241-U-103	241-U-103; 241-U-TK-103	Inactive	Single-Shell Tank	Underground Storage Tank	WMA U	
241-U-104	241-U-104; 241-U-TK-104	Inactive	Single-Shell Tank	Underground Storage Tank	WMA U	
241-U-105	241-U-105; 241-U-TK-105	Inactive	Single-Shell Tank	Underground Storage Tank	WMA U	
241-U-106	241-U-106; 241-U-TK-106	Inactive	Single-Shell Tank	Underground Storage Tank	WMA U	
241-U-107	241-U-107; 241-U-TK-107	Inactive	Single-Shell Tank	Underground Storage Tank	WMA U	
241-U-108	241-U-108; 241-U-TK-108	Inactive	Single-Shell Tank	Underground Storage Tank	WMA U	
241-U-109	241-U-109; 241-U-TK-109	Inactive	Single-Shell Tank	Underground Storage Tank	WMA U	
241-U-110	241-U-110; 241-U-TK-110	Inactive	Single-Shell Tank	Underground Storage Tank	WMA U	
241-U-111	241-U-111; 241-U-TK-111	Inactive	Single-Shell Tank	Underground Storage Tank	WMA U	
241-U-112	241-U-112; 241-U-TK-112	Inactive	Single-Shell Tank	Underground Storage Tank	WMA U	
241-U-153	241-U-153; 241-U-153 Diversion Box	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA U	
241-U-201	241-U-201; 241-U-TK-201	Inactive	Single-Shell Tank	Underground Storage Tank	WMA U	
241-U-202	241-U-202; 241-U-TK-202	Inactive	Single-Shell Tank	Underground Storage Tank	WMA U	
241-U-203	241-U-203; 241-U-TK-203	Inactive	Single-Shell Tank	Underground Storage Tank	WMA U	
241-U-204	241-U-204; 241-U-TK-204	Inactive	Single-Shell Tank	Underground Storage Tank	WMA U	
241-U-252	241-U-252; 241-U-252 Diversion Box	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA U	
241-U-301	241-U-301; 241-U-301B; V478; 231-U-301 Catch Tank	Inactive	Catch Tank	Underground Storage Tank	WMA U	
241-U-A	241-U-A; 241-U-A Diversion Box; 241-U-A Valve Pit	Inactive	Valve Pit	Pipeline and associated valves, etc.	WMA U	
241-U-B	241-U-B; 241-U-B Diversion Box; 241-U-B Valve Pit	Inactive	Valve Pit	Pipeline and associated valves, etc.	WMA U	
241-U-C	241-U-C; 241-U-C Diversion Box; 241-U-C Valve Pit	Inactive	Valve Pit	Pipeline and associated valves, etc.	WMA U	
241-U-D	241-U-D; 241-U-D Diversion Box; 241-U-D Valve Pit	Inactive	Valve Pit	Pipeline and associated valves, etc.	WMA U	
241-UR-151	241-UR-151; 241-UR-151 Diversion Box; Drain Lines 5764 and 5765	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA U	

Note that only those waste sites with a WIDS (Waste Information Data System) Classification of "Accepted" are shown, along with non-duplicate facilities, identified via the Hanford Geographic Information System (HGIS).

Hanford Site-Wide Risk Review
CP-TF-4 (U Tank Farm)
Waste Site and Facility List

Site Code	Name, Aliases, Description	Site Status	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation
241-UR-152	241-UR-152; 241-UR-152 Diversion Box; Line 5053	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA U	
241-UR-153	241-UR-153; 241-UR-153 Diversion Box; Line 5253	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA U	
241-UR-154	241-UR-154; 241-UR-154 Diversion Box; Line 5453	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA U	
244-U DCRT	244-U DCRT; 244-U Double-Contained Receiver Tank; 244-U Receiver Tank; 244-U Receiving Vault; 244-U RT; 244-U-TK/SUMP	Inactive	Receiver Tank	Underground Storage Tank	WMA U	
244-UR VAULT	244-UR VAULT; 244-UR Vault (Tanks -001 Through -004); IMUST; Inactive Miscellaneous Underground Storage Tank; Lines 5764 and 5765	Inactive	Receiving Vault	Underground Storage Tank	WMA U	
2607-WUT	2607-WUT; 2607-WUT Septic Tank and Tile Field	Inactive	Septic Tank	Septic System	TBD	X
UPR-200-W-115	UPR-200-W-115; Ground Contamination Above Transfer Line Along Cooper Street; UN-216-W-25	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	200-IS-1	
UPR-200-W-128	UPR-200-W-128; Contamination Release Inside 241-U Tank Farm	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-W-132	UPR-200-W-132; 241-UR-151 Diversion Box Release; UN-200-W-132	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-W-154	UPR-200-W-154; 241-U-101 Leak	Inactive	Unplanned Release	Unplanned Release - Subsurface	Not Applic	
UPR-200-W-155	UPR-200-W-155; 241-U-104 Leak	Inactive	Unplanned Release	Unplanned Release - Subsurface	Not Applic	
UPR-200-W-156	UPR-200-W-156; 241-U-110 Leak	Inactive	Unplanned Release	Unplanned Release - Subsurface	Not Applic	
UPR-200-W-157	UPR-200-W-157; 241-U-112 Leak	Inactive	Unplanned Release	Unplanned Release - Subsurface	Not Applic	
UPR-200-W-24	UPR-200-W-24; Release from the 244-UR Vault; UN-200-W-24	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-W-71	UPR-200-W-71; Contamination Spread from 16th Street to Dayton Ave.; UN-200-W-71	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	200-WA-1	
241U271	U FARM CONTROL HOUSE	ACTIVE	BUILDING	Infrastructure Building		X
241U701	INSTRUMENT AIR COMPRESSOR HOUSE	ACTIVE	BUILDING	Infrastructure Building		X
244U	SALT WELL RECEIVER VAULT	ACTIVE	STRUCTURE	Process Building		
244U271	244U CONTROL HOUSE	ACTIVE	BUILDING	Infrastructure Building		X
244U2904	244U FLUSH PIT	INACTIVE	BUILDING	Process Building		
2724U	RAD MONITORING AND PROTECTIVE CLOTHING BLDG	INACTIVE	BUILDING	Infrastructure Building		X
MO297	CHANGE TRAILER WEST OF 241U	ACTIVE	BUILDING	Infrastructure Building		X
MO823	CHANGE TRAILER AT U TANK FARM/16TH AND CAMDEN	ACTIVE	BUILDING	Infrastructure Building		X

Note that only those waste sites with a WIDS (Waste Information Data System) Classification of "Accepted" are shown, along with non-duplicate facilities, identified via the Hanford Geographic Information System (HGIS).

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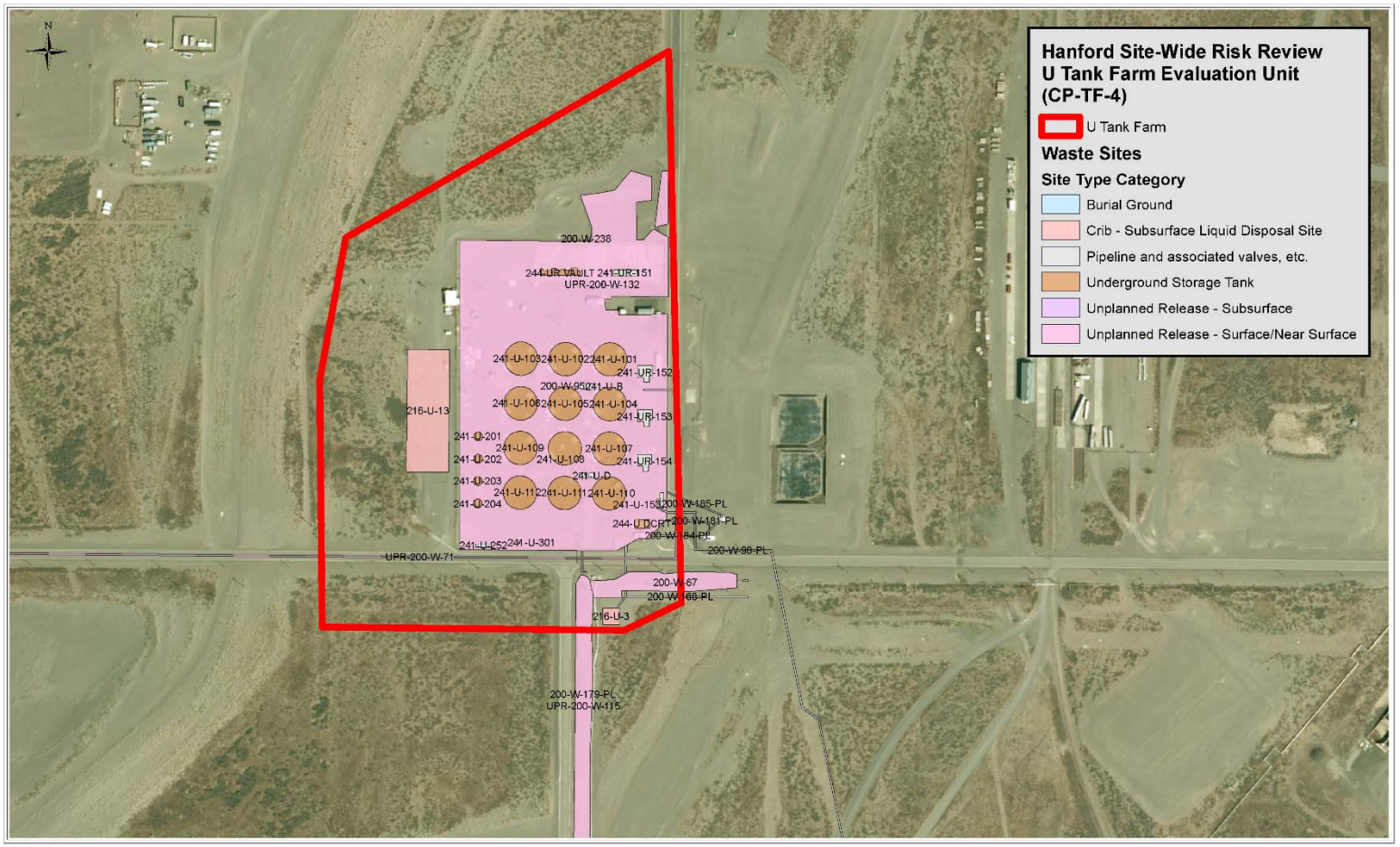

1 inch = 300 feet

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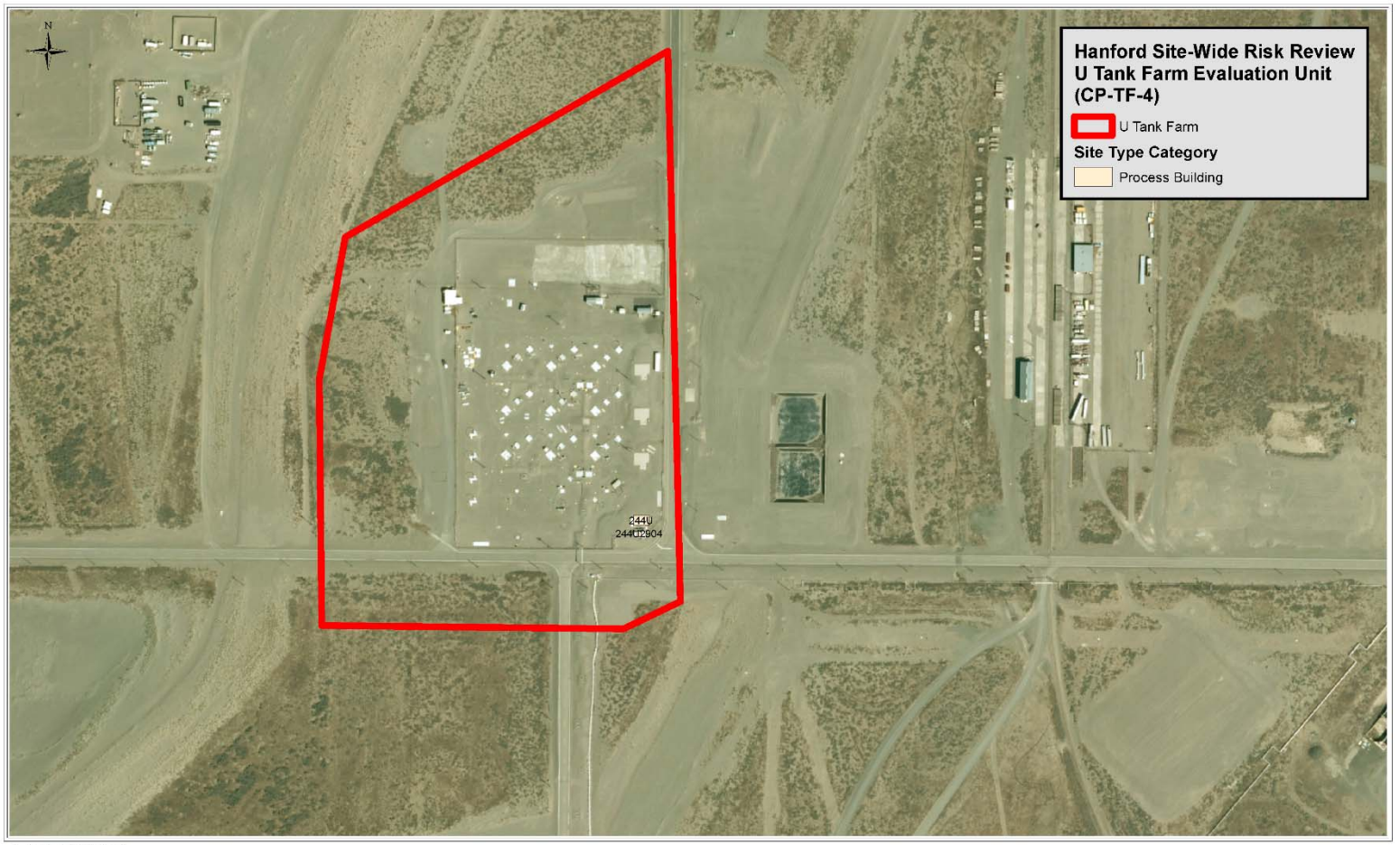

1 inch = 300 feet

APPENDIX E.6

Tank Waste and Farms

CP-TF-5 (A-AX Tank Waste and Farms)
Evaluation Unit Summary Template

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PART E.6. CP-TF-5 A-AX SINGLE-SHELL TANK WASTE AND FARMS (200-E)

E.6.1. EXECUTIVE SUMMARY

Much of the information related to the A-AX Tank and Waste Farms Evaluation Unit (EU) is organized around the corresponding Waste Management Area (namely WMA A-AX) that is regulated under the Resource Conservation and Recovery Act (RCRA) and Washington's Hazardous Waste Management Act (HWMA, RCW 70.105) and it's implementing requirements (Washington's Dangerous Waste Regulations, WAC 173-303) (PNNL-15315).

EU LOCATION:

East-Central part of 200-East on the Hanford Reservation; Central Plateau

RELATED EUS:

T Tank Waste and Farms (CP-TF-1), S-SX Tank Waste and Farms (CP-TF-2), TX-TY Tank Waste and Farms (CP-TF-3), U Tank Waste and Farms (CP-TF-4), B-BX-BY Tank Waste and Farms (CP-TF-6), C Tank Waste and Farms (CP-TF-7), 200-East DST Waste and Farms (CP-TF-8), 200-West DST Waste and Farms (CP-TF-9), 200-E Groundwater Plumes (CP-GW-1), 200-W Groundwater Plumes (CP-GW-2), and 200 Area Waste Transfer Pipeline (CP-LS-7)

PRIMARY CONTAMINANTS, CONTAMINATED MEDIA AND WASTES:

The TC&WM EIS describes tank wastes as including radioactive (tritium or H-3, C-14, Sr-90, Tc-99, I-129, Cs-137, U-233, U-234, U-235, U-238, Np-237, Pu-239, and Pu-240)[88] and non-radioactive contaminants (chromium, mercury, nitrate, lead, total uranium, and PCBs) of potential concern (DOE/EIS-0391 2012, Appendix D). The tank wastes contain saltcake, sludge, and supernatant phases. Contaminated media related to the A-AX Tank Farms include ancillary equipment and surrounding vadose zone (including cribs and trenches) down to the saturated zone (for some mobile contaminants) from past and current discharges. The 2015 Groundwater Monitoring Report (DOE/RL-2016-09, Rev. 0) lists tank wastes including H-3, I-129, nitrate, Sr-90, Tc-99, and uranium for the 200-PO groundwater interest area (GWIA) that is used to geographically represent contaminant migration from the 200-PO-1 OU for monitoring purposes.

After evaluating the contaminants associated with A-AX Tank Farm tanks, ancillary equipment, legacy sources, and contaminated vadose zone, the primary contaminant from the tank wastes that drives human health risk to groundwater associated with the A-AX Tank and Waste Farms Evaluation Unit is Tc-99[89]. Those primary contaminants that may drive risk from groundwater discharge to the Columbia River

[88] Other isotopes considered include U-232 and U-236 and Pu-238, Pu-241, and Pu-242 to be consistent with other EUs. These additional uranium and plutonium isotopes are included in the totals presented but are not used for rating because 1) uranium toxicity impacts (represented by total uranium drives corresponding risks and 2) plutonium has been found relatively immobile in the Hanford subsurface and has not been identified as a risk driver for groundwater impacts.

[89] Tc-99 has been detected in a relatively small areas in the 200-BP and 200-PO around WMA C and WMA A-AX, respectively. It is assumed that the (more northern) plume near WMA C that straddles the 200-BP / 200-PO boundary has sources in WMA C (200-BP) and the other (more southern) plume near WMA A-AX has sources in WMA A-AX (DOE/RL-2016-09, Rev. 0). The WMA A-AX is not considered a source for the I-129 plume (DOE/RL-2016-09, Rev. 0).

are nitrate and chromium; however, any potential impacts are highly uncertain[90]. Cs-137 and Sr-90 are important from a safety standpoint and uranium isotopes, plutonium isotopes, and tritium are iconic constituents; these contaminants are included in the inventory summary even though they are not considered risk drivers for impacts to or from groundwater in this review. Other current plumes including tritium (H-3), I-129, nitrate, Sr-90, and uranium that are not associated with the A-AX Tank and Waste Farms EU are captured in Appendix D.5 for the CP-GW-1 EU (200-PO GWIA).

BRIEF NARRATIVE DESCRIPTION

Waste Management Area A-AX (WMA A-AX) occupies approximately 7 acres (http://phoenix.pnnl.gov/) and contains six underground single-shell tanks (SSTs) in A Tank Farm and four SSTs in AX Tank Farm in additional to ancillary equipment (e.g., diversion boxes, pumps, valves, and pipes). The A Tank Farm was constructed in 1954-55 and the AX Tank Farm in 1963-64 (PNNL-13023, p. 2.1). The SSTs in these Tank Farms were used to store mixed wastes mainly from the PUREX process[91]. After 1977, many tanks received waste listed as evaporator feed, double-shell slurry feed, non-complexed waste, complexed waste, complex concentrated waste, complexant concentrate, and Hanford Defense Residual Liquid. Some waste stored in the A-AX Tank Farms generated sufficient decay heat to cause boiling of the tank supernatant (i.e., were "self-boiling"). Resulting vapors were routed through headers to condensers (vented to the atmosphere through filters) and the condensate was either discharged to cribs or returned to the waste tank to maintain the desired liquid levels in tanks (PNNL-13023, p. 2.2).

The 241-A (or A) Tank Farm contains six carbon steel tanks with capacities of 1 Mgal and the first two tanks (A-101 and A-102) began receiving PUREX wastes in 1956; these two tanks were not initially self-boiling because initial volumes were large. Although the A Tank Farm tanks were equipped for boiling wastes, only the A-101 through A-105 were self-boiling. Two 241-A tanks (A-104 and A-105) are classified as "assumed leakers" (Templeton 2016) where both were "self boiling". The A Tank Farms tanks were removed from service in 1980 with the exceptions of A-104 (removed in 1975) and A-105 (removed in 1963) (PNNL-13023, p. 2.8).

The 241-AX (or AX) Tank Farm contains four carbon steel tanks with capacities of 1 Mgal and received PUREX wastes from 1965 until 1969 (PNNL-13023, p. 2.8). Tanks AX-101 and AX-102 began receiving fractionization waste in 1969; these tanks were sluiced in 1975 to provide feed for B Plant. Tanks AX-103 and AX-104 received only PUREX waste until 1973; these tanks were sluiced in 1976. All four AX Tank Farm tanks are classified as "sound" (Templeton 2016, p. 15). The AX Tank Farms tanks were removed from service in 1980 with the exception of AX-104 (removed in 1978) (PNNL-13023, p. 2.8).

[90] "For groundwater discharging to the Columbia River…, potential long-term impacts on aquatic and riparian receptors would be unlikely for all COPCs and receptors except for chromium and aquatic biota..." (DOE/EIS-0391 2012, p. 2–235). For the COPC (i.e., hexavalent chromium) with the highest risk indices for aquatic biota, Hazard Quotients exceeded 40 (versus a limit of 1). However, the TC&WM EIS states "… Only estimated exposures of aquatic biota to hexavalent chromium in nearshore surface water under all Tank Closure … exceeded the Hazard Quotient criterion of 1 at the Columbia River. Based on the conservative nature of the exposure assumptions, the estimated Hazard Indices and Hazard Quotients for the representative receptors indicated that no adverse effects of radioactive or chemical COPCs in … groundwater releases to the Columbia River..." (DOE/EIS-0391 2012, Appendix P, pp. P–53-54). "The potential impact on aquatic biota in the Hanford Reach of nitrate in groundwater discharge is uncertain." (DOE/EIS-0391 2012, Appendix P, pp. P–54).

[91] Production in the PUREX Plant came on line in January 1956 and processed approximately 72% of the reactor fuel produced at the DOE Hanford Site, where resulting wastes included high-level solvent extraction wastes (both self-boiling and not) and cladding wastes, organic wash wastes, and cell drainage (PNNL-13023, p. 2.7).

There are various non-tank sources that received large volumes of slightly contaminated waste and other waste streams that has resulted in extensive vadose zone and groundwater contamination in the areas around the WMA A-AX as summarized in Section E.6.3.

The SSTs in WMA A-AX have been interim stabilized (i.e., liquid transferred to DSTs to <50 kgal drainable interstitial liquid and <5 kgal of supernatant). The 200-PO GWIA is being monitored to determine the impact to groundwater prior to determining the path forward for remedial action, with a 200-BP-5 and 200-PO-1 Feasibility Study report and proposed plan(s) due in 2018 (Appendix D, Ecology et al., 1996 [Accessed 27 Feb 2017]). No date or milestone has been scheduled for the final Record of Decision (ROD).

SUMMARY TABLES OF RISKS AND POTENTIAL IMPACTS TO RECEPTORS

Table E.6-1 provides a summary of nuclear and industrial safety related consequences from the CP-TF-5 (A-AX Tank and Waste Farms EU) to humans and impacts to important physical Hanford Site resources. Receptors are described in Section E.1.6 (Appendix E.1).

Table E.6-1. CP-TF-5 (A-AX Tank Farms) impact Rating Summary for Human Health (unmitigated basis with mitigated basis provided in parentheses (e.g., "High (Low)").

Population or Resource		Evaluation Time Period[a] Active Cleanup (to 2064) **Current Condition:** Maintenance & Monitoring (M&M)	**From Cleanup Actions:** Retrieval & Closure
Human Health	Facility Worker[b]	***M&M***: Low-High[d] (Low-High)[d] ***Soil***: ND-High (ND-Low)	***Preferred method***: High (Low) ***Alternative***: High (Low)
	Co-located Person[b]	***M&M***: Low-Moderate (Low) ***Soil***: ND (ND)	***Preferred method***: Low-Moderate (Low) ***Alternative***: Low-Moderate (Low)
	Public[b]	***M&M***: Low (Low) ***Soil***: ND (ND)	***Preferred method***: Low (Low) ***Alternative***: Low (Low)
Environmental	Groundwater (A&B) from vadose zone[c]	*Medium* -- Cr(tot) and Cr-VI *Low* -- C-14, I-129, and Tc-99 *ND* -- Sr-90[f] and U(tot)[f] **Overall**: *Medium*	*Medium* -- Cr(tot) and Cr-VI *Low* -- C-14, I-129, and Tc-99 *ND* -- Sr-90[f] and U(tot)[f] **Overall**: *Medium*
	Columbia River from vadose zone[c]	Benthic: ND (rad & chem) Riparian: ND (rad & chem) Free-flowing: ND (rad & chem) **Overall**: ND	Benthic: ND (rad & chem[g]) Riparian: ND (rad & chem[g]) Free-flowing: ND (rad & chem) **Overall**: ND
	Ecological Resources[e]	ND to Low	Low to Medium
Social	Cultural Resources[e]	**Native American:** Direct: Unknown Indirect: Known **Historic Pre-Hanford:** Direct: Unknown Indirect: Unknown **Manhattan/Cold War:** Direct: Known Indirect: Known	**Native American:** Direct: Unknown Indirect: Known **Historic Pre-Hanford:** Direct: Unknown Indirect: Unknown **Manhattan/Cold War:** Direct: Known Indirect: Known

a. A rating for cultural resources is 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.

b. Evaluated in Section E.1.6 (Appendix E.1).

c. Groundwater threat for Group A and B contaminants remaining in the vadose zone or to the Columbia River for all primary contaminants. Threats from existing plumes associated with the A-AX Tank and Waste Farms EU are described in Section E.6.5 and Appendix D.5 (CP-GW-1) for the 200-PO Groundwater Interest Area (GWIA). Note: rad = radionuclides and chem = chemicals.

d. Industrial safety consequences range from low to high (based on the evaluation scale used) for both mitigated (with controls) and unmitigated (without controls). Mitigated radiological and toxicological consequences to facility workers are high (unmitigated) and low (mitigated).

e. 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.

f. The large amounts of Sr-90 and total uranium disposed of in the A-AX Tank and Waste Farms EU would translate to *High* ratings; however, there is no current Sr-90 or total uranium plume associated with A-AX Tank and Waste Farms EU sources in the 200-PO GWIA. It would likely require more than 150 years for either Sr-90 or uranium to reach groundwater in a sufficient amount to exceed the corresponding drinking water standard over an appreciable area (Section E.6.5). Total uranium and Sr-90 are given *Not Discernible* (*ND*) ratings for the Active Cleanup period and *Low* ratings afterwards to account for uncertainties in the evaluation. Thus Sr-90 and total uranium are not considered significant risk drivers during the evaluation period.

g. The information from Appendix P from the TC&WM EIS would suggest that hexavalent chromium would have *Medium* and *High* ratings for benthic and riparian zone impacts, respectively. However, current well data suggest that chromium is moving much more slowly than predicted in the TC&WM EIS evaluation resulting in *Not Discernible* (*ND*) ratings.

SUPPORT FOR RISK AND IMPACT RATINGS FOR EACH POPULATION OR RESOURCE

Human Health

The current and cleanup-related consequences related to work being conducted at the Tank Farms in the 200 Areas (Hanford Central Plateau) was evaluated in Section E.1.6 (Appendix E.1).

Groundwater, Vadose Zone, and Columbia River

Current

A-AX Tank Farm contaminants are currently impacting groundwater, and treatment is not predicted to decrease concentrations to below thresholds before active cleanup commences. Secondary sources in the vadose also threaten to continue to impact groundwater in the future. As described in the TC&WM EIS, there appeared to be large predicted impacts on peak concentrations in groundwater both during and after cleanup (but not the near-shore region of the Columbia River). However, despite these large, predicted impacts, the groundwater ratings for I-129, hexavalent chromium, and uranium are not changed for the Active Cleanup period. On the other hand, the Tc-99 and total chromium were predicted to not exceed thresholds over the TC&WM evaluation period (10,000 years), which resulted in a *Low* groundwater rating for both (which is a change for total chromium) in the Near-term, Post-Cleanup period to account for uncertainty as described in Section E.6.5. The hexavalent chromium rating did not change.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

See Section E.1.1.

Ecological Resources

Current

High quality habitat (22% level 3) exists in EU, and 27% level 3 and 4 in buffer suggests potential for disturbance even though truck traffic is low. Trucks can bring in seeds of exotic species, changing species composition. Has some nice Sage Brush habitat on EU.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches
Remediation may result in some destruction of level 3 habitat in EU (with sage brush habitat); intense activity will result in loss of resources to EU and potentially buffer area (with 27% level 3 and 4 resources).

Cultural Resources

Current
Manhattan Project/Cold War significant resources have already been mitigated. Area is very disturbed and there are no known recorded archaeological resources within the EU. Traditional cultural places are visible from EU.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches
Because area has not been investigated either on the surface or subsurface, archaeological investigations may need to occur within pockets of undisturbed land if any prior to remediation. Potential for intact archaeological material to be present is very low.

Considerations for Timing of the Cleanup Actions

See Section E.1.1 (Appendix E.1).

Near-Term, Post-Cleanup Risks and Potential Impacts

See Section E.1.1 (Appendix E.1).

E.6.2. ADMINISTRATIVE INFORMATION

OU AND/OR TSDF DESIGNATION(S):

The A-AX Tank and Waste Farms Evaluation Unit (EU), denoted *CP-TF-5 – A-AX Tank Farms*, consists of 10 waste tanks, ancillary structures, associated liquid waste sites, and soils contamination; much of this EU is contained within Waste Management Area A-AX (WMA A-AX). WMA A-AX is regulated under the Resource Conservation and Recovery Act (RCRA) as modified in 40 CFR Part 265, Subpart F and Washington State's Hazardous Waste Management Act (HWMA, RCW 70.105 and its implementing requirements in the Washington State dangerous waste regulations [WAC 173-303-400]) (PNNL-15315).

COMMON NAME(S) FOR EU:

There is no common name for the A-AX Tank and Waste Farms EU because the EU is comprised of elements from other waste management units including Waste Management Area A-AX (WMA A-AX) that includes the 241-A (or A) and 241-AX (or AX) Tank Farms.

The A Tank Farm contains six waste tanks (A-101 through A-106); these tanks often are designated as 241-A-101 through 241-A-106. The AX Tank Farm contains four waste tanks (AX-101 through AX-104); these tanks often are designated as 241-AX-101 through 241-AX-104. Other components in the EU are listed below in the *Primary EU Source Components* section.

KEY WORDS:

A Tank Farm, AX Tank Farm, 241-A Tank Farm, 241-AX Tank Farm, waste tanks, tank farm, Waste Management Area A-AX, WMA A-AX

REGULATORY STATUS

Regulatory Basis

DOE is the responsible agency for the closure of all single-shell tank (SST) waste management areas (WMAs) through post closure, in close coordination with other closure and cleanup activities of the Hanford Central Plateau. Washington State has a program that is authorized under RCRA and implemented through the HWMA and its associated regulations; Ecology is the lead regulatory agency responsible for the closure of the SST system. Please refer to Section E.1.2 (Appendix E.1) for more information.

Applicable Regulatory Documentation

The relationship among the tank waste retrieval work plans (TWRWP) and the overall single-shell tank (SST) waste retrieval and closure process is described in Appendix I of the Hanford Federal Facility Agreement and Consent Order (HFFACO), along with requirements for the content of TWRWPs. WMA A-AX was placed in assessment monitoring (40 CFR 265.93[d][4]) based on elevated specific conductance measurements (PNNL-15315, p. iii). A groundwater quality assessment plan was developed (PNNL-15315) describing the monitoring activities used in deciding whether WMA A-AX has affected groundwater.

Applicable Consent Decree or TPA Milestones

Federal Facility Agreement and Consent Order, 1989 and amended through June 16, 2014: Milestone M-045-00; Lead Agency Ecology: *Complete the closure of all Single Shell Tank Farms by 01/31/2043*

RISK REVIEW EVALUATION INFORMATION

Completed: Revised August 25, 2015

Evaluated by: K. G. Brown

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

E.6.3. SUMMARY DESCRIPTION

CURRENT LAND USE

DOE Hanford Site for industrial use. All current land-use activities in the 200-East Area are *industrial* in nature (EPA 2012).

DESIGNATED FUTURE LAND USE

Industrial-Exclusive. All four land-use scenarios listed in the Comprehensive Land Use Plan (CLUP) indicate that the 200-East Area (of which the A-AX Tank and Waste Farms EU is a part) is denoted *Industrial-Exclusive* (DOE/EIS-0222-F). An industrial-exclusive area is “suitable and desirable for treatment, storage, and disposal of hazardous, dangerous, radioactive, and nonradioactive wastes” (DOE/EIS-0222-F).

PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

The legacy source sites associated with the A-AX Tank and Waste Farms EU are described in Attachment Section E.6.8. There are various non-tank sources that received large volumes of slightly contaminated waste and other waste streams that has resulted in extensive vadose zone and groundwater contamination in the areas around the WMA A-AX. Source include surface spills associated with leaks from transfer lines, diversion boxes, catch tanks, and vaults as well as cribs, trenches, and French drains (1,600 gallons to 304 Mgal of volume effluents) (PNNL-13023, p. 3.4-3.5). Two of the SSTs in WMA A-AX are declared "assumed leakers" with leaks estimates ranging from 500-2,500 gallons (A-104 in 1978) to 10,000-270,000 gallons (A-105 in 1979) (Templeton 2014, p. 21). The most significant leak was when the bottom of Tank A-105 ruptured (releasing 10,000-270,000 gallons) from a steam explosion.

Waste Tanks and Ancillary Equipment

The 10 waste tanks in the A-AX Tank and Waste Farms EU are:

- (241-)A-101 (241-A-TK-101)
- (241-)A-102 (241-A-TK-102)
- (241-)A-103 (241-A-TK-103)
- (241-)A-104 (241-A-TK-104)
- (241-)A-105 (241-A-TK-105)
- (241-)A-106 (241-A-TK-106)
- (241-)AX-101 (241-AX-TK-101)
- (241-)AX-102 (241-AX-TK-102)
- (241-)AX-103 (241-AX-TK-103)
- (241-)AX-104 (241-AX-TK-104)

The ancillary equipment included in the A-AX Tank and Waste Farms EU is listed in the Attachment in Section E.6.8 and primarily consists of pipelines, diversion boxes, and catch tanks.

Groundwater Plumes

The A-AX Tank and Waste Farms EU is in the 200-PO GWIA. The current 200-PO plumes that exceed water quality standards (in this case, drinking water standards) are tritium, I-129, nitrate, Sr-90, Tc-99, and uranium; however, only the Tc-99 plume is associated with A-AX Tank and Waste Farms EU sources[92] (DOE/RL-2016-09, Rev. 0). The 200-PO GWIA is being monitored to determine the impact to groundwater prior to determining the path forward for remedial action.

See Appendix D.5 for the CP-GW-1 EU for additional details.

Operating Facilities

Because of the prohibition on waste additions to the Hanford SSTs,[93] the A-AX Tank and Waste Farms EU components are not considered Operating Facilities for this review. See Section E.1.4 (Appendix E.1) for details.

D&D of Inactive Facilities

Not Applicable.

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[92] Tc-99 has been detected in a relatively small areas in the 200-BP and 200-PO region around WMA C and WMA A-AX, respectively, which have sources in WMA C (200-BP) and WMA A-AX (200-PO) (DOE/RL-2016-09, Rev. 0). WMA A-AX is not a source for the I-129 plume.

[93] Berman presentation on July 29, 2009, titled "Hanford Single-Shell Tank Integrity Program." Available at www.em.doe.gov.

LOCATION AND LAYOUT MAPS

A series of maps are used to illustrate the location of the components within the CP-TF-5 EU and the A-AX Tank and Waste Farms EU relative to the Hanford Site. Figure E.2-1 shows the relationship between the 200-E (200 East) Area (where the A-AX Tank Farms and Waste management Area A-AX are located) and the Hanford Site. Figure E.6-1 illustrates the A-AX Tank and Waste Farms EU boundary. Figure E.6-2 shows a detailed view of the waste tanks, ancillary equipment, and legacy source units in the A-AX Tank and Waste Farms EU.

DRAFT

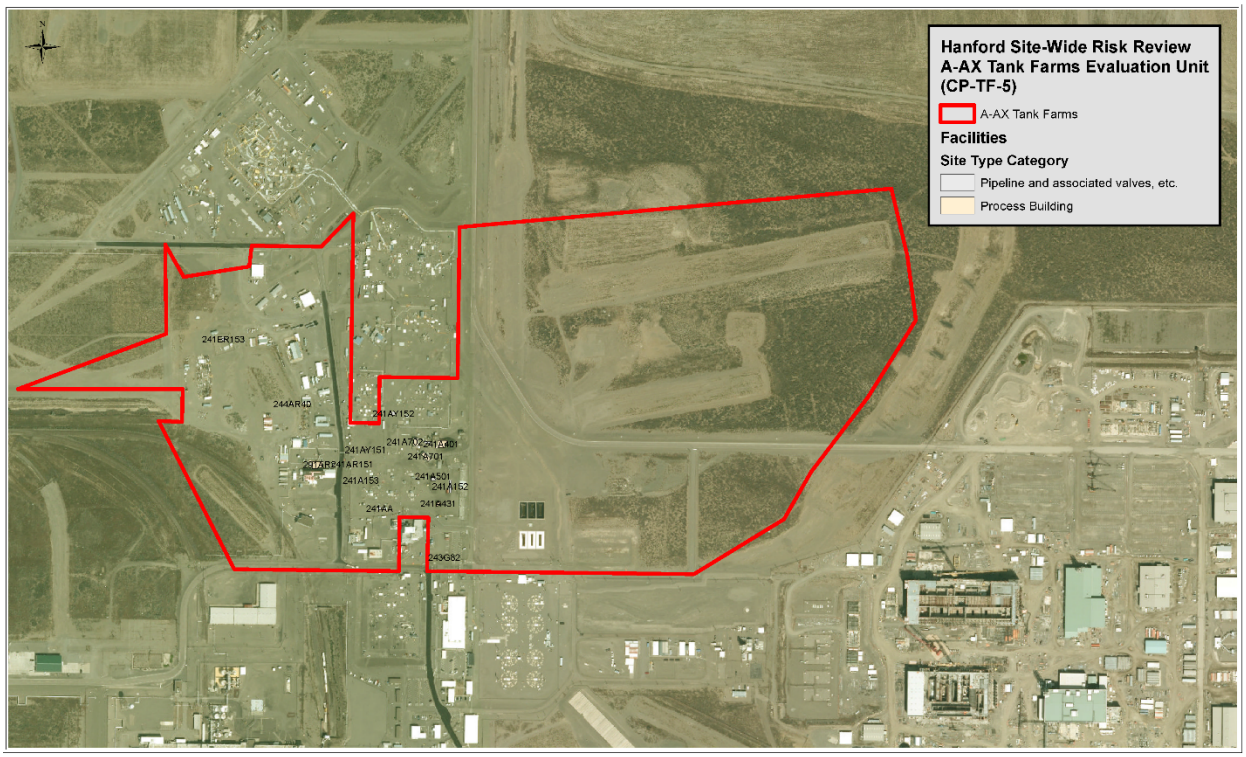

Figure E.6-1. Polygon representing the boundary of the A-AX Tank and Waste Farms Evaluation Unit (Attachment Section E.6.8).

DRAFT

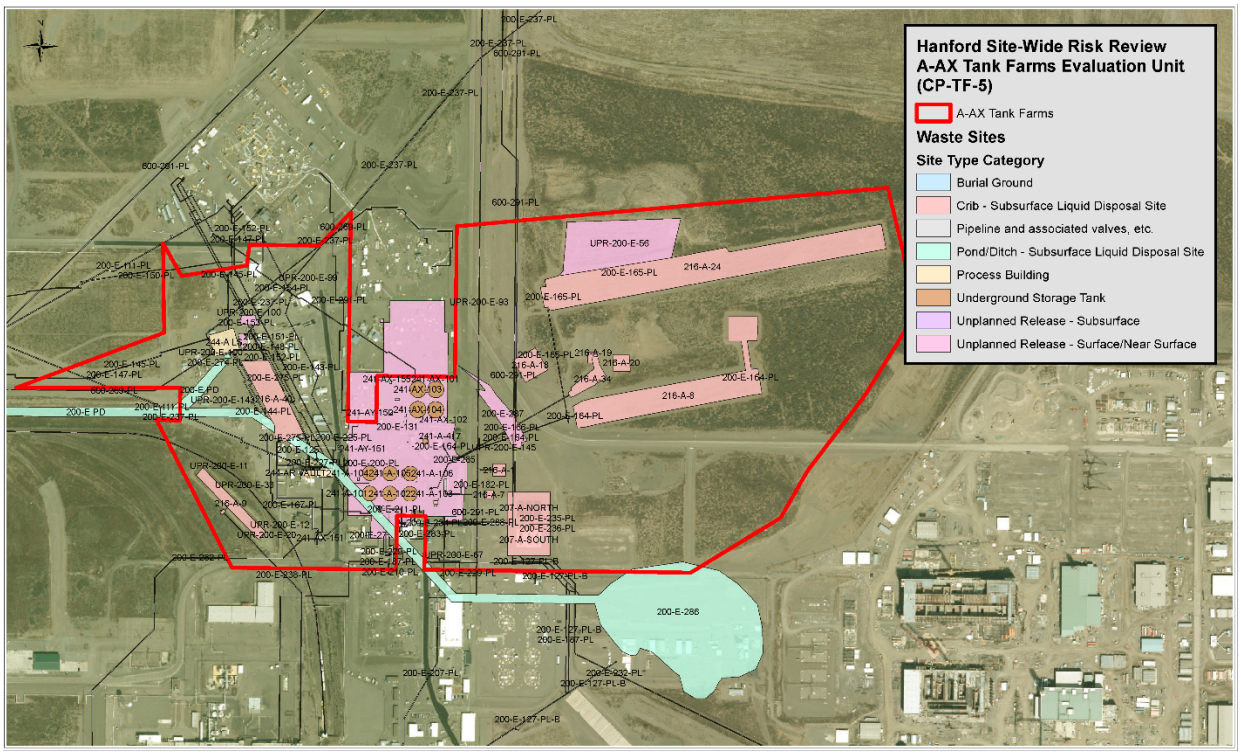

Figure E.6-2. Hanford A-AX Tank and Waste Farms Evaluation Unit including tanks, legacy source units, and ancillary equipment (Attachment Section E.6.8).

E.6.4. UNIT DESCRIPTION AND HISTORY

EU FORMER / CURRENT USES

Waste Management Area A-AX (WMA A-AX) occupies approximately 7 acres (http://phoenix.pnnl.gov/) and contains six underground single-shell tanks (SSTs) in A Tank Farm and four SSTs in AX Tank Farm in additional to ancillary equipment (e.g., diversion boxes, pumps, valves, and pipes). The A Tank Farm was constructed in 1954-55 and the AX Tank Farm in 1963-64 (PNNL-13023, p. 2.1). The SSTs in these Tank Farms were used to store mixed wastes mainly from the PUREX process[94]. After 1977, many tanks received wastes including evaporator feed, double-shell slurry feed, non-complexed waste, complexed waste, complex concentrated waste, complexant concentrate, and Hanford Defense Residual Liquid. Some waste stored in the A-AX Tank Farms generated sufficient decay heat to cause boiling of the tank supernatant (i.e., were "self-boiling").

The AX Tank Farm contains four carbon steel tanks with capacities of 1 Mgal and received PUREX wastes from 1965 until 1969 (PNNL-13023, p. 2.8). Tanks AX-101 and AX-102 began receiving fractionization waste in 1969; these tanks were sluiced in 1975 to provide feed for B Plant. Tanks AX-103 and AX-104

[94] Production in the PUREX Plant came on line in January 1956 and processed approximately 72% of the reactor fuel produced at the DOE Hanford Site, where resulting wastes included high-level solvent extraction wastes (both self-boiling and not) and cladding wastes, organic wash wastes, and cell drainage (PNNL-13023, p. 2.7).

received only PUREX waste until 1973; these tanks were sluiced in 1976. All AX Tank Farm tanks are classified as "sound" (Templeton 2016). The AX Tank Farms tanks were removed from service in 1980 with the exception of AX-104 (removed in 1978) (PNNL-13023, p. 2.8). The SSTs in WMA A-AX have been interim stabilized (i.e., liquid transferred to DSTs to <50 kgal drainable interstitial liquid and <5 kgal of supernatant). The A-AX Tank Farm tanks are currently awaiting retrieval and closure.

LEGACY SOURCE SITES

Vapors from the "self-boiling" tanks were routed through headers to condensers (vented to the atmosphere through filters) and the condensate was either discharged to cribs or returned to the waste tank to maintain the desired liquid levels in tanks (PNNL-13023, p. 2.2).

Various non-tank sources received large volumes of contaminated waste and other waste streams resulted in extensive vadose zone and groundwater contamination in the areas around the WMA A-AX. These sources include (PNNL-13023, p. 3.4-3.5):

- Surface spills associated with leaks from transfer lines, diversion boxes, catch tanks, and vaults.
- Liquid disposal facilities including cribs, trenches, and French drains were used to discharge from 1,600 gallons to 304 Mgal of volume effluents, including condensate and condenser cooling water, depleted uranium waste, cell and stack drainage waste, and tributyl phosphate (TBP)-kerosene organic waste from PUREX.
- Two of the SSTs in WMA A-AX are declared "assumed leakers" with leaks estimates ranging from 500-2,500 gallons (A-104 in 1975) to 10,000-270,000 gallons (A-105 in 1963) that do not include leaks from transfer lines, other ancillary equipment, surface spills or overflow amounts (Templeton 2016, p. 21). The most significant leak was when the bottom of Tank A-105 ruptured (releasing 10,000-270,000 gallons) resulting from a steam explosion.

The 200-PO GWIA is being monitored to determine the impact to groundwater prior to determining the path forward for remedial action (DOE/RL-2016-09, Rev. 0).

WASTE TANKS

See Section E.6.3 for details.

GROUNDWATER PLUMES

The 200-PO groundwater plume (Tc-99) considered to be associated with the A-AX Tank Farm and co-located liquid waste disposal facilities is described in detail in Section E.6.5 with additional information in the Appendix D.5 for the CP-GW-1 EU (200-PO GWIA). Sites within the CP-TF-5 EU, including 216-A-7, 216-A-8, 216-A-9, and 216-A-24 Cribs; 216-A-16 and 216-A-17 French drains; and 216-A-19 and 216-A-20 Trenches are suspected of being able to contribute mobile contaminants to the saturated zone (i.e., representing migration of contaminants from the waste site to the uppermost aquifer) (DOE/RL-92-19, Rev. 0, Table 2-2).

D&D OF INACTIVE FACILITIES – NOT APPLICABLE

OPERATING FACILITIES – NOT APPLICABLE

Because of the prohibition on waste additions to the Hanford SSTs,[95] the A-AX Tank and Waste Farms EU components are not considered Operating Facilities for this Review.

ECOLOGICAL RESOURCES SETTING

Landscape Evaluation and Resource Classification:

Approximately 75% of the A-AX Tank and Waste Farms EU has been previously disturbed, or consists of graveled surfaces, buildings, industrial areas and tank farm infrastructure (levels 0 and 1 from (Appendix J, Table 2, p. J-111)). Several large fragments of level 3 habitat remain within the eastern side of the EU (Appendix J, Figure 2, p. J-111).

The amount of each biological resource category was examined in a circular buffer area radiating 1,386 m from the center of the EU (equivalent to 1,490.5 acres). Approximately 26% of the total combined area (EU and associated adjacent landscape) is classified as level 3 or greater habitat. Areas classified as level 4 resources lie outside the 200 East Area fence and were not reviewed as part of this survey.

Field Survey:

Field measurements and visual surveys were conducted in October 2014 in two habitat areas: one resource level 2 area (visual survey) and one resource level 3 area (two transects) (Appendix J, Table 1, p. J-110). The field data confirmed the resource levels shown in (Appendix J, Figure 2, p. J-111). Previous ECAP survey data taken in 2010 noted an occurrence of Piper's daisy in the level 2 habitat in the southwest corner of the EU.

Wildlife observations within the level 3 habitat areas on the east side of the EU included harvester ant hills, small mammal burrows, coyote (*Canis latrans*) tracks, and an unidentified lizard. Previous ECAP survey data collected in 2010 for polygons within the EU also noted white-crowned sparrow (*Zonotrichia leucophrys*), western meadowlark (*Sturnella neglecta*), and house finch (*Carpodacus mexicanus*), as well as northern pocket gopher mounds (*Thomomys talpoides*).

CULTURAL RESOURCES SETTING

Cultural resources known to be located within the A-AX Tank and Waste Farms EU are limited to the Hanford Site Plant Railroad and the 2707AR Sludge Vault Change both contributing properties within the Manhattan Project/Cold War Era Landscape with documentation required and the 244 AR Vault Facility and Canyon and 242BA (242-A Boiler Annex) contributing properties within the Manhattan Project and Cold War Era Historic District with no documentation required. All documentation has been addressed as described in the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan* (DOE RL-97-56). There are no known archaeological sites, or TCPs known to be recorded within the A-AX Tank and Waste Farms EU. Portions of the A-AX Tank Farms Evaluation Unit have been inventoried for archaeological resources. No archaeological sites were located by these surveys. There is a possibility 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), particularly where pockets of undisturbed soil deposits exist within the A-AX Tank and Waste Farms EU.

[95] Berman presentation on July 29, 2009, titled "Hanford Single-Shell Tank Integrity Program." Available at www.em.doe.gov.

Several National Register-eligible properties associated with the Manhattan Project/Cold War Era Landscape both with documentation required (241 AW Underground Liquid Tank Farm) and no documentation required (271 CR Service and Office Building) are located within 500 meters of the A-AX Tank and Waste Farms EU. Also see the list of Manhattan Project/Cold War Era buildings located within the PUREX Evaluation Unit which is located in adjacent to the A-AX Tank and Waste Farms EU. All have been documented as described in the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan* (DOE/RL-97-56).

Historic maps indicate that there is no evidence of historic-era settlement in or near the A-AX Tank and Waste Farms EU. The eastern most portion of the A-AX Tank and Waste Farms EU where Holocene deposits overlap with areas that have only surface disturbance present a moderate potential for the presence of intact archaeological resources associated with all three landscapes to be present subsurface within these areas within A-AX Tank and Waste Farms EU. Geomorphology throughout the rest of the A-AX Tank and Waste Farms EU and extensive ground disturbance suggest a low potential for the presence of intact archaeological resources be present subsurface within these areas within the A-AX Tank and Waste Farms EU. Where pockets of undisturbed soil may exist, it may be appropriate to conduct 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 associated with these landscapes (e.g. East Benton Historical Society, the Franklin County Historical Society, Prosser Cemetery Association, the Reach and B-Reactor Museum) may need to occur. Indirect effects are always possible when TCPs are known to be located in the general vicinity. 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.

E.6.5. WASTE AND CONTAMINATION INVENTORY

Table E.6-2 provides inventory estimates of the various source components associated with the A-AX Tank and Waste Farms EU including tank wastes and ancillary equipment, legacy sources including leaks, cribs, trenches, unplanned releases (UPRs), vadose zone sources, saturated zone (plume) estimates, treatment amounts, and remaining vadose zone estimates (i.e., the difference of the vadose zone estimates and the saturated zone and treatment estimates)[96]. This information is further summarized in Figure E.6-3 through Figure E.6-11 before and after planned 99% retrieval[97].

[96] The basis for the saturated and vadose zone estimates are provided in Chapter 6 of the Methodology Report (CRESP 2015a) and examples are provided in the demonstration section for the 200-UP-1 Operable Unit that corresponds to the 200-UP GWIA. These estimates tend to have very high associated uncertainties.

[97] According to the Tri-Party Agreement (Ecology, EPA, and DOE, 1998), retrieval limits for residual wastes are 360 ft^3 and 30 ft^3 for 100-Series and 200-Series tanks, respectively, corresponding to the 99% waste retrieval goal as defined in TPA Milestone M-45-00. For purposes of this Review the 99% and 90% Retrieval Scenarios reflect assumptions described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 and apply only to tank volumes and inventories. They are calculated assuming retrieval of a fully mixed tank of homogeneous composition. For tanks that have been declared "Retrieval Completed" or "Retrieved to Limit of … Technologies" (Templeton, AM 2016, page 9, partially duplicated in Table E.1-7), no further retrieval for either the 99% or 90% retrieval scenario is assumed. This includes tank 241-S-112 and all C Tank Farm tanks except 241-C-105. For tanks that are currently undergoing retrieval (tanks 241-AY-102 and 241-C-105), a retrieval amount equivalent to the 99% and 90% retrieval volumes described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 are calculated.

For example, the major sources for Tc-99 and I-129 before retrieval are the A-AX Tank Farm tanks and ancillary equipment. The maximum groundwater threat metric (GTM) (Figure E.6-12)[98] is dominated by the A-AX Tank Farm wastes before retrieval and by ancillary equipment after planned retrieval; this also applies to Tc-99 and I-129. The tritium inventory, both pre- and post-retrieval, is dominated by past discharges to cribs. For chromium, cribs and trenches and the A-AX Tank Farm tanks are major sources before retrieval. After retrieval, cribs and trenches dominate the source of this PC. For nitrate, ancillary equipment and past discharges to cribs and trenches dominate after planned retrieval. Current and post-retrieval uranium inventories are dominated by past discharges to trenches and cribs. For Sr-90 and Cs-137, the post-retrieval inventory is dominated by ancillary equipment. The post-retrieval plutonium isotope inventories are dominated by past discharges to cribs and ancillary equipment.

CONTAMINATION WITHIN PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

The estimated A-AX Tank Farm inventory for the Legacy / Vadose Zone Source Sites (i.e., cribs, trenches, and soil contaminated by tank leaks and unplanned releases) is summarized in Table E.6-2 and further described in Figure E.6-3 through Figure E.6-11 before and after planned 99% retrieval (which will have no impact on current legacy source site inventories). These values constitute estimates of the initial amounts of contaminants discharged to the vadose zone that are then used to estimate the remaining inventory in the vadose zone as described below (i.e., by difference using the process described in Chapter 6 of the Methodology Report (CRESP 2015a) as revised for the 2015 groundwater monitoring results (DOE/RL-2016-09, Rev. 0) as described in Appendi

x D.1). These estimates necessarily have large associated uncertainties.

Waste Tanks and Ancillary Equipment

The estimated total inventory for all the A-AX Tank Farm High Level Waste Tanks and Ancillary Equipment is provided in Table E.6-2 for both the 90% and planned 99% retrieval scenarios. The tank-by-tank inventories are provided in Table E.6-3 through Table E.6-6. Safety-related information (i.e., hydrogen generation rates and times to the lower flammability limit are also provided in Table E.6-3. The inventories for the various contaminant in the A-AX Tank Farm tanks vary over several orders of magnitude as does the GTM. This information is further summarized in Figure E.6-3 through Figure E.6-11 before and after planned 99% retrieval and for the maximum GTM in Figure E.6-12.

Vadose Zone Contamination

The estimated inventories for the vadose zone, saturated zone, and treatment amounts are found in Table E.6-2. These inventories represent the vadose zone contamination *outside* the tanks and ancillary equipment (i.e., that generally available for transport through the environment). These are used to estimate the inventory remaining in the vadose zone using the process described in Chapter 6 of the Methodology Report (CRESP 2015a) as modified for the 2015 groundwater results (Appendix D.1). The focus in this section will be on the Group A and B contaminants with reported vadose zone inventories due to their mobility and persistence and potential threats to groundwater. To summarize (DOE/RL-2016-09, Rev. 0):

- *Tc-99* – There is an existing Tc-99 plume in the groundwater that is associated with A-AX Tank and Waste Farms EU sources. The vadose zone inventory is dominated by ancillary equipment

[98] Maximum of the GTMs for Tc-99 and I-129 only.

- *I-129* – There is an existing I-129 plume that is not considered associated with A-AX Tank and Waste Farms EU sources. The vadose zone inventory is dominated by ancillary equipment.
- *Sr-90* – There is a small existing Sr-90 plume; however, this plume does not appear to be associated with A-AX Tank and Waste Farms EU sources. The vadose zone inventory is dominated by ancillary equipment. The TC&WM EIS groundwater transport analysis (Appendix O, DOE/EIS-0391 2012) indicates that Sr-90, despite there already being a small plume, is not expected to reach the A Barrier[99], which is interpreted here to indicate that Sr-90 is not very mobile in the vadose zone near the A-AX Tank and Waste Farms EU relative to it decay. Furthermore, the average water travel time through the vadose zone for a recharge rate of 100 mm/yr is 63 years for the 200 East Area (Table N-52, DOE/EIS-0391 2012) and thus the resulting average Sr-90 travel time accounting for retardation would be more than 300 years (i.e., 63 yr × 4.6 or 10+ half-lives leaving less than 0.10%) to move through the vadose zone[100]. It would likely require more time to reach groundwater in a sufficient amount to exceed the drinking water standard over an appreciable area. Thus a Sr-90 plume is not expected in the next 150 years due to retardation in the vadose zone or after due to radioactive decay (+97% reduction in Sr-90 inventory). Thus Sr-90 is not considered a significant threat to the Hanford groundwater.
- *Uranium* – There is a small existing uranium plume that is not associated with A-AX Tank and Waste Farms EU sources. The vadose zone inventory is dominated by past discharges to cribs and trenches. Thus much of the uranium originally discharged into the vadose would have to travel through the vadose zone until potentially impacting groundwater. The TC&WM EIS groundwater transport analysis (Appendix O, DOE/EIS-0391 2012) indicates that (like Sr-90) uranium is also not expected to reach the A Barrier. Furthermore, the average water travel time through the vadose zone for a recharge rate of 100 mm/yr is 63 years for the 200-East Area (Table N-52, DOE/EIS-0391 2012), or the uranium travel time might be more than 100 years (i.e., 63 yr × 4.6) for an appreciable amount of uranium to move through the vadose zone[101]. It would likely require almost 300 years (from the original discharge) to reach groundwater in a sufficient amount to exceed the drinking water standard over an appreciable area. Thus an appreciable uranium plume would not be expected in the next 150 years but perhaps during the 1,000-year period after cleanup. Thus total uranium is not considered a significant threat to the Hanford groundwater during the Active Cleanup or Near-term, Post Cleanup periods.
- *Chromium* – There is currently no chromium plume in the vicinity. The vadose zone inventory is dominated by past discharges to cribs and trenches.

Using the process outlined in Chapter 6 of the Methodology Report (CRESP 2015a) as revised for the 2015 groundwater monitoring results (Appendix D.1), the vadose zone inventories in Table E.6-2 are estimated and used to calculate Groundwater Threat Metric (GTM) values for the Group A and B contaminants remaining in the vadose zone as illustrated in Table E.6-7. Note that the vadose zone (VZ)

[99] The barrier represents the edge of the infiltration barrier to be constructed over disposal areas that are within 100 meters [110 yards] of facility fence lines (DOE/EIS-0391 2012). The A Barrier is the closest to the A-AX Tank and Waste Farms EU. Despite including sources other than those for the A-AX Tank and Waste Farms EU, the analysis in the TC&WM EIS was considered reasonable to assess the rate of movement of contaminants to groundwater through the vadose zone.

[100] The minimum best-estimate K_d for Sr-90 for WMA C (proximate to A-AX) is 1 mL/g (PNNL-17154, p. 3.43), which translates to a retardation factor of ~4.6.

[101] The minimum best-estimate K_d for uranium for WMA C (proximate to WMA A-AX) is 1 mL/g (PNNL-17154, p. 3.43), which translates to a retardation factor of ~4.6.

ratings range from *Not Discernible* (*ND*) for total uranium and Sr-90[102] to *Low* for C-14, I-129, and Tc-99 to *Medium* for chromium (total and hexavalent). The overall rating for current conditions would be *Medium* (i.e., defined as the maximum of the ratings for an EU) related to the remaining chromium (total and hexavalent) in the vadose zone.

Groundwater Plumes

Legacy waste sites within the CP-TF-5 EU are suspected of be able to contribute mobile contaminants to the saturated zone (DOE/RL-92-19, Rev. 0) and the 200-PO Tc-99 plume has been linked to CP-TF-5 sources (DOE/RL-2016-09, Rev. 0). In general groundwater plumes are evaluated in separate EUs; however, those portions of groundwater plumes that can be associated with the TF EU (i.e., a plume with sources associated with the TF EU) will be evaluated to provide a better idea of the saturated zone versus remaining vadose zone threats to groundwater. The estimated inventory for the saturated zone contamination is provided in Table E.6-2 where Photoshop was used to estimate the fraction of the plumes considered associated with the A-AX Tank and Waste Farms EU (Attachment 6-4 in the Methodology Report (CRESP 2015a) as revised to accommodate the 2015 groundwater monitoring results described in Appendix D.1[103]). This information is also used to estimate amounts treated and remaining in the vadose zone. For the groundwater plumes described in the 200-PO GWIA (DOE/RL-2016-09, Rev. 0), apportionment of plumes and ratings from the Group A and B primary contaminants to the A-AX Tank and Waste Farms EU is as follows:

- *I-129* – There is a very large plumes that straddles the 200-BP and 200-PO GWIAs; however, the plume is not related to the A-AX Tank and Waste Farms EU sources. Any portion of the plume that may have resulted from A-AX Tank and Waste Farms EU sources are considered insignificant.
- *Sr*-90 and total uranium – There are current plumes in the GWIA, but none are considered associated with A-AX Tank and Waste Farms EU sources. Any portions of the plumes that may have resulted from A-AX Tank and Waste Farms EU sources are considered insignificant.
- *Tc-99* – There are plumes in the GWIA; the plume near the A-AX Tank and Waste Farms EU is considered associated with the EU, and the area of this plume is 39% of the area of the plumes (CRESP 2015a).

The Tc-99 groundwater plume associated with the A-AX Tank Farm and co-located liquid waste disposal facilities is described in detail in the Appendix D.5 for the CP-GW-1 EU (200-PO GWIA). Note that I-129 (*Very High*), nitrate (*Medium*), and H-3 (*Medium*) are the risk drivers for the 200-PO-1 GW OU; however, only the I-129 has EU sources associated with these plumes and the remaining I-129 in the vadose is indeterminate and the contribution to the existing plume is small. Thus the remaining vadose zone sources would drive the risks associated with this TF EU.

Impact of Recharge Rate and Radioactive Decay on Groundwater Ratings

The TC&WM EIS screening groundwater transport analysis (Appendix O, DOE/EIS-0391 2012) indicates that there may be large impacts resulting from emplacing the engineered surface barrier (and resulting

[102] The remaining vadose zone inventories for uranium and Sr-90 would translate to *Medium* ratings. However, no appreciable Sr-90 or uranium plume would be expected in the next 150 years due to transport considerations; however, uranium may impact groundwater after the 150-year period. Thus *Low* ratings are applied after the Active Cleanup period to account for uncertainties.

[103] From the graphic map files provided by PNNL, the Photoshop Magic Wand Tool was used to select areas representing plumes and then the "Record Measurements" Tool was used to provide relative areal extents. A Custom Measurement Scale was set to that of the original map.

reduction of infiltrating water) on the predicted peak groundwater concentrations at the A Barrier[104]. To summarize, the screening groundwater results including sources in addition to those for the A-AX Tank and Waste Farms EU (Appendix O, DOE/EIS-0391 2012) include[105]:

- Tc-99 peak concentration is 41,700 pCi/L (CY 2121) for the No Action Alternative versus 774 pCi/L (CY 2102) for Landfill Closure where the threshold value is 900 pCi/L.
- I-129 peak concentration is 38.5 pCi/L (CY 2123) for the No Action Alternative versus 1.5 pCi/L (CY 2104) for Landfill Closure where the threshold value is 1 pCi/L.
- Chromium peak concentration is 323 µg/L (CY 3710) for the No Action Alternative versus 81 µg/L (CY 2168) for Landfill Closure where the threshold value is 100 µg/L (total) or 48 µg/L (hexavalent).
- Total uranium peak concentration is 7 µg/L (CY 11,823) for the No Action Alternative versus 0 µg/L (CY 2104) for Landfill Closure where the threshold value is 1 pCi/L.
- No values are reported at the A Barrier for Sr-90 for either scenario, which indicates that peak fluxes that were less than 1×10^{-8} Ci/yr (Appendix O, DOE/EIS-0391 2012, p. O-2).

Despite the large impacts on the predicted peak concentrations, peak values for I-129 and hexavalent chromium were predicted to exceed thresholds at the A Barrier within 150-200 years and thus the saturated and vadose ratings will not be altered even though impacts may be large. The peak total chromium value is below the threshold; thus there would be no plume including the barrier after cleanup. A rating of *Low* is applied to the total chromium during the Near-term, Post-Cleanup period to address uncertainty. The peak predicted concentration for Tc-99 does not exceed the threshold during the TC&WM EIS evaluation period (10,000 years); thus the Tc-99 saturated zone rating for the Near-term, Post-Cleanup period is maintained at *Low* to address uncertainty.

Based on the TC&WM EIS results, it is assumed that total uranium would not reach the groundwater in sufficient quantity to exceed the standard during the Active Cleanup and Near-term Post-Cleanup periods (i.e., any effects would be local); this assumption is based on total uranium not reaching the A Barrier during the evaluation period (10,000 years). Thus the uranium evaluation would result in a *Not Discernible* rating for both the Current and Active Cleanup periods; however, a *Low* rating will be used for the Near-term Post-Cleanup period to address uncertainty.

For Sr-90, the times required for the remaining vadose zone inventory to decay to values that would result in *Medium* and *Low* ratings are 36 and 131 years, respectively. Furthermore, the TC&WM EIS screening analysis described above indicate that it is unlikely that sufficient Sr-90 would reach the groundwater to exceed the drinking water standard in the next 150 years. Thus the Sr-90 ratings would be *ND* for both the Current and Active Cleanup periods; however, a *Low* rating will be used for the Near-term Post-Cleanup period to address uncertainty.

[104] The barrier represents the edge of the infiltration barrier to be constructed over disposal areas that are within 100 meters [110 yards] of facility fence lines (DOE/EIS-0391 2012). The A Barrier is the closest to the A-AX Tank and Waste Farms EU. Despite including sources other than those for the A-AX Tank and Waste Farms EU, the analysis in the TC&WM EIS was considered a reasonable source of information to assess the impact of the engineered surface barrier emplacement.

[105] Analyses specific to each Tank Farm or Central Plateau EU are not available; thus the aggregate screening analysis provided in the TC&WM EIS was used as an indication.

Columbia River

The process illustrated in Chapter 6 of the Methodology Report (CRESP 2015a) as revised for the 2015 groundwater and Columbia River results (Appendix D.1) is used to evaluate potential impacts to the Columbia River. Note that the evaluation of potential benthic and riparian impacts has a common thread up to the point when the shoreline impact (benthic) or riparian zone impact area is used to define ratings. Thus a common evaluation for the benthic and riparian zone is performed here.

Benthic and Riparian Zone – Current Impacts

Based on the information in the 2013 Hanford Annual Groundwater Report (DOE/RL-2016-09, Rev. 0) and HEIS (http://ehs.hanford.gov/eda/), only the tritium (Group C) plume from the 200-PO GWIA currently intersects the Columbia River at concentrations exceeding the appropriate water quality standard (WQS). Using the framework process (Figure 6-11, Chapter 6, Methodology Report (CRESP 2015a)), since this plume is not associated with the A-AX Tank and Waste Farms EU (DOE/RL-2016-09, Rev. 0), a *Not Discernible* rating for the current impact of tritium on the Columbia River is ascribed.

Benthic and Riparian Zone – Active Cleanup and Near-term, Post Cleanup for Current Plumes

Because of the high decay rate of tritium relative to the Active Cleanup and Near-term, Post-Cleanup evaluation periods and the fact that no source associated with the A-AX Tank and Waste Farms EU would likely impact the Columbia River (within these evaluation periods) (Appendix O, DOE/EIS-0391 2012); a *Not Discernible* rating for tritium (H-3) would also apply to these evaluation periods.

Because another 200-PO plume (Tc-99) associated with the A-AX Tank and Waste Farms EU originates from 200-East, it is possible that a current plume might reach the Columbia River in the next 150 years since these contaminants are assumed to move unretarded and the *water* travel time is ~10-30 years from 200-East to the Columbia River (Gephart 2003; PNNL-6415 Rev. 18). Following the framework process (Figure 6-11, Chapter 6, Methodology Report (CRESP 2015a)), the ratio, R1, of the peak predicted concentration (Table O-8, Appendix O, DOE/EIS-0391 2012, p. O-59) incorporating source in addition to those from the A-AX Tank and Waste Farms EU to the BCG for the radioactive A-AX Tank and Waste Farms EU contaminant with a current plume (Tc-99[106]) is significantly less than one, which leads to a *Not Discernible* rating for both the Active Cleanup and Near-term, Post-Cleanup impacts of Tc-99 (current radioactive plumes) on the Columbia River.

Benthic and Riparian Zone – Active Cleanup and Near-term, Post Cleanup for Vadose Zone Contaminants

The TC&WM EIS results of the screening evaluation at the near-shore region under the No Action Alternative (DOE/EIS-0391 2012, Appendix O) indicate that, although not a current 200-PO plume, the chromium concentration could exceed thresholds for chromium (48 or 100 µg/L) and the benchmark threshold[107] (as well as the ambient water quality criterion of 10 µg/L) for hexavalent chromium. The predicted concentrations are likely highly overestimated since all discharge is assumed to occur in a 40-

[106] Sr-90 and total uranium have current plumes but neither is associated with the A-AX Tank and Waste Farms EU nor is expected to reach the Columbia River in the next 10,000 years based on the TC&WM EIS screening groundwater results (DOE/EIS-0391 2012, Appendix O).

[107] The benchmark value used for chromium (hexavalent) in the TC&WM EIS was the sensitive-species-test-effect concentration that affects 20 percent of a test population (EC_{20}) despite the fact that the less toxic trivalent form of chromium is more like to be present in oxygenated, aquatic environs (DOE/EIS-0391 2012, Appendix P, pp. P-52 to P-53).

m near-shore region; furthermore, recent well data indicate that chromium (and other contaminants) from 200-East is (are) moving much more slowly than predicted in the TC&WM EIS[108].

Following the procedure outlined in Chapter 6 of the Methodology Report (CRESP 2015a), the ratio (R1) of the maximum concentration (expected in the next 150 years) for chromium (assumed to be hexavalent) of 232 µg/L[109] to the AWQC (10 µg/L for hexavalent chromium) exceeds the threshold value of 5. Furthermore, a chromium plume (from sources in addition to those from the A-AX Tank and Waste Farms EU) is predicted to intersect the Columbia River along a 40-m near-shore zone (DOE/EIS-0391 2012, Appendix P, p. P-53)[110]. Using the matrix in Table 6-5 (Chapter 6, Methodology Report (CRESP 2015a)) for the benthic zone using the ratio of R1 for R2 (since the 95% UCL is not available) and a 40-m river reach, the hexavalent chromium would translate to a (benthic) rating of *Medium* during the Active Cleanup and Near-term, Post-Cleanup periods. However, since well data suggest that chromium is not moving toward the Columbia River at the predicted rate, a rating of *Not Discernible* is ascribed for the benthic ecology.

Using the ratio R1 (instead of R2 since an estimate of R2 is unavailable) and assuming an approximate 0.023-ha riparian zone area per river reach (m) or 0.9 ha[111], the hexavalent chromium values translate (Table 6-6, Chapter 6, Methodology Report (CRESP 2015a)) into a (riparian) rating of *High* (for the Active Cleanup and Near-term, Post-Cleanup periods). However, since well data suggest that chromium is not moving toward the Columbia River at the predicted rate, a rating of *Not Discernible* is ascribed for the riparian zone.

Benthic and Riparian Zone – Long-term

An ecological screening analysis was performed in the TC&WM EIS (DOE/EIS-0391 2012, Appendix P) to evaluate potential long-term impacts of radioactive and chemical contaminants (*under a No Action Alternative for sources including but not limited to those from the A-AX Tank and Waste Farms EU*) discharged with groundwater on aquatic and riparian receptors at the nearshore region of the Columbia River. The screening results indicate that exposure to radioactive contaminants from peak groundwater discharge was below benchmarks (0.1-rad-per-day for wildlife receptors and 1-rad-per-day for benthic invertebrates and aquatic biota, including salmonids consistent with DOE Technical Standard DOE-STD-1153-2002) (DOE/EIS-0391 2012, Appendix P, p. P-52), indicating there should be no expected adverse effects from radionuclides during the TC&WM EIS evaluation period (10,000 years).

The corresponding evaluation in the TC&WM EIS for potential impacts of chemical contaminants discharged with groundwater to the near-river ecology (benthic and riparian) indicate that chromium and nitrate would have expected Hazard Quotients exceeding one for aquatic and riparian receptors over the evaluation period (10,000 years) in the TC&WM EIS. The results of the screening evaluation at the near-shore region under the No Action Alternative (DOE/EIS-0391 2012, Appendix O) indicate that the nitrate peak concentration (and discharge) occurred in the past and that future concentrations

[108] Note that TC&WM EIS predictions indicate possible impacts from chromium to the benthic and riparian zones within the next decade; however, actual well measurements for chromium and other contaminants show no likely impacts in the foreseeable future from 200-West or 200-East sources, including the next 150 years.
[109] DOE/EIS-0391 2012, Appendix O, p. O-60 for maximum concentrations related to cribs and trenches including the period before CY 2050.
[110] The intersection between the current tritium plume originating from the 200-East Area and the Columbia River is approximately 4,600 m (Chapter 6, Methodology Report (CRESP 2015a)) or more than two orders of magnitude higher.
[111] The maximum ratio of the riparian zone area estimated by PNNL to the shoreline impact (River Reach) along the River Corridor for hexavalent chromium was 0.023 ha per m of river reach (Chapter 6, Methodology Report (CRESP 2015a)).

would appear to not exceed either the drinking water standard or ambient water quality criterion in the future and thus nitrate from the A-AX Tank and Waste Farms EU would pose little additional risk to the Columbia River benthic or riparian ecology. Furthermore, the potential impact of increased nitrate levels may depend on other factors (e.g., phosphorus). For the long-term evaluation period (>150 years), the peak concentration for chromium (assumed to be hexavalent from all sources including the A-AX Tank and Waste Farms EU) is 84 µg/L[112] would translate to some additional risk to benthic and riparian receptors (i.e., exceeds the screening threshold). This is consistent with the statements in the TC&WM EIS[113]:

> "For groundwater discharging to the Columbia River (see Table 2–23), potential long-term impacts on aquatic and riparian receptors would be unlikely for all COPCs and receptors except for chromium and aquatic biota, including salmonids...." (DOE/EIS-0391 2012, Chapter 2, p. 2–235)
>
> "… maximum groundwater concentrations and nearshore surface-water concentrations of chromium resulting from all Tank Closure alternatives, including the No Action Alternative, could pose a toxicological risk to aquatic biota, including salmonids, exposed to surface water in the nearshore environment of the Columbia River…." (DOE/EIS-0391 2012, Chapter 2, p. 2–235 & 2–237)

Threats to the Columbia River Free-flowing Ecology

As described in Section E.2.5, the large dilution effect of the Columbia River on the contamination from the seeps and groundwater upwellings results in *Not Discernible* ratings for the Active Cleanup and Near-term, Post Cleanup periods and insignificant long-term impacts to the free-flowing ecology for all contaminants.

Potential Impact of Recharge Rate on Threats to the Columbia River

The TC&WM EIS Alternative 2B (*Tank Closure Alternative 2B: Expanded WTP Vitrification; Landfill Closure*) gives an idea of the impact on chromium (i.e., the only contaminant with ratings above Not Discernible) in the nearshore region if surface barriers are emplaced (i.e., Landfill Closure). The maximum predicted chromium concentration for the Landfill Closure Alternatives is 228 µg /L (DOE/EIS-0391 2012, Appendix O, p. O-67 for cribs and trenches) versus a value of 232 µg/L for the No Action Alternative. Thus ratings for the benthic and riparian zone would not change based on surface barrier installation and changes in recharge rates. This is not due to ineffectiveness of the barrier but instead due to large amounts of contaminant already in the groundwater and possible impacts from sources outside the A-AX Tank and Waste Farms EU.

Facilities for D&D – Not Applicable

Operating Facilities – Not Applicable

Because of the prohibition on waste additions to the Hanford SSTs,[114] the A-AX Tank and Waste Farms EU components are not considered Operating Facilities for this Review.

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[112] DOE/EIS-0391 2012, Appendix O, p. O-59 for maximum concentrations for all sources after CY 2050.

[113] However, note that TC&WM EIS Appendix P indicates that "…Based on the conservative nature of the exposure assumptions, the estimated Hazard Indices and Hazard Quotients for the representative receptors indicated that no adverse effects of radioactive or chemical COPCs in air and groundwater releases to the Columbia River under the various alternatives evaluated are expected." (DOE/EIS-0391 2012, Appendix P, pp. P–53-54)

[114] Berman presentation on July 29, 2009, titled "Hanford Single-Shell Tank Integrity Program." Available at www.em.doe.gov.

Table E.6-2. Summary Table of Infrastructure and Subsurface Contamination Inventory for the A-AX Tank and Waste Farms Evaluation Unit (CP-TF-5) [a,b]

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[c]	99% Retrieval Scenario[c]
Infrastructure (Tanks and Ancillary Equipment)				
Tank Waste	Waste (kGal)	1389	138.9	13.89
	Sludge (kGal)	139	13.9	1.39
	Saltcake (kGal)	1238	123.8	12.38
	Supernatant (kGal)	12	1.2	0.12
Tank Waste (rad)	Am-241 (Ci)	10000	1000	100
	C-14 (Ci)	21	2.1	0.21
	Co-60 (Ci)	250	25	2.5
	Cs-137 (Ci)	1200000	120000	12000
	Eu-152 (Ci)	130	13	1.3
	Eu-154 (Ci)	6400	640	64
	H-3 (Ci)	45	4.5	0.45
	I-129 (Ci)	0.68	0.068	0.0068
	Ni-59 (Ci)	73	7.3	0.73
	Ni-63 (Ci)	6400	640	64
	Pu (total) (Ci)	8900	890	89
	Sr-90 (Ci)	7500000	750000	75000
	Tc-99 (Ci)	980	98	9.8
	U (total) (Ci)	36	3.6	0.36
Tank Waste (non-rad)	Cr (kg)	20000	2000	200
	Hg (kg)	270	27	2.7
	NO3 (kg)	940000	94000	9400
	Pb (kg)	4700	470	47
	U (total) (kg)	14000	1400	140

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[(c)]	99% Retrieval Scenario[(c)]
Ancillary Equipment (rad)	C-14 (Ci)	1.4	1.4	1.4
	Cs-137 (Ci)	17000	17000	17000
	H-3 (Ci)	4.2	4.2	4.2
	I-129 (Ci)	0.013	0.013	0.013
	Pu (total) (Ci)	40	40	40
	Sr-90 (Ci)	88000	88000	88000
	Tc-99 (Ci)	10	10	10
	U (total) (Ci)	0.31	0.31	0.31
Ancillary Equipment (non-rad)	Cr (kg)	220	220	220
	Hg (kg)	1.8	1.8	1.8
	NO3 (kg)	20000	20000	20000
	Pb (kg)	47	47	47
	U (total) (kg)	110	110	110
Vadose Zone Source (Leaks and Intentional Discharges into Cribs and Trenches)				
Leaks (rad)	C-14 (Ci)	0.12	0.12	0.12
	Cs-137 (Ci)	4800	4800	4800
	H-3 (Ci)	0.086	0.086	0.086
	I-129 (Ci)	0.0015	0.0015	0.0015
	Pu (total) (Ci)	0.76	0.76	0.76
	Sr-90 (Ci)	280	280	280
	Tc-99 (Ci)	1.3	1.3	1.3
	U (total) (Ci)	0.0052	0.0052	0.0052
Leaks (non-rad)	Cr (kg)	8.8	8.8	8.8
	Hg (kg)	0.0018	0.0018	0.0018
	NO3 (kg)	540	540	540
	Pb (kg)	0.53	0.53	0.53
	U (total) (kg)	4.7	4.7	4.7

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[(c)]	99% Retrieval Scenario[(c)]
Cribs (rad)	Am-241 (Ci)	1.1	1.1	1.1
	C-14 (Ci)	7.7	7.7	7.7
	Co-60 (Ci)	0.022	0.022	0.022
	Cs-137 (Ci)	5800	5800	5800
	Eu-152 (Ci)	0.0078	0.0078	0.0078
	Eu-154 (Ci)	0.62	0.62	0.62
	H-3 (Ci)	34000	34000	34000
	I-129 (Ci)	0.0013	0.0013	0.0013
	Ni-59 (Ci)	0.0013	0.0013	0.0013
	Ni-63 (Ci)	0.12	0.12	0.12
	Pu (total) (Ci)	1500	1500	1500
	Sr-90 (Ci)	27	27	27
	Tc-99 (Ci)	0.13	0.13	0.13
	U (total) (Ci)	15	15	15
Cribs (non-rad)	Cr (kg)	880	880	880
	Hg (kg)	6.3	6.3	6.3
	NO3 (kg)	25000	25000	25000
	Pb (kg)	160	160	160
	TBP (kg)	310000	310000	310000
	U (total) (kg)	3000	3000	3000
Trenches (rad)	Am-241 (Ci)	0.00027	0.00027	0.00027
	C-14 (Ci)	0.0034	0.0034	0.0034
	H-3 (Ci)	2.3	2.3	2.3
	Pu (total) (Ci)	0.00057	0.00057	0.00057
	Sr-90 (Ci)	0.00042	0.00042	0.00042
	U (total) (Ci)	30	30	30
Trenches (non-rad)	Cr (kg)	720	720	720

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[(c)]	99% Retrieval Scenario[(c)]
	Hg (kg)	29	29	29
	NO3 (kg)	18000	18000	18000
	Pb (kg)	40	40	40
	U (total) (kg)	45000	45000	45000
UPR (rad)	Am-241 (Ci)	6.80E-07	6.80E-07	6.80E-07
	C-14 (Ci)	2.00E-07	2.00E-07	2.00E-07
	Co-60 (Ci)	1.90E-06	1.90E-06	1.90E-06
	Cs-137 (Ci)	0.03	0.03	0.03
	Eu-152 (Ci)	1.10E-07	1.10E-07	1.10E-07
	Eu-154 (Ci)	8.30E-06	8.30E-06	8.30E-06
	H-3 (Ci)	0.19	0.19	0.19
	I-129 (Ci)	3.90E-09	3.90E-09	3.90E-09
	Ni-59 (Ci)	5.60E-08	5.60E-08	5.60E-08
	Ni-63 (Ci)	5.30E-06	5.30E-06	5.30E-06
	Pu (total) (Ci)	1.40E-06	1.40E-06	1.40E-06
	Sr-90 (Ci)	0.00025	0.00025	0.00025
	Tc-99 (Ci)	0.00084	0.00084	0.00084
	U (total) (Ci)	0.0037	0.0037	0.0037
UPR (non-rad)	Cr (kg)	0.00077	0.00077	0.00077
	Hg (kg)	2.30E-05	2.30E-05	2.30E-05
	NO3 (kg)	95	95	95
	Pb (kg)	4.70E-06	4.70E-06	4.70E-06
	U (total) (kg)	5.4	5.4	5.4
Vadose Zone (from Vadose Zone Sources)				
VZ Remaining (rad)	Am-241 (Ci)	1.1	1.1	1.1
	C-14 (Ci)	7.9	7.9	7.9
	Co-60 (Ci)	0.022	0.022	0.022

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[(c)]	99% Retrieval Scenario[(c)]
	Cs-137 (Ci)	11000	11000	11000
	Eu-152 (Ci)	0.0078	0.0078	0.0078
	Eu-154 (Ci)	0.62	0.62	0.62
	H-3 (Ci)	34000	34000	34000
	I-129 (Ci)	0.0028	0.0028	0.0028
	Ni-59 (Ci)	0.0013	0.0013	0.0013
	Ni-63 (Ci)	0.12	0.12	0.12
	Pu (total) (Ci)	1500	1500	1500
	Sr-90 (Ci)	310	310	310
	Tc-99 (Ci)	1.2	1.2	1.2
	U (total) (Ci)	46	46	46
VZ Remaining (non-rad)	Cr (kg)	1600[(d)]	1600[(d)]	1600[(d)]
	Cr-VI (kg)	1600[(d)]	1600[(d)]	1600[(d)]
	Hg (kg)	35	35	35
	NO3 (kg)	43000	43000	43000
	Pb (kg)	200	200	200
	TBP (kg)	310000	310000	310000
	U (total) (kg)	48000	48000	48000
Saturated Zone (from Vadose Zone Sources)				
SZ Inventory (rad)	Tc-99 (Ci)	0.1	0.1	0.1

a. Tanks (SST and DST): Best Basis Inventory (BBI) March 2014; Ancillary Equipment (Anc Eq): Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix D; Unplanned Releases (UPRs): Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0); Ponds: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0); Cribs: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0); Trenches: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0) and Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix S; Leaks: Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix D; MUSTs: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0) and Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix S.

b. All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

c. 99% and 90% Retrieval Scenarios reflect assumptions described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 and apply only to tank volumes and inventories. They are calculated assuming retrieval of a fully mixed tank of homogeneous composition. For tanks that have been declared "Retrieval Completed" or "Retrieved to Limit of … Technologies" (Templeton, AM 2016, page 9, partially duplicated in Table E.1-7), no further retrieval for either the 99% or 90% retrieval scenario is assumed. This includes tank 241-S-112 and all C Tank Farm tanks except 241-C-105. For tanks that are currently undergoing retrieval (tanks 241-AY-102 and 241-C-105), a retrieval amount equivalent to the 99% and 90% retrieval volumes described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 are calculated.

d. Differences in inventories for Cr vs Cr-IV are due to differing Water Quality Standards (WQS) and thus plume extents: 100 mg/L for total chromium vs 48 mg/L for chromium (VI). The difference may not be distinguishable within the number of significant digits (2) displayed.

Table E.6-3. Current Bulk Inventory and Steady State Flammability Results (by Tank) for the A-AX Tank Farms (CP-TF-5)

Tank ID	Tank Type	Capacity (kGal)[a]	Sludge (kGal)[a]	Saltcake (kGal)[a]	Supernatant (kGal)[a]	HGR (ft^3/d)[b]	Days to 25% LFL Barometric[c]	Days to 25% LFL Zero Ventilation[d]
A-101	SST	1000	3	317	0	1.5	NA	695
A-102	SST	1000	0	38	2	0.51	NA	>1826
A-103	SST	1000	2	376	10	2.5	NA	439
A-104	SST	1000	25	0	0	3.3	NA	451
A-105	SST	1000	37	0	0	6.4	NA	230
A-106	SST	1000	50	29	0	2.2	NA	658
AX-101	SST	1000	3	355	0	1.9	NA	NA
AX-102	SST	1000	6	24	0	0.75	NA	NA
AX-103	SST	1000	8	99	0	1.2	NA	NA
AX-104	SST	1000	5	0	0	0.7	NA	NA

a. Volumes from the Waste Tank Summary Report for Month Ending November 30, 2016 (Templeton, AM 2016).

b. Hydrogen generation rate (ft^3/d) (RPP-5926 Rev. 17). Note in 2001 all 24 tanks were removed from the flammable gas watch list (including T-110 in the T Tank and Waste Farms EU) (Johnson, et al. 2001, p. iii).

c. Time (in days) to 25% of the Lower Flammability Limit (LFL) under a barometric (barom) breathing scenario (RPP-5926, Rev. 17). "NA" indicates that the headspace will not reach specified flammability level.

d. Time (in days) to 25% of the LFL under a zero ventilation scenario (RPP-5926, Rev. 17).

Table E.6-4. Current Primary Contaminant Inventory (by Tank) for the A-AX Tank Farms (CP-TF-5) [a]

Tank ID	Baseline Status[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)
A-101	2001	380	6.6	NR[c]	25	280000	6.5	420	16
A-102	2001	360	0.25	NR	5.3	33000	0.7	36	1.1
A-103	2001	400	4.6	NR	5.6	220000	3.4	170	8.6
A-104	2001	710	0.33	NR	26	42000	4.5	450	0.79
A-105	2001	3100	0.28	NR	38	83000	39	1100	0.49
A-106	2001	1400	0.37	NR	18	63000	37	1900	1.6
AX-101	2001	350	6.8	NR	8.5	300000	3	150	11
AX-102	2001	2100	0.066	NR	60	22000	17	560	1.5
AX-103	2001	720	1.7	NR	42	110000	13	1400	4.1
AX-104	2001	600	0.069	NR	21	25000	9.6	220	0.12

a. From Best Basis Inventory (BBI) Summary (February 2017) . All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

b. This is the “Baseline Status” date as reported in the BBI (February 2017) as “Baselined 2001.” It should not be necessarily be considered the decay date for isotope inventories.

c. NR = Not reported for this EU

Table E.6-5. Current Primary Contaminant Inventory[a] and Groundwater Threat Metric (by Tank) for the A-AX Tank Farms (CP-TF-5)

Tank ID	I-129 (Ci)	Ni-59 (Ci)	Ni-63 (Ci)	Pu (total) (Ci)[b]	Sr-90 (Ci)	Tc-99 (Ci)	U (total) (Ci)[c]	GTM (Mm3)[d]
A-101	0.23	14	1300	220	110000	230	3.6	250
A-102	0.019	1.8	150	740	57000	36	19	40
A-103	0.048	12	1000	530	110000	260	7.2	290
A-104	0.0064	8.6	740	1200	1500000	12	1.2	14
A-105	0.00095	7.2	630	1300	2200000	16	0.0018	18
A-106	0.036	7.0	600	3200	1800000	88	0.55	97
AX-101	0.25	14	1200	240	150000	250	2.7	280
AX-102	0.017	1.7	160	810	210000	6.3	1.5	7.0
AX-103	0.068	5.1	460	260	400000	70	0.28	78
AX-104	0.00024	1.8	160	410	1000000	13	0.074	15

a. From Best Basis Inventory (BBI) Summary (February 2017). All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

b. Sum of plutonium isotopes 238, 239, 240, 241, and 242

c. Sum of uranium isotopes 232, 233, 234, 235, 236, and 238

d. The Groundwater Threat Metric (GTM) shown for tanks is equal to the maximum of the GTM for Tc-99 and I-129.

Table E.6-6. Current Primary Contaminant Inventory (by Tank) for the A-AX Tank Farms (CP-TF-5) [a]

Tank ID	CCl4 (kg)	CN (kg)	Cr (kg)	Cr-VI (kg)	Hg (kg)	NO3 (kg)	Pb (kg)	TBP (kg)	TCE (kg)	U (total) (kg)
A-101	NR[b]	NR	6600	NR	3.4	240000	330	NR	NR	1300
A-102	NR	NR	1600	NR	0.99	25000	260	NR	NR	6400
A-103	NR	NR	2700	NR	2.7	230000	230	NR	NR	2500
A-104	NR	NR	160	NR	32	300	58	NR	NR	1700
A-105	NR	NR	360	NR	21	17000	2800	NR	NR	2.6
A-106	NR	NR	1900	NR	180	50000	670	NR	NR	520
AX-101	NR	NR	4200	NR	13	340000	200	NR	NR	1700
AX-102	NR	NR	100	NR	7.6	26000	440	NR	NR	540
AX-103	NR	NR	2100	NR	5.2	68000	390	NR	NR	190
AX-104	NR	NR	19	NR	5.3	2300	470	NR	NR	170

a. From Best Basis Inventory (BBI) Summary (February 2017). All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

b. NR = Not reported for this EU

Table E.6-7. Summary of the Evaluation of Current Threats to Groundwater as a Protected Resource from Remaining Vadose Zone (VZ) Contamination associated with the A-AX Tank and Waste Farms Evaluation Unit (CP-TF-5)

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} [d]	VZ GTM (Mm^3)	VZ Rating[e]
C-14	A	2000 pCi/L	0.25	0	1.82	7.85E+00 Ci	---	---	7.85E+00 Ci	3.93E+00	*Low*
I-129	A	1 pCi/L	0.25	0.2	1.82	2.82E-03 Ci	---	---	2.82E-03 Ci	1.15E+00	*Low*
Sr-90	B	8 pCi/L	0.25	22	1.82	3.07E+02 Ci	---	---	3.07E+02 Ci	2.38E+02	*ND*[f]
Tc-99	A	900 pCi/L	0.25	0	1.82	1.42E+00 Ci	2.14E-01 Ci	---	1.20E+00 Ci	1.33E+00	*Low*
CCl_4	A	5 µg/L	0.25	0	1.82	---	---	---	---	---	*ND*
Cr	B	100 µg/L	0.25	0	1.82	1.61E+03 kg	---	---	1.61E+03 kg	1.61E+01	*Medium*
Cr-VI	A	48 µg/L[b]	0.25	0	1.82	1.61E+03 kg	---	---	1.61E+03 kg	3.35E+01	*Medium*
TCE	B	5 µg/L	0.25	2	1.82	---	---	---	---	---	*ND*
U(tot)	B	30 µg/L	0.25	0.8	1.82	4.77E+04 kg	---	---	4.77E+04 kg	2.33E+02	*ND*[f]

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

b. "Model Toxics Control Act−Cleanup" (WAC 173-340) Method B groundwater cleanup level for hexavalent chromium. Other WQS values represent drinking water standards.

c. Treatment amounts from the 2015 Hanford Annual Groundwater Report (DOE/RL-2016-09, Rev. 0). No active remedial actions are being performed in the 200-PO GWIA.

d. The remaining vadose zone inventory is estimated by difference (CRESP 2015a; Appendix D.1) and thus has a high associated uncertainty.

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

f. For Sr-90, the times required for the remaining vadose zone inventory to decay to values that would result in *Medium* and *Low* ratings are 36 and 131 years, respectively. However, as discussed in Section E.6.5, no appreciable total uranium or Sr-90 plume would be expected in the next 150 years due to transport and decay (Sr-90) considerations. Thus the *Low* rating would apply to the period *after* the Active Cleanup is complete to account for uncertainties.

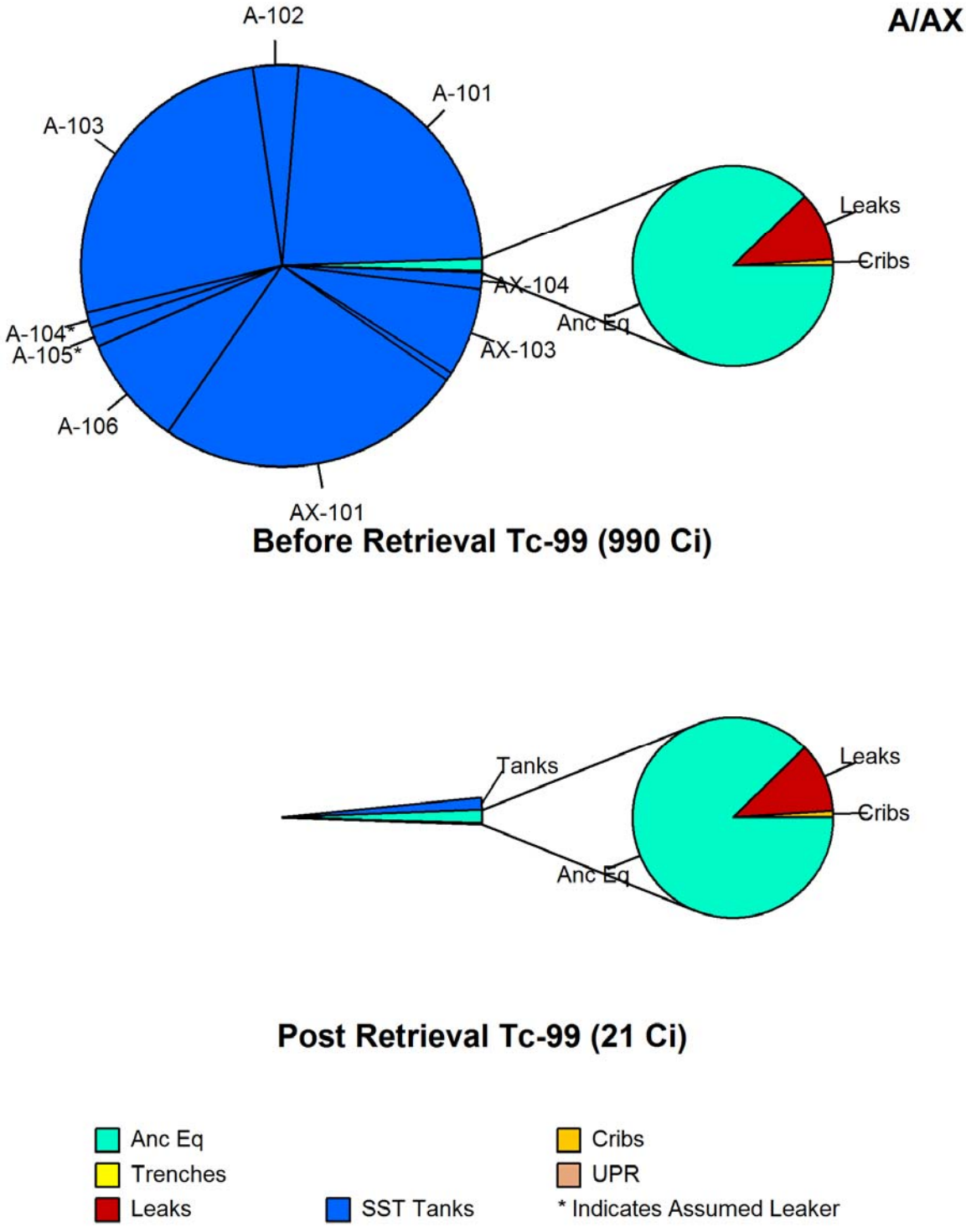


Figure E.6-3. A-AX Tank and Waste Farms Evaluation Unit Inventory Estimates for Tc-99 Before and After 99% Retrieval

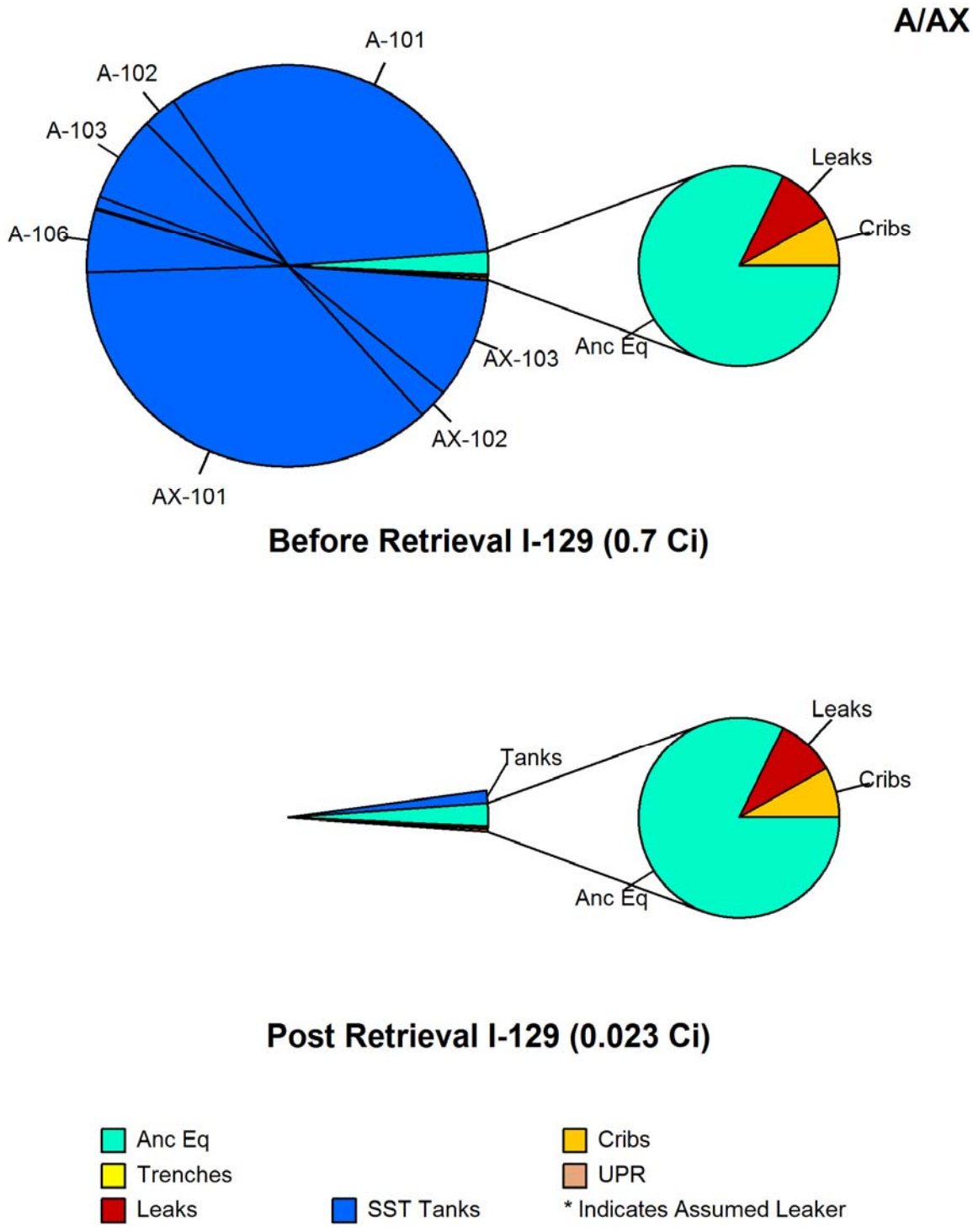


Figure E.6-4. A-AX Tank and Waste Farms Evaluation Unit Inventory Estimates for I-129 Before and After 99% Retrieval

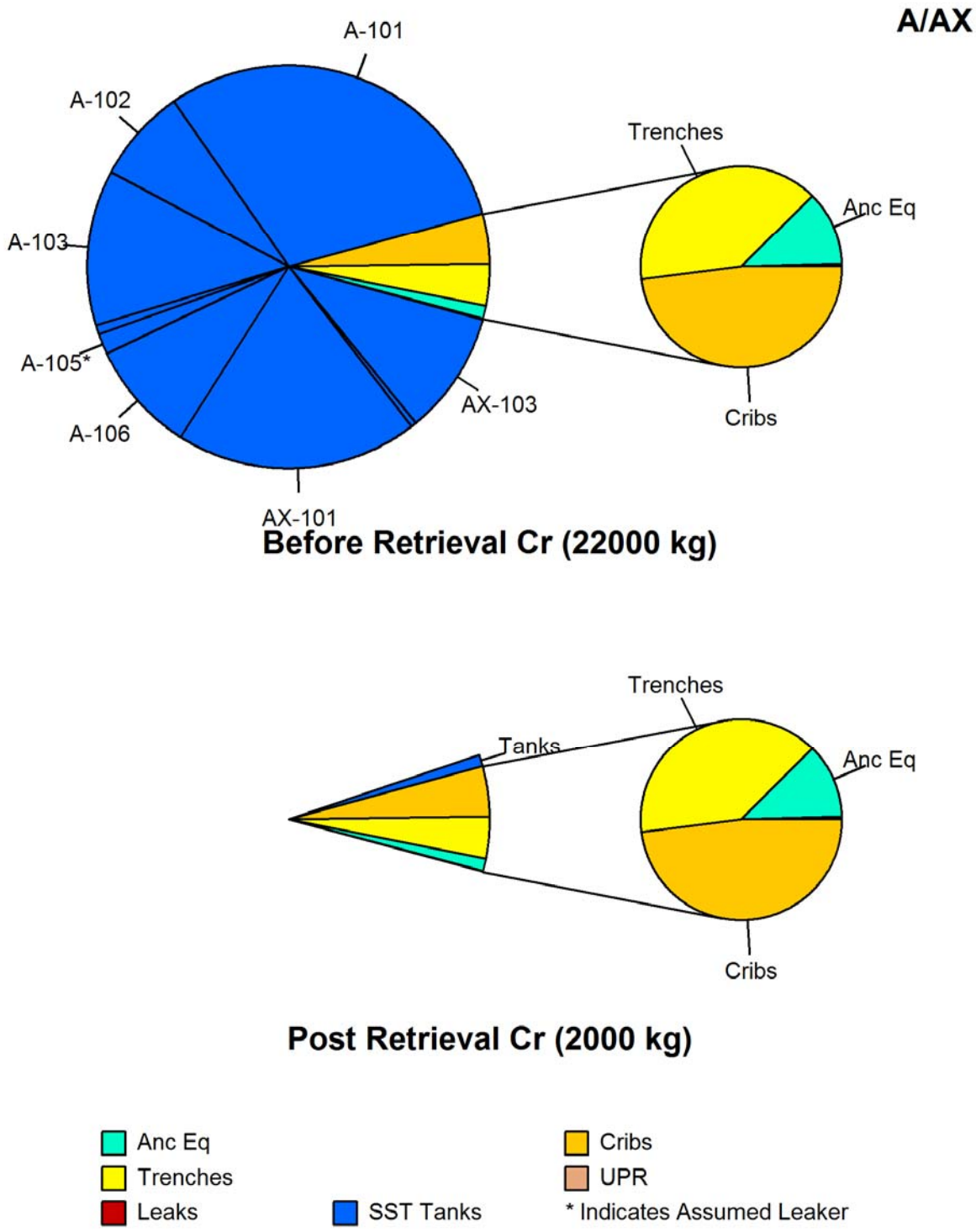


Figure E.6-5. A-AX Tank and Waste Farms Evaluation Unit Inventory Estimates for Chromium Before and After 99% Retrieval

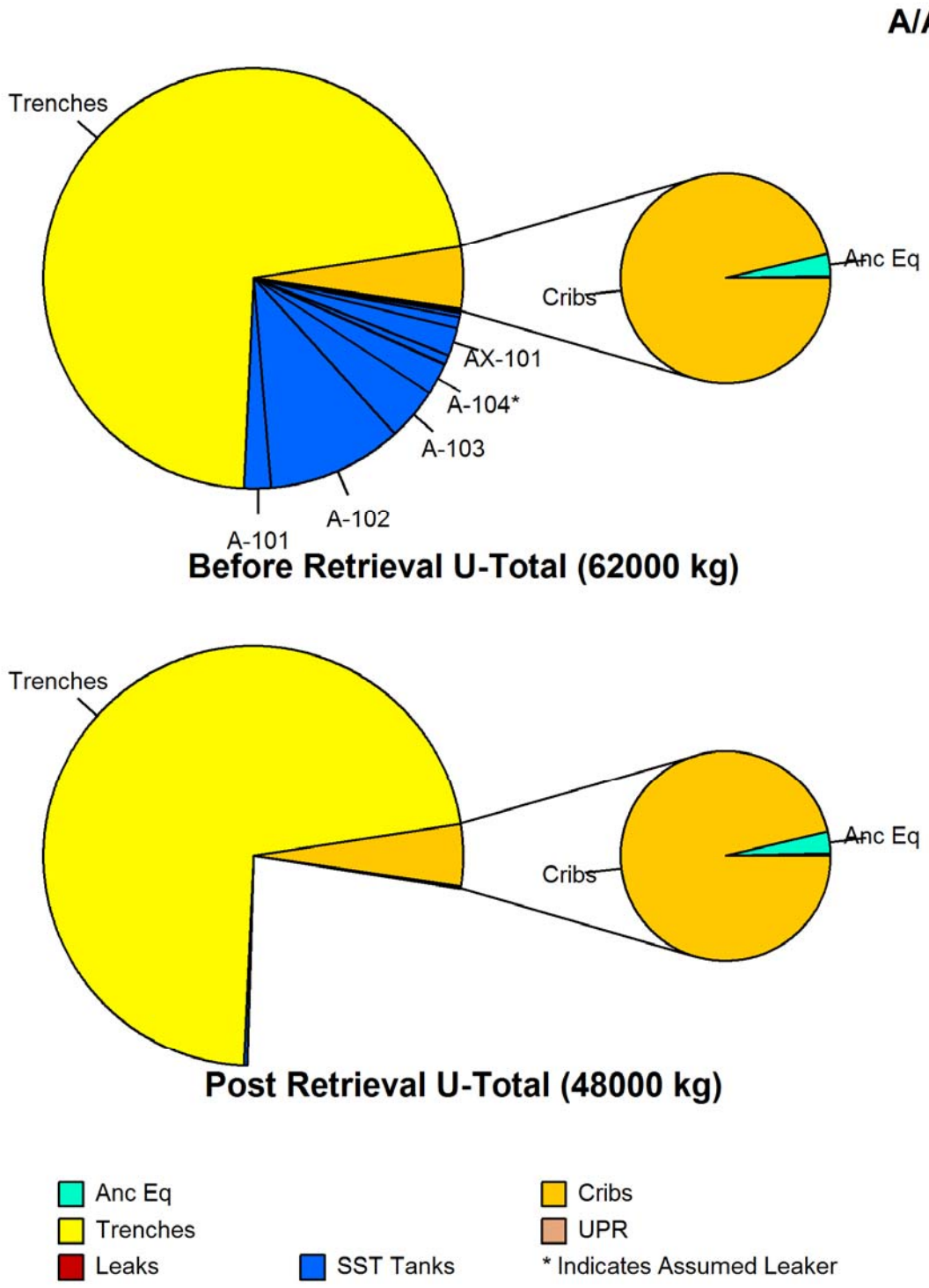


Figure E.6-6. A-AX Tank and Waste Farms Evaluation Unit Inventory Estimates for U(tot) Before and After 99% Retrieval

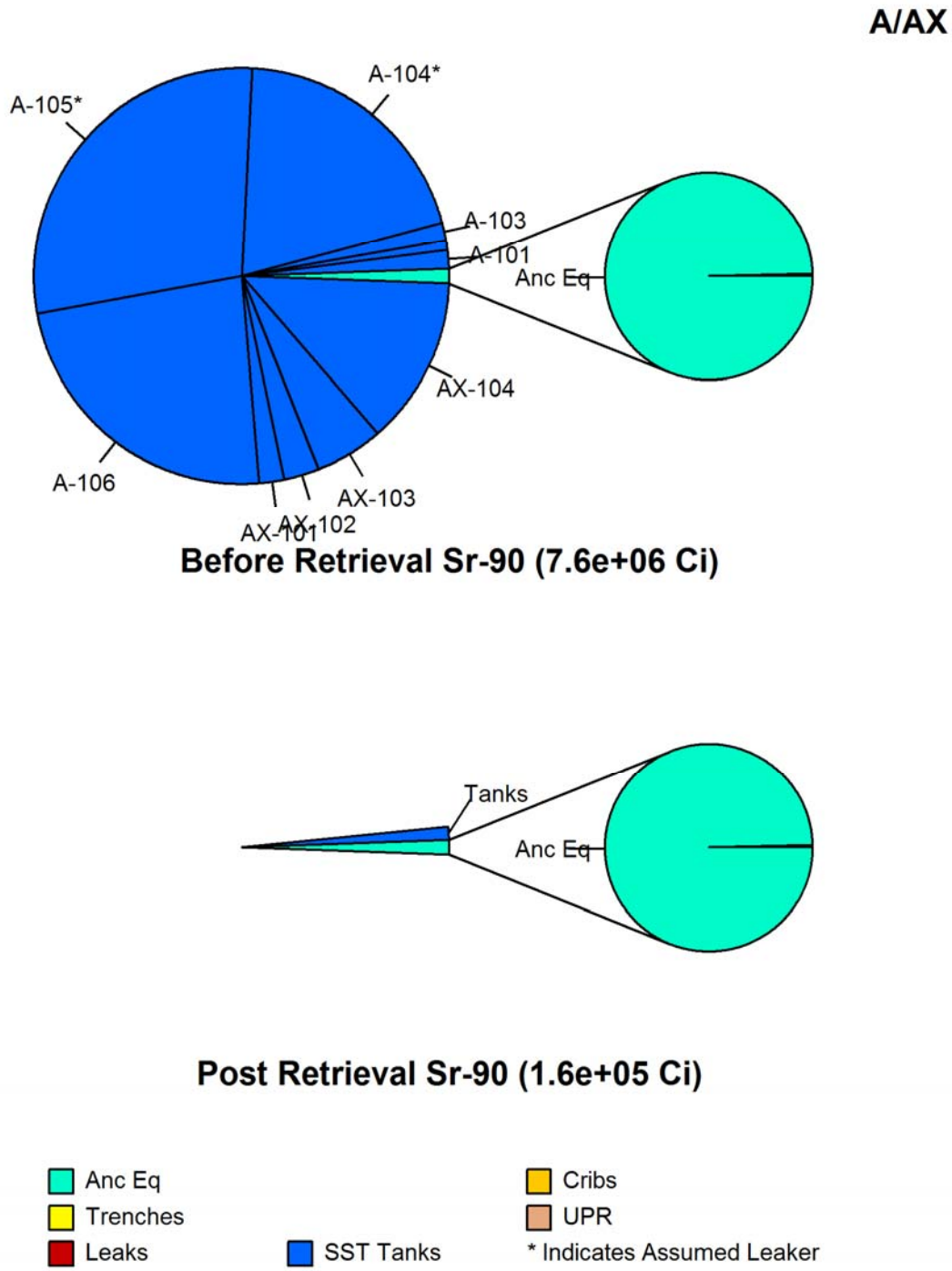


Figure E.6-7. A-AX Tank and Waste Farms Evaluation Unit Inventory Estimates for Sr-90 Before and After 99% Retrieval

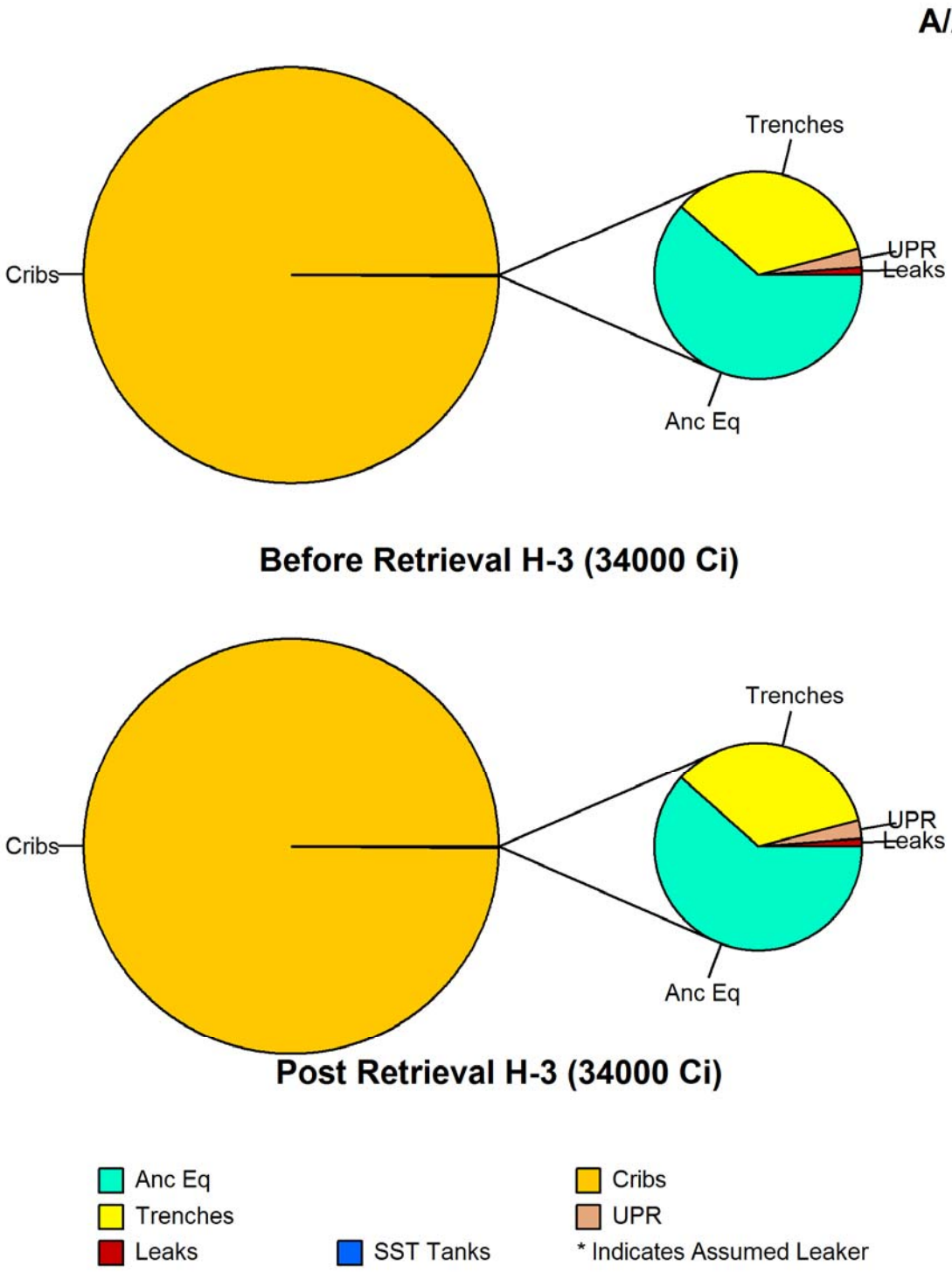


Figure E.6-8. A-AX Tank and Waste Farms Evaluation Unit Inventory Estimates for Tritium (H-3) Before and After 99% Retrieval

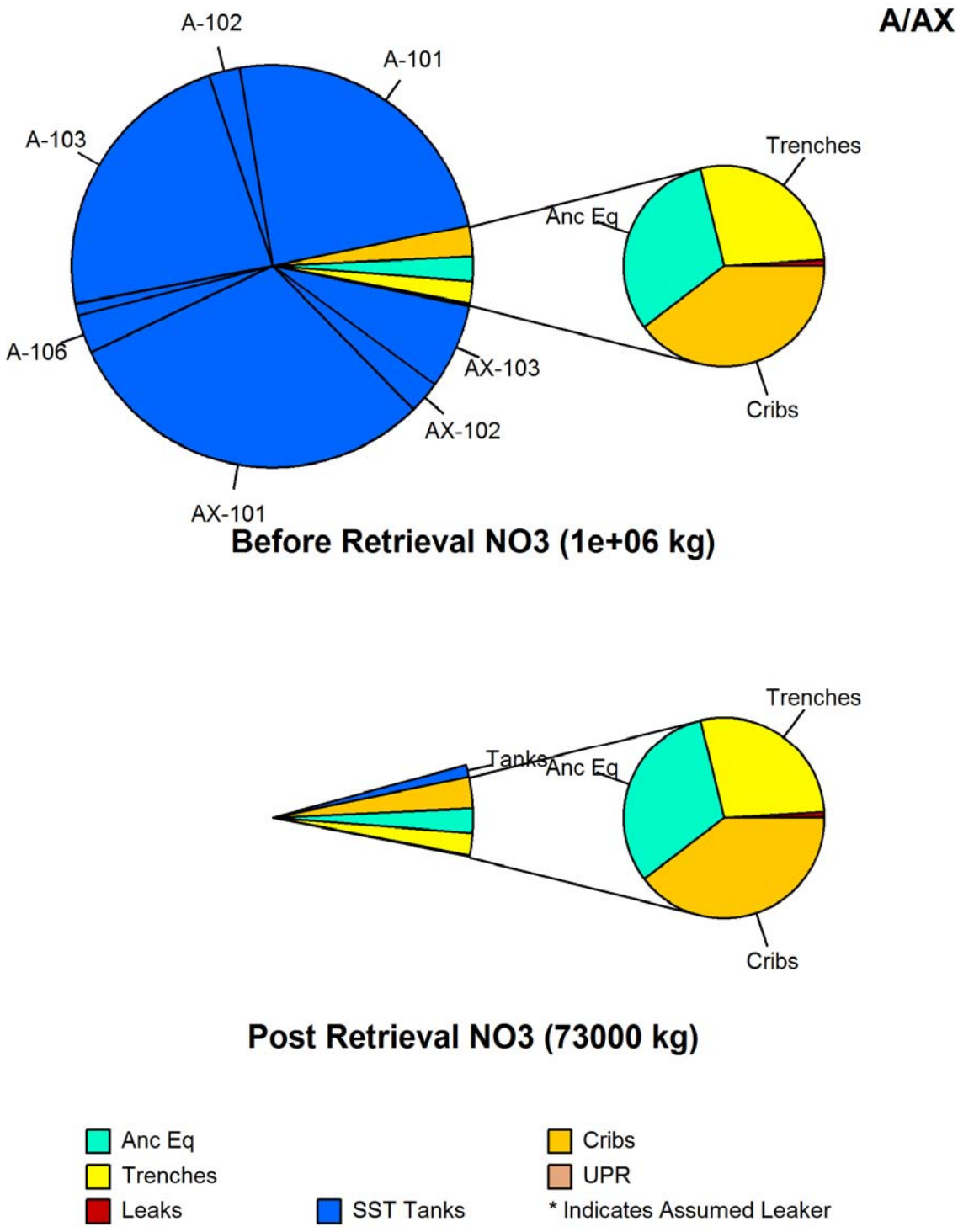


Figure E.6-9. A-AX Tank and Waste Farms Evaluation Unit Inventory Estimates for Nitrate (NO3) Before and After 99% Retrieval

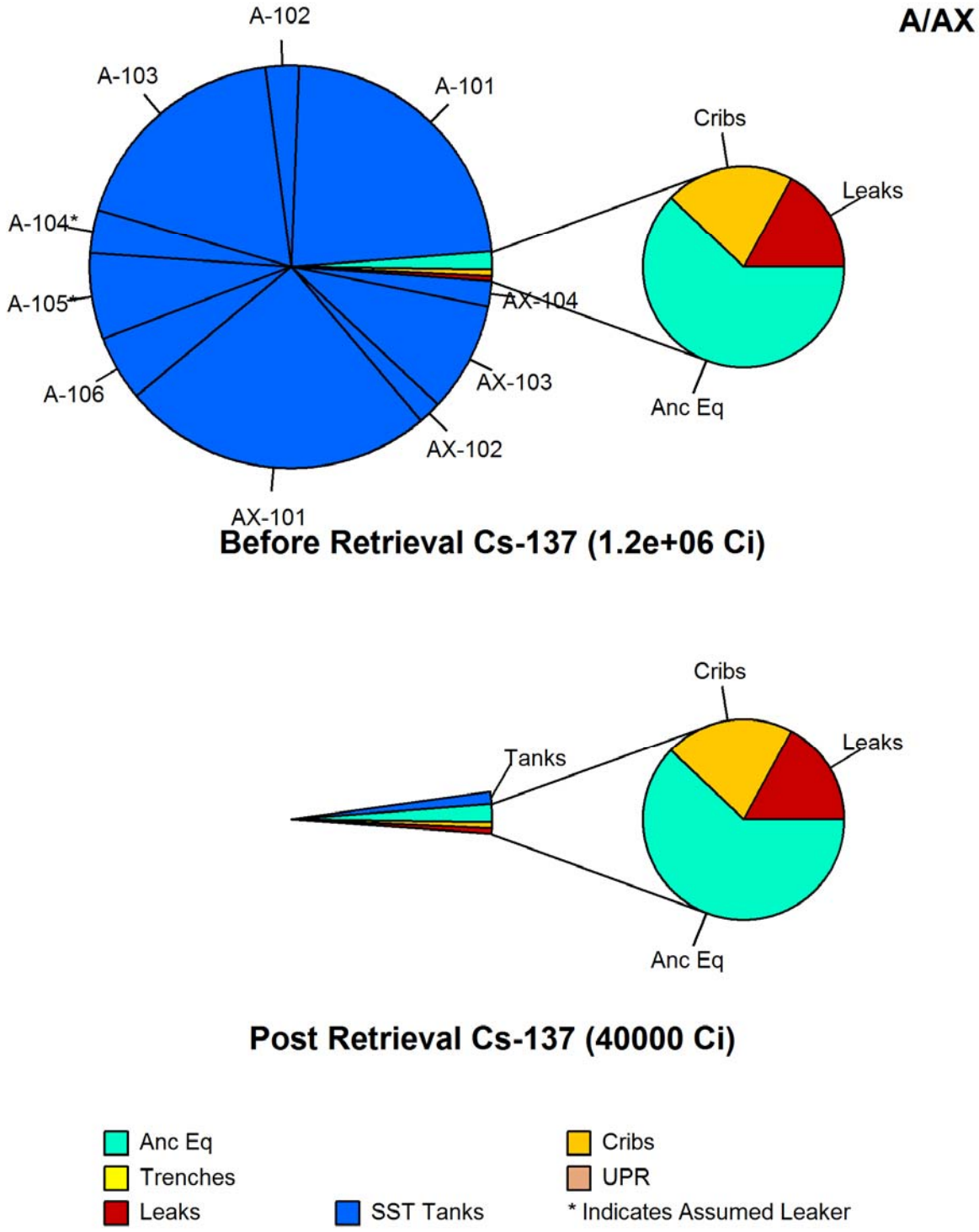


Figure E.6-10. A-AX Tank and Waste Farms Evaluation Unit Inventory Estimates for Cs-137 Before and After 99% Retrieval

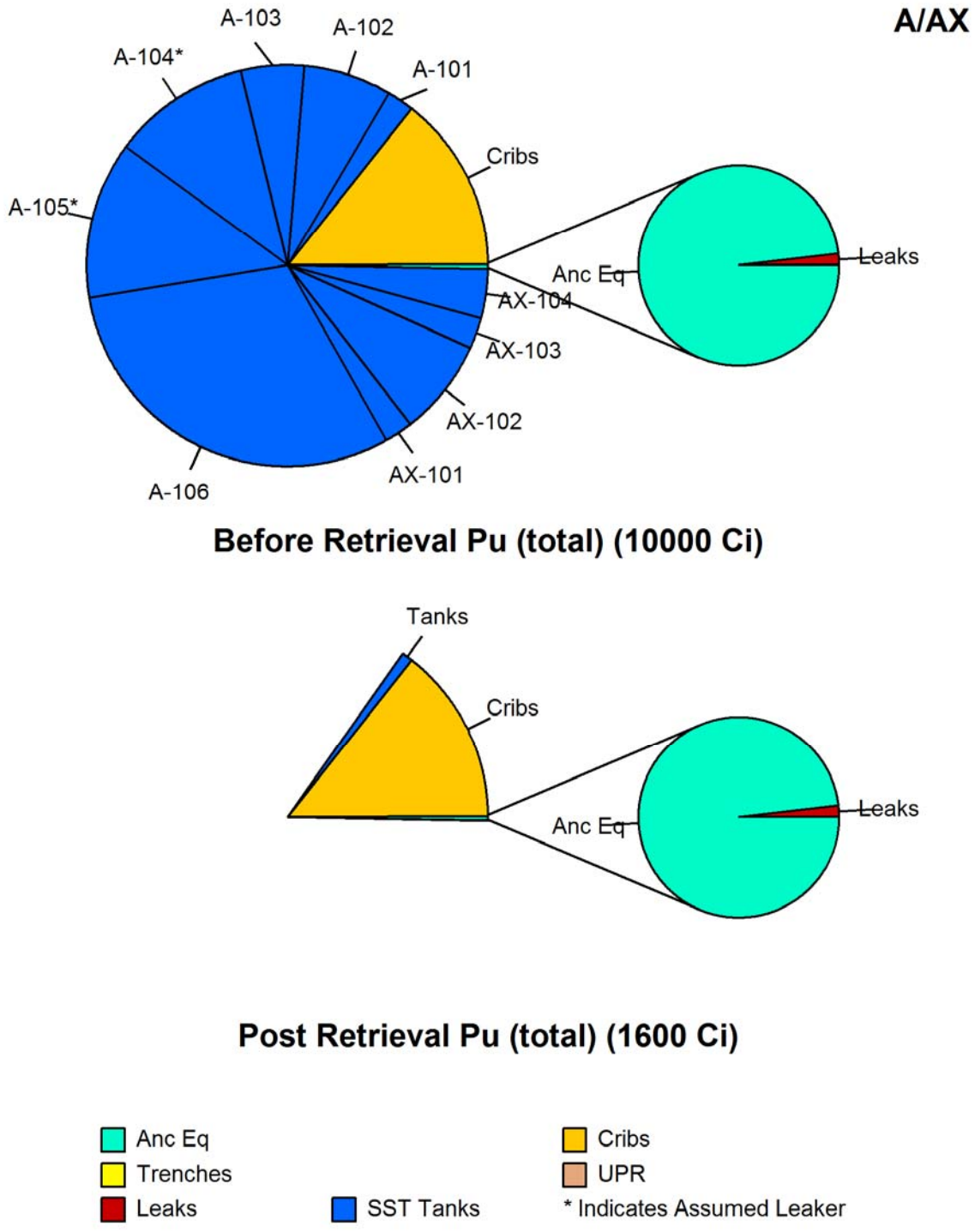


Figure E.6-11. A-AX Tank and Waste Farms Evaluation Unit Inventory Estimates for Plutonium (total) Before and After 99% Retrieval

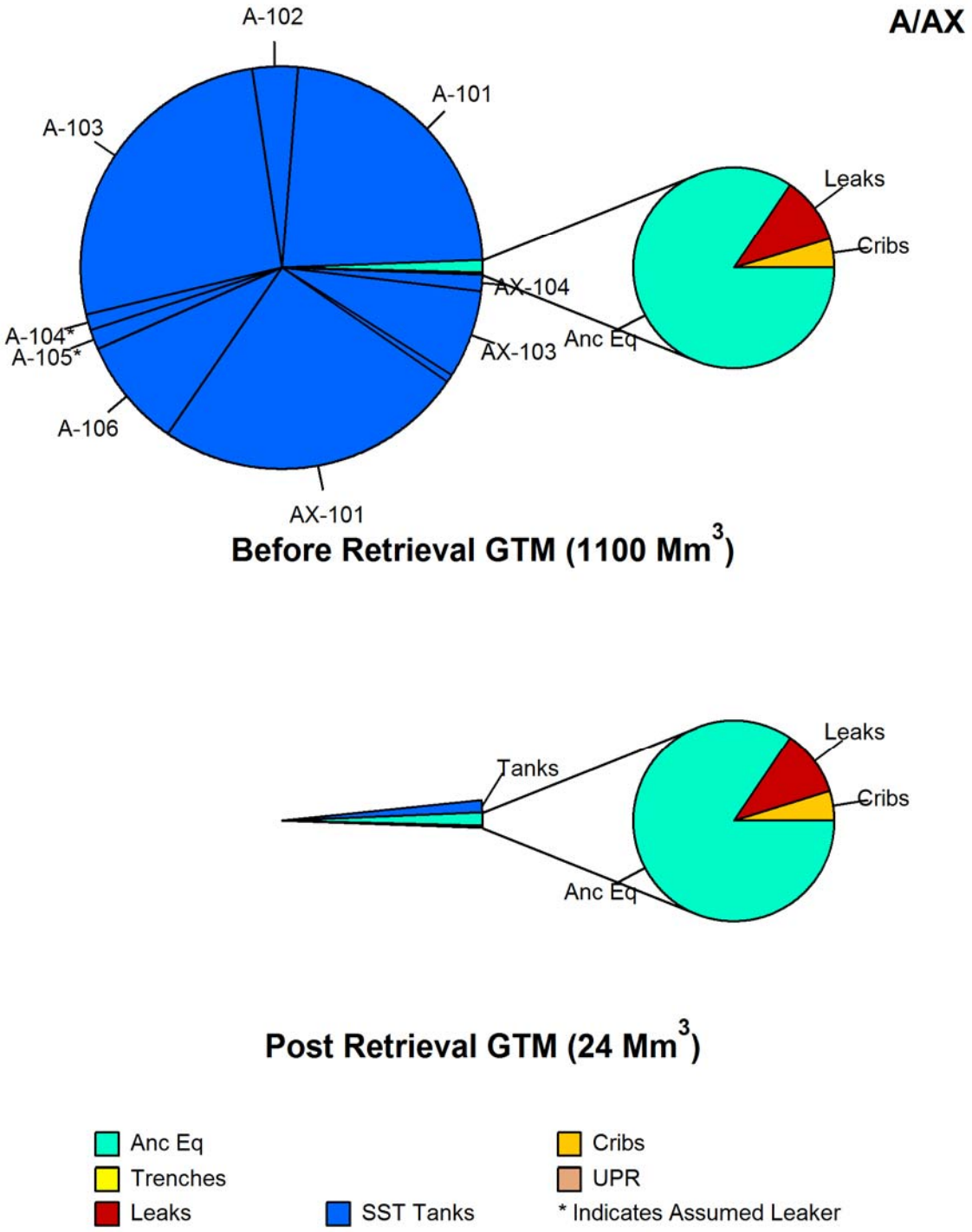


Figure E.6-12. A-AX Tank and Waste Farms Evaluation Unit Maximum Groundwater Threat Metric (GTM) of I-129 and Tc-99 Estimates Before and After 99% Retrieval

E.6.6. POTENTIAL RISK/IMPACT PATHWAYS AND EVENTS

CURRENT CONCEPTUAL MODEL

A common safety analysis was performed for all the single- and double-shell tanks including pathways and barriers (safety scenarios that dominate risk, safety systems and controls, barriers to release, failure mechanisms, pathways and receptors, time frames for exposure). See Section E.1.6 in Appendix E.1 for details.

POPULATIONS AND RESOURCES CURRENTLY AT RISK OR POTENTIALLY IMPACTED

Facility Worker, Co-located Person, and Public

A common analysis was performed for the Facility Worker, Co-located Person, and Public. See Section E.1.6 (Appendix E.1) for details.

Groundwater

The Tc-99 groundwater plume associated with the A-AX Tank and Waste Farms EU and liquid waste disposal facilities is described in Section E.6.5 and further details including ratings are provided in the Appendix D.5 for the CP-GW-1 EU (200-PO GWIA).

As shown in Table E.6-7 (Section E.6.5), the vadose zone (VZ) GTM values for the Group A and B primary contaminants translate into ratings of *Not Discernible* (*ND*) for total uranium and Sr-90 (i.e., these have inventories that would translate to *High* ratings but appear relatively immobile in the area as described in Section E.6.5), *Low* for C-14, I-129, and Tc-99, and *Medium* for chromium (total and hexavalent) for the A-AX Tank and Waste Farms EU. Thus the overall rating for groundwater impact from vadose zone sources is *Medium*.

Columbia River

As described in Section E.6.5, the 200-PO tritium (H-3) plume that currently intersects the Columbia River is not associated with the A-AX Tank and Waste Farms EU, and thus a *Not Discernible* rating is ascribed for all evaluation periods. This rating applies to all current plumes.

As described in Section E.6.5, TC&WM EIS screening results indicate that peak concentrations in the nearshore region of the Columbia River were below benchmarks for wildlife receptors and benthic invertebrates and aquatic biota leading to a *Not Discernible* rating for radionuclides for both benthic and riparian receptors for all evaluation periods.

For chemicals, only nitrate and chromium (assumed hexavalent) are predicted in the TC&WM EIS screening groundwater analysis (Appendix O) to have concentrations (from sources including those other than the A-AX Tank and Waste Farms EU) that could exceed thresholds in the near-shore ecology as described in Section E.6.5. However, nitrate has a *Not Discernible* rating for current conditions (since the plume is not in contact with the Columbia River) and a *Not Discernible* rating for the benthic and riparian ecology for the Active Cleanup and Near-term, Post-Cleanup periods. Hexavalent chromium has a *Not Discernible* rating for current conditions (since the plume is not in contact with the Columbia River). Hexavalent chromium would have a *Medium* rating for benthic and a *High* rating for the riparian ecology for the Active Cleanup and Near-term, Post-Cleanup periods based on the screening evaluation in the TC&WM EIS. However, well data indicate that chromium is moving much slower toward the Columbia River than predicted in the TC&WM EIS resulting in a *Not Discernible* rating for these evaluation periods.

The large dilution effect of the Columbia River results in a rating of *Not Discernible* for the free-flowing ecology for the Active Cleanup and Near-term, Post-Cleanup periods.

Additional information concerning potential threats to the Columbia River from A-AX Tank Farm and co-located liquid waste disposal facilities is provided in the Appendix D.5 for the CP-GW-1 EU (200-PO GWIA).

Ecological Resources

- More than 75% of the EU consists of level 0 and level 1 habitat resources.
- Up to 27 acres of level 3 habitat may be lost if remediation actions were to result in clearing the entire EU. This would represent a loss of 1.8% of this habitat level at the landscape scale considered for this EU.
- Wildlife observations within the level 3 habitat areas on the east side of the EU included harvester ant hills, small mammal burrows, coyote tracks, and an unidentified lizard; previous surveys noted 3 migratory bird species and northern pocket gopher mounds.
- One individual occurrence of a sensitive plant species (Piper's daisy) has been previously noted within the EU boundary, but was not relocated during the October 2014 survey. Loss of individual sensitive plant occurrences is unlikely to affect population viability for this species.
- The A-AX Tank and Waste Farms EU is surrounded by additional industrial and operations areas inside the 200-East Area. Loss of level 3 resources from within the EU would not be expected to significantly impact habitat connectivity.

Cultural Resources

- The Hanford Site Plant Railroad and 2707AR Sludge Vault Change House contributing properties within the Manhattan Project and Cold War Era Historic District, with documentation required are located within the A-AX Tank and Waste Farms EU.
- The 244 AR Vault Facility and Canyon and 242BA (242-A Boiler Annex) are contributing properties within the Manhattan Project and Cold War Era Historic District with no documentation required are located within the A-AX Tank and Waste Farms EU.
- There are no archaeological sites or TCPs known to be located within the A-AX Tank Farms Evaluation Unit.

Archaeological sites and TCPs located within 500 meters of the EU

- The 241 AW Underground Liquid Tank Farm are contributing properties within the Manhattan Project and Cold War Era Historic District with documentation required are located within close proximity to the A-AX Tank and Waste Farms EU.
- The 271 CR Service and Office Building is a contributing property within the Manhattan Project and Cold War Era Historic District with no documentation required is located within close proximity to the A-AX Tank and Waste Farms EU.
- All of the Manhattan Project and Cold War era contributing properties both with documentation and no documentation requirements that are listed as being located within the PUREX Evaluation Unit are also located in close proximity to the A-AX Tank and Waste Farms EU.

Closest Recorded TCP

- There are two recorded TCPs associated with the Native American Precontact and Ethnographic Landscape that are visible from the A-AX Tank and Waste Farms EU.

CLEANUP APPROACHES AND END-STATE CONCEPTUAL MODEL

Selected or Potential Cleanup Approaches

A common analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

Contaminant Inventory Remaining at the Conclusion of Planned Active Cleanup Period

See Section E.6.5 including Table E.6-2 and Figure E.6-3 through Figure E.6-11 for the inventory information after planned 99% retrieval. Furthermore, a more general analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

Risks and Potential Impacts Associated with Cleanup

A common analysis was performed for all the single- and double-shell tanks for workers and the Public. See Section E.1.6 (Appendix E.1) for details.

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

Facility Worker, Co-located Person, and Public

A common analysis was performed for the Facility Worker, Co-located Person, and Public. See Section E.1.6 (Appendix E.1) for details.

Groundwater

As described in Section E.6.5, there will be a continuing impact during this period to groundwater (as a protected resource) from those mobile A-AX Tank Farm primary contaminants currently with plumes that exceed thresholds. These impacts are described in Appendix D.5 for the CP-GW-1 EU (200-PO-1 OU).

Furthermore, there are primary (e.g., tank wastes) and secondary contaminant sources (legacy source sites) in the vadose zone that pose risk to groundwater. The vadose zone (VZ) GTM values for the Group A and B primary contaminants for the A-AX Tank and Waste Farms EU translate to ratings of *Not Discernible* (*ND*) for total uranium and Sr-90[115] to *Low* for C-14, I-129, and Tc-99 to *Medium* for chromium (total and hexavalent). The overall rating is *Medium*.

The 200-PO GWIA is being monitored to determine the impact to groundwater prior to determining the path forward for remedial action; thus groundwater will likely be treated in the future to help address groundwater contamination.

It is considered unlikely that additional groundwater resources would be impacted as a result of either interim remedial actions (e.g., pump and treat) or final closure activities (that are not covered in the Ecological or Cultural Resources results).

Columbia River

As described in Section E.6.5, impacts from radiological contaminants to the Columbia River benthic and riparian ecology for the Active Cleanup and Near-term, Post Cleanup periods are rated as *Not Discernible*. The nitrate has a rating of *Not Discernible* for the benthic and riparian ecology. For the

[115] Note that no appreciable uranium or Sr-90 plume would be expected in the next 150 years due to transport considerations; however, these may impact groundwater after the 150-year period. Thus a *Low* rating would apply after the Active Cleanup period to account for uncertainties.

Active Cleanup and Near-term, Post Cleanup periods, chromium (assumed hexavalent) would have had benthic and riparian zone ratings of *Medium* and *High*, respectively; however, well data suggest that chromium is moving much slower than predicted in the TC&WM EIS (Appendix O, DOE/EIS-0391 2012) resulting in *Not Discernible* ratings. The large dilution effect of the Columbia River on the contamination from the seeps and groundwater upwellings produces *Not Discernible* ratings for all contaminants for the Active Cleanup and Near-term, Post Cleanup periods.

Additional information on groundwater plumes and potential threats associated with the A-AX Tank Farm and liquid waste disposal facilities are described in Appendix D.5 for the CP-GW-1 EU (200-PO GWIA).

It is considered unlikely that additional benthic or riparian resources would be impacted as a result of either interim remedial actions (e.g., pump and treat) or final closure activities (that are not covered in the Ecological or Cultural Resources results).

Ecological Resources

See Section E.1.6 (Appendix E.1) for details.

Cultural Resources

See Section E.1.6 (Appendix E.1) for details.

ADDITIONAL RISKS AND POTENTIAL IMPACTS IF CLEANUP IS DELAYED

A common analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

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

A common analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

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

Table E.6-8. Summary of Populations and Resources at Risk or Potentially Impacted after Cleanup

Population or Resource		Impact Rating	Comments
Human	Facility Worker	Low	Workers will be low risk from exposure to direct radiation and waste contaminants after waste retrieval, grouting, and capping.
	Co-located Person	Low	These persons will be at low risk from exposure to direct radiation and waste contaminants after waste retrieval, grouting, and capping.
	Public	Not Discernible (ND)	The Tank Farms will be in secure and controlled areas that prevent intentional and inadvertent intruders. No complete groundwater pathway and no impact from air pathway.
Environmental	Groundwater (A&B) from vadose zone[(a)]	*Low* (Sr-90, U(tot), C-14, I-129, Tc-99, and Cr(tot)) *Medium* (Cr-VI) **Overall**: *Medium*	Current GTM values for Group A and B primary contaminants (Table E.6-7): *ND* (Sr-90, U(tot)), *Low* (C-14, I-129, Tc-99) and Medium (hexavalent and total chromium). Changes in ratings account for significant impacts due to recharge (Cr(tot), Tc-99, Sr-90, U(tot)) and recharge and decay (Sr-90) and to address uncertainty (Section E.6.5).
	Columbia River from vadose zone[(a)]	Benthic: *ND* (radionuclides) *ND* (chemicals) Riparian: *ND* (radionuclides) *ND* (chemicals) Free-flowing: *ND* (all) **Overall**: *ND*	TC&WM EIS screening results used to evaluate benthic and riparian receptors (Section E.6.5). Only nitrate (*ND* for both benthic and riparian) and hexavalent chromium (*Medium* for benthic and *High* for riparian) are predicted to have concentrations (including sources other than A-AX) that could threaten the near-shore ecology. However, well data indicate slower movement of chromium toward the river resulting in *ND* ratings. Dilution factor of greater than 100 million between River and upwellings.

Population or Resource		Impact Rating	Comments
	Ecological Resources[b]	ND to Low	If capped and monitored, there could be some disturbance to EU and buffer habitat, but re-vegetation may increase resource value.
Social	Cultural Resources[b]	**Native American:** Direct: Unknown Indirect: Known **Historic Pre-Hanford:** Direct: Unknown Indirect: Unknown **Manhattan/Cold War**: Direct: None Indirect: None	Permanent indirect effects to viewshed are possible from capping. Permanent effects may be possible due to presence of contamination if capping occurs. No other expected cultural resources impacts.

a. Groundwater threat for Group A and B contaminants remaining in the vadose zone or to the Columbia River for all primary contaminants. Threats from existing plumes associated with the A-AX Tank and Waste Farms EU are described in Section E.6.5 and Appendix D.5 (CP-GW-1) for the 200-PO Groundwater Interest Area.

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

As described in Section E.6.5, the TC&WM ecological screening analysis indicate that that exposure to radioactive contaminants from peak groundwater discharge was below screening levels at the Columbia River near-shore region, indicating there should be no expected adverse effects from radionuclides. Furthermore, results of the corresponding TC&WM screening evaluation for chemicals indicated that predicted chromium and nitrate concentrations could exceed screening values (i.e., Hazard Quotient of unity) in the near-shore region. The predicted nitrate peak concentration was in the past and would be unlikely to exceed human or aquatic standards in the future. On the other hand, unless treated chromium (assumed hexavalent) could over the long term impact benthic and riparian receptors (i.e., concentrations could exceed screening levels).

For more information, see Section E.1.6 (Appendix E.1).

E.6.7. SUPPLEMENTAL INFORMATION AND CONSIDERATIONS

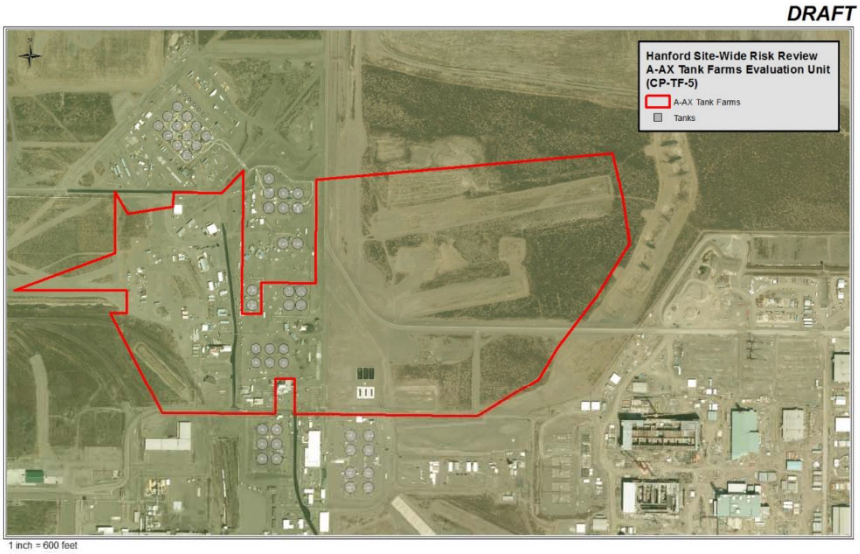
A common analysis was performed for all the single- and double-shell tanks. See Section E.1.7 (Appendix E.1) for details.

E.6.8. ATTACHMENT – A-AX TANK FARMS EVALUATION UNIT WIDS REVIEW

Hanford Site-Wide Risk Review

Evaluation Unit:	A-AX Tank Farms
ID:	CP-TF-5
Group:	Tank Farm
Operable Unit Cross-Walk:	WMA A/AX 200-EA-1 200-PW-3
Related EU:	CP-LS-7 CP-TF-8 CP-GW-1
Sites & Facilities:	A-AX tank farm, ancillary structures, associated liquid waste sites, and soils contamination
Key Data Sources Docs:	RPP-13033 RPP-23405 RPP-40545 RPP-PLAN-40145 RPP-10435

Figure 1. Site Map with Evaluation Unit Boundaries and Tank Locations



Attached:

- Waste Site and Facility List
- Site Map with Evaluation Unit Boundaries and Associated Waste Sites
- Site Map with Evaluation Unit Boundaries and Associated Facilities

Prepared by: AMG, 08/29/2014
Reviewed by: GVL, 08/29/2014
Revisions: AMG, 09/10/2014

Hanford Site-Wide Risk Review
CP-TF-5 (A-AX Tank Farms)
Waste Site and Facility List

Site Code	Name, Aliases, Description	Site Status	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation
200-E PD	200-E PD; 200-E Powerhouse Ditch; 200 East Powerhouse Pond	Active	Ditch	Pond/Ditch - Subsurface Liquid Disposal Site	200-EA-1	
200-E-111-PL	200-E-111-PL; 3-38 Encasement; Encased Pipeline from 241-ER-151 Diversion Box to 241-C Tank Farm and 244-AR Vault; Lines V108/V837/8618/8653/8901PAS, 809, 818, V836 and V834	Inactive	Encased Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-125	200-E-125; Contamination Area Northwest of 244-AR Building	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	200-EA-1	
200-E-127-PL-B	200-E-127-PL-B; Segments of Gable Mountain Pond Pipeline Located in the Inner Area	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-131	200-E-131; Contaminated Soil Associated with 241-A Tank Farm Complex	Inactive	Contamination Migration	Unplanned Release - Surface/Near Surface	WMA A/AX	
200-E-143-PL	200-E-143-PL; Encased Transfer Line from 241-AX-151 Diversion Box to 241-A Tank Farms and 244-CR Vault in 241-C Tank Farm; Tank Farm Transfer Lines 4101, 4102, 4103, 4104, 4105, 4106, 4107/V033, 4017, 4018 and 8656	Inactive	Encased Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-144-PL	200-E-144-PL; Encased Transfer Line from 241-CR-152 and 241-CR-153 to 241-AX-151; Lines 4006 and 4007 from 244-AR Vault to 241-AX-151; Tank Farm Transfer Line 4012; Transfer Line 4013 (A-4013)	Inactive	Encased Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-145-PL	200-E-145-PL; 241-ER-152 and 241-ER-151; Interplant Transfer Line; Tank Farm Transfer Line V228; Transfer Pipeline from 241-CR-153 to 241-ER-153	Inactive	Encased Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-147-PL	200-E-147-PL; Interplant Transfer Line; Tank Farm Transfer Line PAS-244; Transfer Line from 244-CR-TK-003 to 241-ER-153	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-148-PL	200-E-148-PL; Direct Buried Transfer Line from 241-C-151 to 241-A-01A; Tank Farm Transfer Line V109	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-150-PL	200-E-150-PL; Direct Buried Transfer Line from 244-CR-TK-003 to 201-C Hot Semi Works Valve Box; Tank Farm Pipeline; Tank Farm Transfer Line 8900	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-151-PL	200-E-151-PL; Direct Buried Transfer Line from 241-C-104 to 241-A-152; Tank Farm Pipeline; Tank Farm Transfer Line V050	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-152-PL	200-E-152-PL; Direct Buried Transfer Line from 241-C-104 to 241-A-152; Tank Farm Pipeline; Tank Farm Transfer Line V051	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-153-PL	200-E-153-PL; Direct Buried Transfer Line from 241-C-151 to 244-AR-TK-002; Tank Farm Pipeline; Tank Farm Transfer Line V108/812	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-154-PL	200-E-154-PL; Direct Buried Transfer Line from 241-C-151 to 241-AX-01A; Tank Farm Pipeline; Tank Farm Transfer Line V113	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-158-PL	200-E-158-PL; 216-A-1 Pipeline; Pipeline from Sample Pit #3 to 216-A-1 Crib	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-164-PL	200-E-164-PL; Pipeline Between the 216-A-8 Control Structure and the 216-A-508 Control Structure; Pipeline to 216-A-8 Crib	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	

Note that only those waste sites with a WIDS (Waste Information Data System) Classification of "Accepted" are shown, along with non-duplicate facilities, identified via the Hanford Geographic Information System (HGIS).

Hanford Site-Wide Risk Review
CP-TF-5 (A-AX Tank Farms)
Waste Site and Facility List

Site Code	Name, Aliases, Description	Site Status	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation
200-E-165-PL	200-E-165-PL; Pipeline to 216-A-24 Crib	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-166-PL	200-E-166-PL; Pipeline to 216-A-34 Ditch	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-167-PL	200-E-167-PL; Lines SN-215 and SN-216; Underground Pipelines from 244-A Lift Station to 241-A-A and 241-A-B Valve Pits	Inactive	Encased Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-182-PL	200-E-182-PL; 216-A-7 Crib Pipeline	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-187-PL	200-E-187-PL; Chemical Sewer from 202-A to 216-A-29 Ditch; Lines 8819, 5802 and 5701; PUREX Chemical Sewer (CSL)	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-200-PL	200-E-200-PL; Lines 801, 802, 806 and 805; Pipelines from 244-AR Vault to 241-AY-152 and 241-A-153 Diversion Boxes	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	WMA A/AX	
200-E-206-PL	200-E-206-PL; Double Pipes from 244-AR Vault to 241-AR-151 Diversion Box; Lines V716, V717 and V718/817	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-207-PL	200-E-207-PL; Encased Transfer Line from 241-A-151 Diversion Box to 241-A-152 Diversion Box; Lines V004, V005, V006, V007 and V008	Inactive	Encased Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-210-PL	200-E-210-PL; Encased Lines Between 241-AW Tank Farm and 242-A Evaporator Building; Lines SL-167, SL-168, SN-219, SN-220, SN-269 and SN-270	Active	Encased Tank Farm Pipeline	Pipeline and associated valves, etc.	Not Applic	
200-E-211-PL	200-E-211-PL; Lines DR334, DR335 and DR343; Transfer Lines from 241-AW to 242-A Evaporator Building	Active	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	Not Applic	
200-E-225-PL	200-E-225-PL; Line V720; Transfer Line from 241-AR-151 Diversion Box to 241-AY-102 Tank	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-227-PL	200-E-227-PL; Lines 4005/810, 4015/814 and 4019/817; Transfer Lines Between 244-AR Vault Facility and 241-AX-151 Diversion Box	Inactive	Encased Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-229-PL	200-E-229-PL; Line SN-650; Transfer Line Between tank 241-AP-102 and 241-A-B Valve Pit	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-232-PL	200-E-232-PL; Pipeline from 207-A Basins to 216-A-30 and 216-A-37-1 Cribs	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-234-PL	200-E-234-PL; Lines 300, 501, 505, and 557; Pipelines from 242-A Evaporator Building to the 207-A Basins	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-235-PL	200-E-235-PL; 207-A North Basin Distribution Lines; Lines 501,502, 503, 504, 506, and 507	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	Not Applic	
200-E-236-PL	200-E-236-PL; 207-A South Basin Distribution Lines; Lines 557, 558, 559, 560, 562, and 563	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	Not Applic	
200-E-237-PL	200-E-237-PL; 2904-E-24; Line 2904-E-1; Pipeline to 200 East Powerhouse Ditch and Pipeline from Powerhouse Ditch to 216-B-3 Ditches	Active	Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-238-PL	200-E-238-PL; Pipeline from 206-A to 216-A-9 Crib	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-27	200-E-27; 242-AC; 242AC Pipefitter Shop Lead Cutting Area	Inactive	Dumping Area	Burial Ground	TBD	
200-E-274-PL	200-E-274-PL; Line 323; Pipeline from 244-A Lift Station to 216-A-40 Basin	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-275-PL	200-E-275-PL; Cooling Water Pipeline to 216-A-40 Basin; Line 815	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	

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Hanford Site-Wide Risk Review
CP-TF-5 (A-AX Tank Farms)
Waste Site and Facility List

Site Code	Name, Aliases, Description	Site Status	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation
200-E-276-PL	200-E-276-PL; 216-A-41 Crib Pipeline	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-282-PL	200-E-282-PL; Lines 4001, 4002, 4003 and 4004; Process Waste Lines from 202-A to 241-AX-151 Diversion Box	Inactive	Encased Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-283-PL	200-E-283-PL; Line 395; Pipeline from 242-A Bldg to 600-291-PL (TEDF Line)	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-285	200-E-285; 216-A-8 Control Structure; 216-A-8 Sample Pit; Sample Pit #2	Inactive	Control Structure	Pipeline and associated valves, etc.	TBD	
200-E-286	200-E-286; A Swamp; A-Swamp and Ditch; Original 200 East Area Powerhouse Effluent Pond; Powerhouse Swamp	Inactive	Pond	Pond/Ditch - Subsurface Liquid Disposal Site	Not Applic	
200-E-287	200-E-287; Posted Contamination Areas on Pipe Berm east of 241-A, AN, AX, AY and AZ Tank Farms	Unknown	Contamination Migration	Unplanned Release - Surface/Near Surface	TBD	
200-E-288-PL	200-E-288-PL; PC-5000; Pipeline from 242-A Evaporator to Liquid Effluent Retention Facility	Active	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-291-PL	200-E-291-PL; Pipeline from 241-C-106 to 241-AY-102, SN-200, SL-100, 241-C-106 Sluice line	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
204-AR	204-AR; 204-AR Waste Unloading Station; 204-AR-TK-1	Active	Loading Dock	Infrastructure Building	Not Applic	X
207-A-NORTH	207-A-NORTH; 207-A-NORTH Retention Basin; 207-A; 207-A North; 207-A Retention Basin	Inactive	Retention Basin	Crib - Subsurface Liquid Disposal Site	200-EA-1	
207-A-SOUTH	207-A-SOUTH; 207-A-SOUTH Retention Basin and Pump Pit; 207-A; 207-A Retention Basin; 207-A South	Inactive	Retention Basin	Crib - Subsurface Liquid Disposal Site	Not Applic	
216-A-1	216-A-1; 216-A-1 Cavern; 216-A-1 Trench	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	200-EA-1	
216-A-16	216-A-16; 216-A-16 Dry Well	Inactive	French Drain	Crib - Subsurface Liquid Disposal Site	WMA A/AX	
216-A-17	216-A-17; 216-A-17 Dry Well	Inactive	French Drain	Crib - Subsurface Liquid Disposal Site	WMA A/AX	
216-A-18	216-A-18; 216-A-18 Crib; 216-A-18 Excavation; 216-A-18 Grave; 216-A-18 Sump	Inactive	Trench	Crib - Subsurface Liquid Disposal Site	200-EA-1	
216-A-19	216-A-19; 216-A-19 Crib; 216-A-19 Grave; 216-A-19 Sump; 216-A-19 Test Hole	Inactive	Trench	Crib - Subsurface Liquid Disposal Site	200-EA-1	
216-A-20	216-A-20; 216-A-20 Crib; 216-A-20 Grave; 216-A-20 Sump; 216-A-20 Test Hole	Inactive	Trench	Crib - Subsurface Liquid Disposal Site	200-EA-1	
216-A-23A	216-A-23A; 216-A-23-A French Drain	Inactive	French Drain	Crib - Subsurface Liquid Disposal Site	WMA A/AX	
216-A-23B	216-A-23B; 216-A-23-B French Drain	Inactive	French Drain	Crib - Subsurface Liquid Disposal Site	WMA A/AX	
216-A-24	216-A-24; 216-A-24 Crib	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	200-PW-3	
216-A-34	216-A-34; 216-A-34 Crib; 216-A-34 Ditch	Inactive	Ditch	Crib - Subsurface Liquid Disposal Site	200-EA-1	
216-A-40	216-A-40; 216-A-40 Retention Basin; 216-A-39 Crib; 216-A-39 Trench	Inactive	Retention Basin	Crib - Subsurface Liquid Disposal Site	200-EA-1	
216-A-41	216-A-41; 216-A-41 Crib; 291-AR Stack Drain; 296-A-13 Stack Drain	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	200-EA-1	
216-A-508	216-A-508; 216-A-8 Distribution Box; Control Structure for 216-A-8 Crib	Inactive	Control Structure	Crib - Subsurface Liquid Disposal Site	200-IS-1	
216-A-524	216-A-524; 216-A-524 Control Structure; 216-A 524 Weir; 216-A-24 Control Structure	Inactive	Control Structure	Crib - Subsurface Liquid Disposal Site	200-IS-1	
216-A-7	216-A-7; 216-A-7 Cavern	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	200-PW-3	
216-A-8	216-A-8; 216-A-8 Crib and Overflow Pond	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	200-PW-3	
216-A-9	216-A-9; 216-A-9 Crib	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	200-EA-1	

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Hanford Site-Wide Risk Review
CP-TF-5 (A-AX Tank Farms)
Waste Site and Facility List

Site Code	Name, Aliases, Description	Site Status	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation
241-A-101	241-A-101; 241-A-TK-101	Inactive	Single-Shell Tank	Underground Storage Tank	WMA A/AX	
241-A-102	241-A-102; 241-A-TK-102	Inactive	Single-Shell Tank	Underground Storage Tank	WMA A/AX	
241-A-103	241-A-103; 241-A-TK-103	Inactive	Single-Shell Tank	Underground Storage Tank	WMA A/AX	
241-A-104	241-A-104; 241-A-TK-104	Inactive	Single-Shell Tank	Underground Storage Tank	WMA A/AX	
241-A-105	241-A-105; 241-A-TK-105	Inactive	Single-Shell Tank	Underground Storage Tank	WMA A/AX	
241-A-106	241-A-106; 241-A-TK-106	Inactive	Single-Shell Tank	Underground Storage Tank	WMA A/AX	
241-A-152	241-A-152; 241-A-152 Diversion Box	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA A/AX	
241-A-153	241-A-153; 241-A-153 Diversion Box; 241-A-153 Transfer Station	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA A/AX	
241-A-302B	241-A-302B; 241-A-302-B Catch Tank; IMUST; Inactive Miscellaneous Underground Storage Tank; V062	Inactive	Catch Tank	Underground Storage Tank	200-IS-1	
241-A-350	241-A-350; 241-A-350 Catch Tank; 241-A-350 Drainage Lift Station	Inactive	Catch Tank	Underground Storage Tank	WMA A/AX	
241-A-417	241-A-417; 241-A-417 Condensate Tank	Inactive	Catch Tank	Underground Storage Tank	WMA A/AX	
241-A-431	241-A-431; 241-A-431 Tank Farm Ventilation Building; 241-A-431 Ventilation Building	Inactive	Process Unit/Plant	Process Building	WMA A/AX	
241-A-702-WS-1	241-A-702-WS-1; 702-A Drain Lines	Inactive	French Drain	Crib - Subsurface Liquid Disposal Site	WMA A/AX	
241-A-A	241-A-A; 241-A-A Diversion Box; 241-A-A Structural Valve Pit	Inactive	Valve Pit	Pipeline and associated valves, etc.	WMA A/AX	
241-A-B	241-A-B; 241-A-B Diversion Box; 241-A-B Structural Valve Pit	Inactive	Valve Pit	Pipeline and associated valves, etc.	WMA A/AX	
241-AR-151	241-AR-151; 241-AR-151 Diversion Box	Inactive	Diversion Box	Pipeline and associated valves, etc.	TBD	
241-AX-101	241-AX-101; 241-AX-TK-101	Inactive	Single-Shell Tank	Underground Storage Tank	WMA A/AX	
241-AX-102	241-AX-102; 241-AX-TK-102	Inactive	Single-Shell Tank	Underground Storage Tank	WMA A/AX	
241-AX-103	241-AX-103; 241-AX-TK-103	Inactive	Single-Shell Tank	Underground Storage Tank	WMA A/AX	
241-AX-104	241-AX-104; 241-AX-TK-104	Inactive	Single-Shell Tank	Underground Storage Tank	WMA A/AX	
241-AX-151	241-AX-151; 241-AX-151 Diversion Box; 241-AX-151 Diverter Station; IMUST; Inactive Miscellaneous Underground Storage Tank	Inactive	Diversion Box	Pipeline and associated valves, etc.	Not Applic	
241-AX-152CT	241-AX-152CT; 241-AX-152-CT Catch Tank	Inactive	Catch Tank	Underground Storage Tank	Not Applic	
241-AX-152DS	241-AX-152DS; 241-AX-152-DS Diverter Station; Line V713; 241-AX-152 Diverter Station	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA A/AX	
241-AX-155	241-AX-155; 241-AX-155 Diversion Box; Line V713	Inactive	Diversion Box	Pipeline and associated valves, etc.	Not Applic	
241-AX-501	241-AX-501; 241-AX-501 Condensate Valve Pit; 241-AX-501 Valve Pit	Inactive	Valve Pit	Pipeline and associated valves, etc.	WMA A/AX	
241-AX-A	241-AX-A; 241-AX-A Diversion Box; 241-AX-A Structural Valve Pit; 241-AX-A Valve Pit	Inactive	Valve Pit	Pipeline and associated valves, etc.	WMA A/AX	
241-AX-B	241-AX-B; 241-AX-B Diversion Box; 241-AX-B Structural Valve Pit; 241-AX-B Valve Pit	Inactive	Valve Pit	Pipeline and associated valves, etc.	WMA A/AX	
241-AY-151	241-AY-151; 241-AY-151 Diversion Box; 241-AY-151 Pump Out Pit	Inactive	Diversion Box	Pipeline and associated valves, etc.	Not Applic	
241-AY-152	241-AY-152; 241-AY-152 Diverter Station; 241-AY-152 Sluice Transfer Box; Line DR0074	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA A/AX	
241-ER-153	241-ER-153; 241-ER-153 Diversion Box	Inactive	Diversion Box	Pipeline and associated valves, etc.	TBD	
244-A CT	244-A CT; 244-A DCRT; 244-A Receiver Tank; 244-A RT; 244-A-TK/SMP; 244-A Catch Tank	Inactive	Catch Tank	Underground Storage Tank	TBD	

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Hanford Site-Wide Risk Review
CP-TF-5 (A-AX Tank Farms)
Waste Site and Facility List

Site Code	Name, Aliases, Description	Site Status	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation
244-A LS	244-A LS; 244-AR Lift Station; 244-AR LS; SN-232, SN-233 and SN-234; 244-A Lift Station	Inactive	Control Structure	Process Building	TBD	
244-AR VAULT	244-AR Vault; 244-AR VAULT	Inactive	Receiving Vault	Process Building	TBD	
2607-E12	2607-E12; 2607-E12 Septic System	Active	Septic Tank	Septic System	200-EA-1	X
2607-E13	2607-E13; Septic Holding Tank South of 277-A	Active	Septic Tank	Septic System	TBD	X
2607-EA	2607-EA; 2607-EA Septic Tank and Drywell	Inactive	Septic Tank	Septic System	200-EA-1	X
2607-EC	2607-EC	Inactive	Septic Tank	Septic System	WMA A/AX	X
2607-ED	2607-ED	Inactive	Septic Tank	Septic System	WMA A/AX	X
2607-ES	2607-ES; Septic Tank and Dry Well North of 204-AR	Active	Septic Tank	Septic System	TBD	X
296-A-13	296-A-13; 291-AR Filter Building Stack	Inactive	Stack	Process Building	Not Applic	
600-269-PL	600-269-PL; Cross Site Transfer Line Replacement; Lines SNL-3150 and 3160; New Cross-Site Transfer Line	Active	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	Not Applic	
600-291-PL	600-291-PL; TEDF Line; 200 Area Treated Effluent Disposal Facility Pipeline	Active	Process Sewer	Pipeline and associated valves, etc.	Not Applic	
UPR-200-E-10	UPR-200-E-10; Contaminated Purex Railroad Spur; UN-200-E-10	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	200-EA-1	
UPR-200-E-100	UPR-200-E-100; Radioactive Contamination Near 244-A Lift Station; UN-200-E-100; UN-216-E-100; UN-216-E-29	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	TBD	
UPR-200-E-11	UPR-200-E-11; Railroad Track Contamination Spread; UN-200-E-11	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	200-OA-1	
UPR-200-E-115	UPR-200-E-115; Contamination Spread Inside 241-AX; UN-200-E-115	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-E-119	UPR-200-E-119; Contamination Spread Inside 241-AX; UN-200-E-119	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-E-12	UPR-200-E-12; Contaminated Purex Railroad Spur; UN-200-E-12	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	200-EA-1	
UPR-200-E-125	UPR-200-E-125; 241-A-104 Release; UN-200-E-125	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-E-126	UPR-200-E-126; 241-A-105 Tank Leak; UN-200-E-126	Inactive	Unplanned Release	Unplanned Release - Subsurface	Not Applic	
UPR-200-E-143	UPR-200-E-143; Contamination Adjacent to 244-A Lift Station; UN-216-E-43	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	200-EA-1	
UPR-200-E-145	UPR-200-E-145; VCP Pipeline Leak; W049H Green Soil	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	200-IS-1	
UPR-200-E-18	UPR-200-E-18; Contamination Release at the 216-A-8 Sampler Pit; UN-200-E-18	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	TBD	
UPR-200-E-20	UPR-200-E-20; Contaminated Purex Railroad Spur; UN-200-E-20	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	200-EA-1	
UPR-200-E-33	UPR-200-E-33; Contaminated Purex Railroad Tracks; UN-200-E-33	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	200-EA-1	
UPR-200-E-42	UPR-200-E-42; 241-AX-151 Release; UN-200-E-42	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	200-IS-1	
UPR-200-E-47	UPR-200-E-47; Contamination Spread from 241-A Tank Farm; UN-200-E-47	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-E-48	UPR-200-E-48; 241-A-106 Pump Pit Release; UN-200-E-48	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-E-56	UPR-200-E-56; 216-A-24 Crib Excavation; Excavated Contamination Adjacent to 216-A-24 Crib; UN-200-E-56; UN-216-E-33	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	200-PW-3	

Note that only those waste sites with a WIDS (Waste Information Data System) Classification of "Accepted" are shown, along with non-duplicate facilities, identified via the Hanford Geographic Information System (HGIS).

Hanford Site-Wide Risk Review
CP-TF-5 (A-AX Tank Farms)
Waste Site and Facility List

Site Code	Name, Aliases, Description	Site Status	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation
UPR-200-E-59	UPR-200-E-59; Contaminated Bird Nests and Mud at 216-A-40 and 244-AR Vault; UN-200-E-59	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-E-67	UPR-200-E-67; Excavation of Radioactively Contaminated Pipe Encasement (V004, V005, V006, V007,V008); UN-200-E-67; UN-216-E-67	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	200-IS-1	
UPR-200-E-93	UPR-200-E-93; UN-216-E-21 Ground Contamination Along 200 East Area fence	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-E-99	UPR-200-E-99; Contamination Adjacent to 244-CR Vault; UN-200-E-99; UN-216-E-27	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	TBD	
2237	PIPEFITTERS SHOP	ACTIVE	STRUCTURE	Infrastructure Building		X
2258	DEMO'D -- STORAGE BLDG BEHIND A-FARM COMPOUND	DEMO"D	STRUCTURE	Infrastructure Building		X
241A152	DIVERSION BOX AT A TANK FARM	INACTIVE	STRUCTURE	Pipeline and associated valves, etc.		
241A153	TRANSFER BOX AT A TANK FARM	INACTIVE	STRUCTURE	Pipeline and associated valves, etc.		
241A271	INSTRUMENT CONTROL HOUSE FOR (A) FARM	ACTIVE	BUILDING	Infrastructure Building		X
241A401	TANK FARM CONDENSER FACILITY	ACTIVE	BUILDING	Process Building		
241A417	CONDENSATATE RECEIVER AND PUMP PIT	INACTIVE	STRUCTURE	Pipeline and associated valves, etc.		
241A431	TANK FARM VENTILATION HOUSE, STANDBY	INACTIVE	BUILDING	Process Building		
241A501	CONDENSATE VALVE PIT	ACTIVE	STRUCTURE	Pipeline and associated valves, etc.		
241A701	TANK FARM COMPRESSOR HOUSE	ACTIVE	BUILDING	Process Building		
241A702	TANK FARM FAN HOUSE	ACTIVE	BUILDING	Process Building		
241AA	DIVERSION BOX AT A TANK FARM	INACTIVE	STRUCTURE	Pipeline and associated valves, etc.		
241AR151	DIVERSION BOX N OF 244AR	INACTIVE	STRUCTURE	Pipeline and associated valves, etc.		
241AX801A	TANK FARM CONTROL HOUSE NORTH	ACTIVE	BUILDING	Infrastructure Building		X
241AX801B	TANK FARM CONTROL HOUSE SOUTH	ACTIVE	BUILDING	Infrastructure Building		X
241AX801C	TANK FARM DIVERSION HOUSE, SOUTH OF A FARM	ACTIVE	BUILDING	Infrastructure Building		X
241AY151	PUMP OUT PIT	INACTIVE	STRUCTURE	Pipeline and associated valves, etc.		
241AY152	SLUICE TRANSFER BOXES	ACTIVE	STRUCTURE	Pipeline and associated valves, etc.		
241ER153	DIVERSION BOX	INACTIVE	STRUCTURE	Pipeline and associated valves, etc.		
242A-BA	242A BOILER ANNEX	ACTIVE	BUILDING	Infrastructure Building		X
242AC	CRAFT SHOP	ACTIVE	BUILDING	Infrastructure Building		X
243G82	GROUT PROCESSING FAC. PRESSURE REDUCING VALVE PIT	INACTIVE	STRUCTURE	Pipeline and associated valves, etc.		
244A	WASTE VAULT AND INSTRUMENT HOUSE	ACTIVE	BUILDING	Infrastructure Building		X
244AR40	COOLING WATER DIVERSION BOX	INACTIVE	STRUCTURE	Pipeline and associated valves, etc.		
244AR701	ENERGENCY GENERATOR BUILDING	ACTIVE	BUILDING	Infrastructure Building		X
244AR702	500 KW STANDBY GENERATOR ENCLOSURE	INACTIVE	STRUCTURE	Infrastructure Building		X
244AR712	VAULT AIR LOCK AND LOAD OUT BUILDING	ACTIVE	BUILDING	Infrastructure Building		X
244AR715	COMPRESSOR BUILDING	ACTIVE	BUILDING	Infrastructure Building		X
244AR716	SOUTH COMPRESSOR BLDG WEST OF 244AR	ACTIVE	BUILDING	Infrastructure Building		X
244AR717	NORTH COMPRESSOR BLDG NW OF 244AR	ACTIVE	BUILDING	Infrastructure Building		X
2707AR	SLUDGE VAULT CHANGE HOUSE	ACTIVE	BUILDING	Infrastructure Building		X
2707AX	CHANGE HOUSE AX FARM	INACTIVE	BUILDING	Infrastructure Building		X

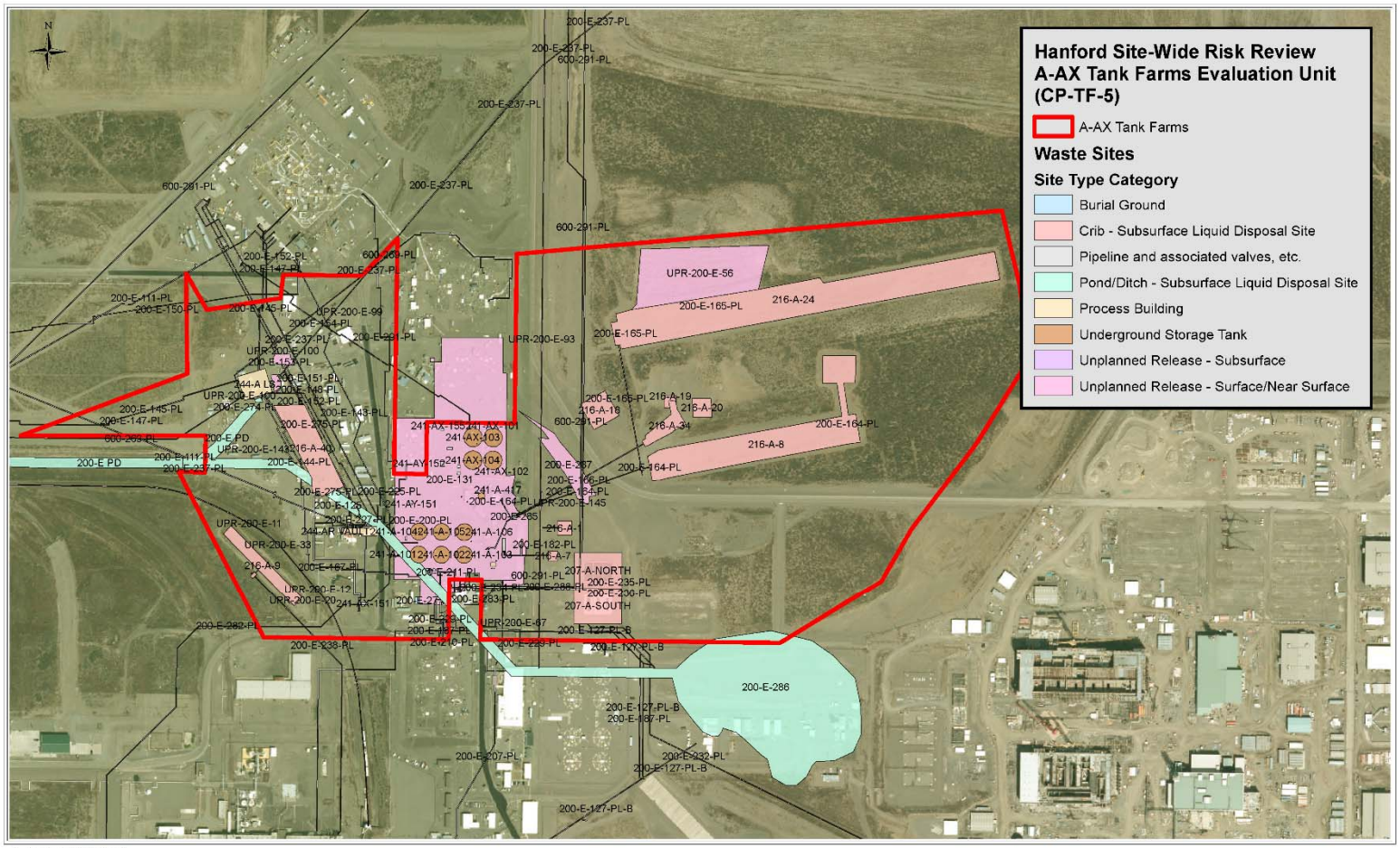
Note that only those waste sites with a WIDS (Waste Information Data System) Classification of "Accepted" are shown, along with non-duplicate facilities, identified via the Hanford Geographic Information System (HGIS).

Hanford Site-Wide Risk Review
CP-TF-5 (A-AX Tank Farms)
Waste Site and Facility List

Site Code	Name, Aliases, Description	Site Status	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation
2724A	RAD MONITORING AND PROTECTIVE CLOTHING BLDG	INACTIVE	BUILDING	Infrastructure Building		X
2724AB	RAD MONITORING AND PROTECTIVE CLOTHING BLDG	INACTIVE	BUILDING	Infrastructure Building		X
2724AY	RAD MONITORING AND PROTECTIVE CLOTHING BLDG	INACTIVE	BUILDING	Infrastructure Building		X
2766	CONSTRUCTION LABORER SHOP WEST OF 244AR	ACTIVE	BUILDING	Infrastructure Building		X
2767	CONSTRUCTION CARPENTER SHOP	ACTIVE	BUILDING	Infrastructure Building		X
277A	CONSTRUCTION FAB SHOP - WEST OF 241AZ TANK FARM	ACTIVE	BUILDING	Infrastructure Building		X
2904AR	COOLING WATER SAMPLER MONITORING SYSTEM	ACTIVE	STRUCTURE	Infrastructure Building		X
291AR	EXHAUST AIR FILTER STACK BUILDING	INACTIVE	BUILDING	Process Building		
292AR	FILTER CONTAINMENT VAULT AND INSTRUMENT HOUSE	ACTIVE	STRUCTURE	Process Building		
CC2E0101	CARGO CONTAINER AT A TANK FARM	ACTIVE	STRUCTURE	Infrastructure Building		X
CC2E0102	CARGO CONTAINER AT -A- TANK FARM	ACTIVE	STRUCTURE	Infrastructure Building		X
CC2E0110	CARGO CONTAINER AT -A- TANK FARM	ACTIVE	STRUCTURE	Infrastructure Building		X
CC2E0111	CARGO CONTAINER AT -A- TANK FARM	ACTIVE	STRUCTURE	Infrastructure Building		X
MO272	CONSTRUCTION CRAFT LUNCHROOM SOUTH OF 277A	ACTIVE	BUILDING	Infrastructure Building		X
MO377	MOBILE OFFICE AT A TANK FARM	INACTIVE	BUILDING	Infrastructure Building		X
MO421	FIELD TRAILER AT 277A	ACTIVE	BUILDING	Infrastructure Building		X
MO503	MOBILE OFFICE AT A FARM	ACTIVE	BUILDING	Infrastructure Building		X
MO513	HPT/CHANGE TRAILER AT 241AY TANK FARM	ACTIVE	BUILDING	Infrastructure Building		X
MO527	RESTROOM TRAILER NORTH OF MO919	ACTIVE	BUILDING	Infrastructure Building		X
MO528	RESTROOM TRAILER NORTH OF MO919	ACTIVE	BUILDING	Infrastructure Building		X
MO564	CONSTRUTION OFFICE TRAILER NORTH OF 244AR	ACTIVE	BUILDING	Infrastructure Building		X
MO565	CONSTRUCTION OFFICE TRAILER NORTH OF 244AR	ACTIVE	BUILDING	Infrastructure Building		X
MO575	MOBILE OFFICE OFF OF BUFFALO WEST SIDE OF AY TANK	ACTIVE	BUILDING	Infrastructure Building		X
MO596	241C TANK FARM MOBILE OFFICE	ACTIVE	BUILDING	Infrastructure Building		X
MO597	241C TANK FARM MOBILE OFFICE	ACTIVE	BUILDING	Infrastructure Building		X
MO598	241C TANK FARM MOBILE OFFICE	ACTIVE	BUILDING	Infrastructure Building		X
MO599	241C TANK FARM MOBILE OFFICE	ACTIVE	BUILDING	Infrastructure Building		X
MO637	CONSTRUCTION MOBILE OFFICE BY 242AC SHOP	ACTIVE	BUILDING	Infrastructure Building		X
MO639	FIELD MOBILE RESTROOM AT BUFFALO AVE	ACTIVE	BUILDING	Infrastructure Building		X
MO816	CHANGE TRAILER AT 244A TANK FARM	ACTIVE	BUILDING	Infrastructure Building		X
MO890	MOBILE OFFICE SW OF 2237E	ACTIVE	BUILDING	Infrastructure Building		X
MO919	MOBILE OFFICE WEST OF 241AY EVAP SUPP	ACTIVE	BUILDING	Infrastructure Building		X
MO979	MOBILE OFFICE WEST OF 277A AT A FARM	ACTIVE	BUILDING	Infrastructure Building		X

Note that only those waste sites with a WIDS (Waste Information Data System) Classification of "Accepted" are shown, along with non-duplicate facilities, identified via the Hanford Geographic Information System (HGIS).

DRAFT



1 inch = 600 feet

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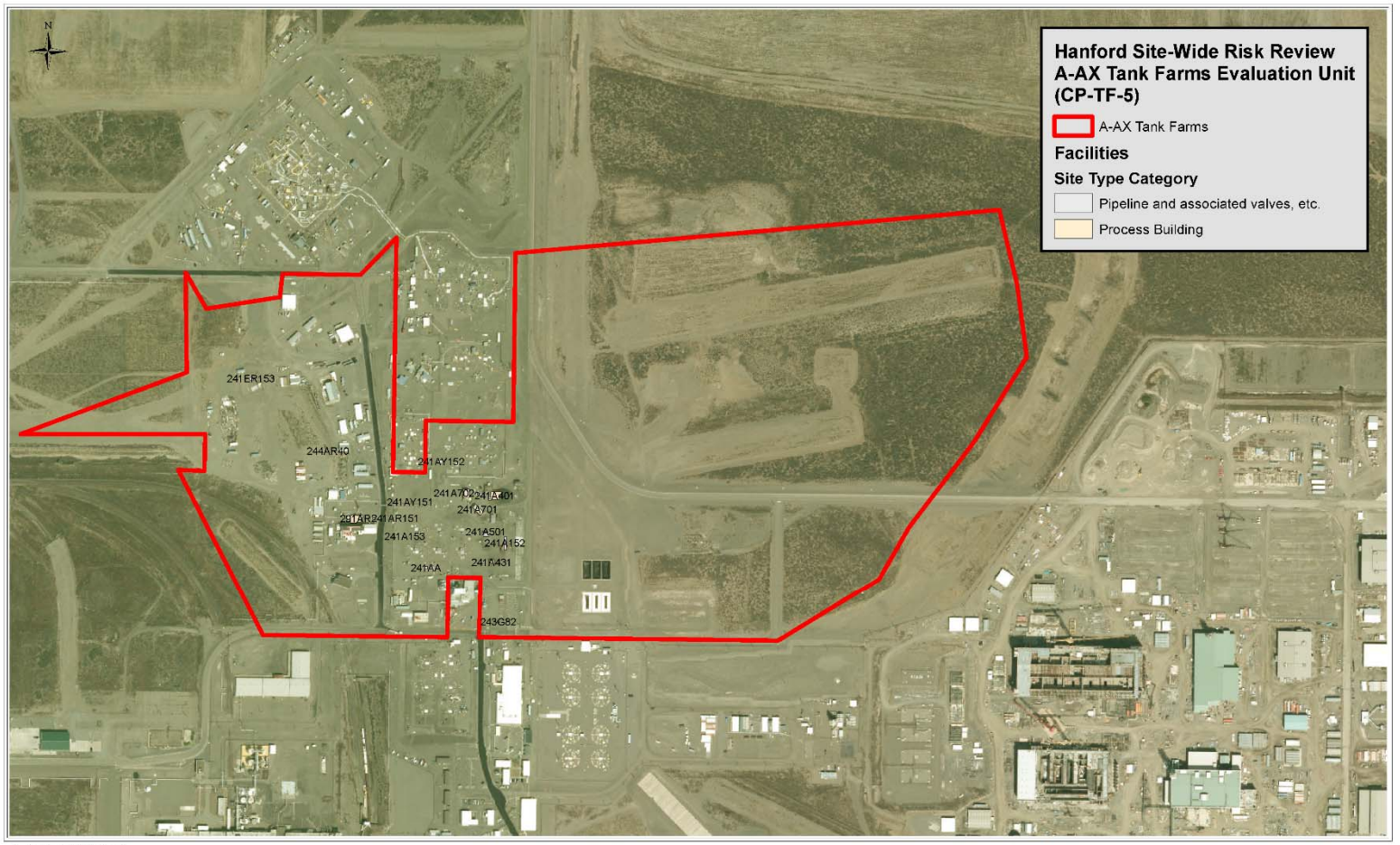

1 inch = 600 feet

APPENDIX E.7

Tank Waste and Farms

CP-TF-6 (B-BX-BY Tank Waste and Farms)
Evaluation Unit Summary Template

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PART E.7. CP-TF-6 B-BX-BY SINGLE-SHELL TANK WASTE AND FARMS (200-E)

E.7.1. EXECUTIVE SUMMARY

Much of the information related to the B-BX-BY Tank and Waste Farms Evaluation Unit (EU) is organized around the corresponding Waste Management Area (namely WMA B-BX-BY) that is regulated under the Resource Conservation and Recovery Act (RCRA) and Washington's Hazardous Waste Management Act (HWMA, RCW 70.105) and it's implementing requirements (Washington's Dangerous Waste Regulations, WAC 173-303) (PNNL-13022).

EU LOCATION:

North-Central part of 200-East on the Hanford Reservation; Central Plateau

RELATED EUS:

T Tank Waste and Farms (CP-TF-1), S-SX Tank Waste and Farms (CP-TF-2), TX-TY Tank Waste and Farms (CP-TF-3), U Tank Waste and Farms (CP-TF-4), A-AX Tank Waste and Farms (CP-TF-5), C Tank Waste and Farms (CP-TF-7), 200-East DST Waste and Farms (CP-TF-8), 200-West DST Waste and Farms (CP-TF-9), 200-E Groundwater Plumes (CP-GW-1), 200-W Groundwater Plumes (CP-GW-1), and 200 Area Waste Transfer Pipeline (CP-LS-7)

PRIMARY CONTAMINANTS, CONTAMINATED MEDIA AND WASTES:

The TC&WM EIS describes tank wastes as including radioactive (tritium or H-3, C-14, Sr-90, Tc-99, I-129, Cs-137, U-233, U-234, U-235, U-238, Np-237, Pu-239, and Pu-240)[116] and non-radioactive contaminants (chromium, mercury, nitrate, lead, total uranium, and PCBs) of potential concern (DOE/EIS-0391 2012, Appendix D). The tank wastes contain saltcake, sludge, and supernatant phases. Contaminated media related to the B-BX-BY Tank Farms include ancillary equipment and surrounding vadose zone (including cribs and trenches) down to the saturated zone (for some mobile contaminants) from past and current discharges. The 2015 Groundwater Monitoring Report (DOE/RL-2016-9, Rev. 0) lists plumes for nitrate, I-129, Tc-99, total uranium, cyanide (CN), and tritium (H-3) associated with the B-BX-BY Tank and Waste Farms EU for the 200-BP groundwater interest area (GWIA) that is used to geographically represent contaminant migration from the 200-BP-5 OU for monitoring purposes; the current Sr-90 plume is not associated with the CP-TF-6 EU.

After evaluating the contaminants associated with B-BX-BY Tank Farm tanks, ancillary equipment, legacy sources, and contaminated vadose zone, the primary contaminants from the tank wastes that drive human health risk to groundwater associated with the B-BX-BY Tank Farms Evaluation Unit are: Tc-99, I-129, Sr-90, H-3, chromium, uranium, cyanide, and nitrate. Those primary contaminants that may drive risk from groundwater discharge to the Columbia River are nitrate and chromium; however, any potential impacts are highly uncertain (Section E.6.1). Cs-137 and Sr-90 are important from a safety standpoint and uranium isotopes, plutonium isotopes, and tritium are iconic constituents; these

[116] Other isotopes considered include U-232 and U-236 and Pu-238, Pu-241, and Pu-242 to be consistent with other EUs. These additional uranium and plutonium isotopes are included in the totals presented but are not used for rating because 1) uranium toxicity impacts (represented by total uranium drives corresponding risks and 2) plutonium has been found relatively immobile in the Hanford subsurface and has not been identified as a risk driver for groundwater impacts.

contaminants are included in the inventory summary even though they are not considered risk drivers for impacts to or from groundwater in this review. The Sr-90 plume that is not associated with the B-BX-BY Tank and Waste Farms EU is described in Appendix D.5 for the CP-GW-1 EU (200-BP GWIA).

BRIEF NARRATIVE DESCRIPTION

Waste Management Area B-BX-BY (WMA B-BX-BY) occupies approximately 20 acres (http://phoenix.pnnl.gov/apps/gw/phoenix.html) consisting of three Tank Farms, each with 12 underground single-shell tanks (SSTs) in additional to ancillary equipment (e.g., diversion boxes, pumps, valves, and pipes); the B Tank Farm also includes four smaller tanks. The tanks contain primarily salt cake from evaporator campaigns B and BY, metal waste from bismuth phosphate process, 1st / 2nd cycle decontamination from bismuth phosphate process, and lanthanum fluoride finishing waste (Remund et al. 1995). The tanks were taken out of service in 1980.

The B Tank Farm was constructed in 1943-44 (RPP-RPT-54913). The B Tank Farm includes 12 530-kgal underground waste storage tanks (B-101 through B-112) arranged in four rows of three tanks in a cascade and four smaller 55-kgal tanks. The tanks were designed for non-boiling wastes. Ten of the 16 tanks in the B Tank Farm are classified as “assumed leakers” (Templeton 2016).

The BX Tank Farm was constructed in 1946-47 to store high-level radioactive waste generated by chemical processing of irradiated uranium fuel at the chemical separation plants (RPP-RPT-47562). The BX Tank Farm contains 12 530-kgal tanks arranged in four rows of three tanks in a cascade. Five of the 12 BX Tank Farm tanks have been declared “assumed leakers” (Templeton 2016).

The BY Tank Farm was constructed in 1948-49 to store high-level radioactive waste generated from chemical processing of irradiated uranium fuel (RPP-RPT-43704). The BY Tank Farm contains 12 758-kgal underground waste storage tanks (BY-101 through BY-112) arranged in four rows of three tanks in a cascade. Five of the 12 BY Tank Farm tanks have been declared “assumed leakers” (Templeton 2016).

Twenty of the 40 SSTs in WMA B-BX-BY are classified as “assumed leakers”; leaks from these tanks total at least 119,500 gallons ranging from not estimated for nine tanks to 300 gallons (B-203 in 1973) to 15,100 gallons (BY-107 in 1984) to 70,000 gallons (BX-102 in 1971) (Templeton 2016, p. 21).

There are also various non-tank sources (e.g., cribs, trenches, tile fields and reverse wells) that received large volumes (7.2 to 36.8 Mgal) of contaminated waste and other waste streams resulting in extensive vadose zone and groundwater contamination in the areas around the WMA B-BX-BY (PNNL-13022).

The SSTs in WMA B-BX-BY have been interim stabilized (i.e., liquid transferred to DSTs to <50 kgal drainable interstitial liquid and <5 kgal of supernatant). The 200-BP GWIA is being monitored to determine the impact to groundwater prior to determining the path forward for remedial action, with a 200-BP-5 and 200-PO-1 Feasibility Study report and proposed plan(s) due in 2018 (Appendix D, Ecology et al., 1996 [Accessed 27 Feb 2017]). No date or milestone has been scheduled for the final Record of Decision (ROD).

SUMMARY TABLES OF RISKS AND POTENTIAL IMPACTS TO RECEPTORS

Table E.7-1 provides a summary of nuclear and industrial safety related consequences from the CP-TF-6 (B-BX-BY Tank and Waste Farms EU) to humans and impacts to important physical Hanford Site resources. Receptors are described in Section E.1.6 (Appendix E.1).

Table E.7-1. CP-TF-6 (B-BX-BY Tank Farms) impact Rating Summary for Human Health (unmitigated basis with mitigated basis provided in parentheses (e.g., "High (Low)").

Population or Resource		Evaluation Time Period[a] Active Cleanup (to 2064) **Current Condition:** Maintenance & Monitoring (M&M)	 **From Cleanup Actions:** Retrieval & Closure
Human Health	Facility Worker[b]	***M&M***: Low-High[d] (Low-High)[d] ***Soil***: Not Discernible (ND)-High (ND-Low)	***Preferred method***: High (Low) ***Alternative***: High (Low)
	Co-located Person[b]	***M&M***: Low-Moderate (Low) ***Soil***: ND (ND)	***Preferred method***: Low-Moderate (Low) ***Alternative***: Low-Moderate (Low)
	Public[b]	***M&M***: Low (Low) ***Soil***: ND (ND)	***Preferred method***: Low (Low) ***Alternative***: Low (Low)
Environmental	Groundwater (A&B) from vadose zone[c]	*High* -- Tc-99, Cr(tot), Cr-VI *Medium* -- I-129, U(tot)[h] *Low* -- C-14 *ND* -- Sr-90[f] **Overall**: *High*	*High* -- Tc-99, Cr(tot), Cr-VI *Medium* -- I-129, U(tot)[h] *Low* -- C-14 *ND* -- Sr-90[f] **Overall**: *High*
	Columbia River from vadose zone[c]	Benthic: *ND* (rad & chem) Riparian: *ND* (rad & chem) Free-flowing: *ND* (rad & chem) **Overall**: *ND*	Benthic: *ND* (rad & chem[g]) Riparian: *ND* (rad & chem[g]) Free-flowing: *ND* (rad & chem) **Overall**: *ND*
	Ecological Resources[e]	ND to Low	Low to Medium
Social	Cultural Resources[e]	**Native American:** Direct: Unknown Indirect: Known **Historic Pre-Hanford:** Direct: Known Indirect: Unknown **Manhattan/Cold War:** Direct: Known Indirect: Known	**Native American:** Direct: Unknown Indirect: Known **Historic Pre-Hanford:** Direct: Known Indirect: Unknown **Manhattan/Cold War:** Direct: Known Indirect: Known

a. A rating for cultural resources is 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.

b. Evaluated in Section E.1.6 (Appendix E.1).

c. Groundwater threat for Group A and B contaminants remaining in the vadose zone or to the Columbia River for all primary contaminants. Threats from existing plumes associated with the B-BX-BY Tank and Waste Farms EU are described in Section E.7.5 and Appendix D.5 (CP-GW-1) for the 200-BP Groundwater Interest Area (GWIA). Note: rad = radionuclides and chem = chemicals.

d. Industrial safety consequences range from low to high (based on the evaluation scale used) for both mitigated (with controls) and unmitigated (without controls). Mitigated radiological and toxicological consequences to facility workers are high (unmitigated) and low (mitigated).

e. 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.

f. The large amount of Sr-90 disposed of in the B-BX-BY Tank and Waste Farms EU would translate to a *Very High* rating; however, there is no current Sr-90 plume associated with B-BX-BY Tank and Waste Farms EU sources in the 200-BP GWIA. It would likely require more than 150 years for Sr-90 to reach groundwater in a sufficient amount to exceed the drinking water standard over an appreciable area (Section E.7.5). Sr-90 is given a *Not Discernible* (*ND*) rating for the Active Cleanup period and *Low* rating afterwards to account for uncertainties in the evaluation. Thus the Sr-90 is not considered a risk driver.

g. The information from Appendix P from the TC&WM EIS would suggest that hexavalent chromium would have *Medium* and *High* ratings for benthic and riparian zone impacts, respectively. However, current well data suggest that chromium is moving much more slowly than predicted in the TC&WM EIS evaluation resulting in *Not Discernible* ratings.

h. Unlike in other EUs, there is a total uranium plume associated with the B-BX-BY Tank and Waste Farms EU.

SUPPORT FOR RISK AND IMPACT RATINGS FOR EACH POPULATION OR RESOURCE

Human Health

The current and cleanup-related consequences related to work being conducted at the Tank Farms in the 200 Areas (Hanford Central Plateau) was evaluated in Section E.1.6 (Appendix E.1).

Groundwater, Vadose Zone, and Columbia River

Current

B-BX-BY Tank Farm contaminants are currently impacting the vadose zone and groundwater (where CP-TF-6 sources are suspected of being able to contribute mobile contaminants to groundwater (DOE/RL-92-19, Rev. 0)) and remedial actions have not included active treatment; thus there is no driver for concentrations to fall below thresholds before active cleanup commences. Secondary sources (e.g., total and hexavalent chromium) in the vadose also threaten to continue to impact groundwater in the future, including the Active Cleanup period. As described in the TC&WM EIS, there appeared to be large predicted impacts on peak concentrations in groundwater both during and after cleanup (but not the near-shore region of the Columbia River). However, despite these large, predicted impacts, the groundwater ratings for Tc-99, I-129, hexavalent chromium, and total uranium would not change. The Sr-90 will decay significantly during both the Active Cleanup and Near-term, Post-Cleanup periods, however, transport considerations results in *ND* ratings as described in Section E.7.5. Following a similar analysis, the uranium plume is also predicted to decrease significantly after emplacement of a surface barrier.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

See Section E.1.1.

Ecological Resources

Current
Little habitat in EU, but over 10% in buffer is level 3 resources. Effect ND in EU, but may be up to Low in buffer due to truck disturbance. Habitat is fragmented, which increases disturbance and increases exotic species and potentially changes in species composition of vegetation.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches
Effects due to increased disturbance and potential for contaminant release, increases in exotic species, and could lose some nesting habitat, trucks could run over lizards and other wildlife during cleanup.

Cultural Resources

Current
Manhattan Project/Cold War significant resources have already been mitigated. Area is very disturbed and there are no known recorded archaeological resources within the EU. EU has not been investigated for archaeological resources (surface or subsurface). Traditional cultural places are visible from EU.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches
Because area has not been investigated either on the surface or subsurface, archaeological investigations may need to occur within pockets of undisturbed land if any prior to remediation. Potential for intact archaeological material to be present is very low.

Considerations for Timing of the Cleanup Actions

See Section E.1.1 (Appendix E.1).

Near-Term, Post-Cleanup Risks and Potential Impacts

See Section E.1.1 (Appendix E.1).

E.7.2. ADMINISTRATIVE INFORMATION

OU AND/OR TSDF DESIGNATION(S):

The B-BX-BY Tank Farms Evaluation Unit (EU), denoted *CP-TF-6 – B-BX-BY Tank Farms*, consists of 20 waste tanks, ancillary structures, associated liquid waste sites, and soils contamination; much of this EU is contained within Waste Management Area B-BX-BY (WMA B-BX-BY). WMA B-BX-BY is regulated under the Resource Conservation and Recovery Act (RCRA) as modified in 40 CFR Part 265, Subpart F and Washington State's Hazardous Waste Management Act (HWMA, RCW 70.105 and its implementing requirements in the Washington State dangerous waste regulations [WAC 173-303-400]) (PNNL-13022).

COMMON NAME(S) FOR EU:

There is no common name for the B-BX-BY Tank and Waste Farms EU because the EU is comprised of elements from other waste management units including Waste Management Area B-BX-BY (WMA B-BX-BY) that includes the 241-B (or B) and 241-BX (or BX) and 241-BY (or BY) Tank Farms.

The B Tank Farm contains 16 waste tanks (B-101 through B-112 and B-201 through B-204); these tanks often are designated as 241-B-101 through 241-B-112 and 241-B-201 through 241-B-204. The BX Tank Farm contains 12 waste tanks (BX-101 through BX-112); these tanks often are designated as 241-BX-101 through 241-BX-112. The BY Tank Farm contains 12 waste tanks (BY-101 through BY-112); these tanks

often are designated as 241-BY-101 through 241-BY-112. Other components in the EU are listed below in the *Primary EU Source Components* section.

KEY WORDS:

B Tank Farm, BX Tank Farm, BY Tank Farm, 241-B Tank Farm, 241-BX Tank Farm, 241-BY Tank Farm, waste tanks, tank farm, Waste Management Area B-BX-BY, WMA B-BX-BY

REGULATORY STATUS

Regulatory Basis

DOE is the responsible agency for the closure of all single-shell tank (SST) waste management areas (WMAs) through post closure, in close coordination with other closure and cleanup activities of the Hanford Central Plateau. Washington State has a program that is authorized under RCRA and implemented through the HWMA and its associated regulations; Ecology is the lead regulatory agency responsible for the closure of the SST system. Please refer to Section E.1.2 (Appendix E.1) for more information.

Applicable Regulatory Documentation

The relationship among the tank waste retrieval work plans (TWRWP) and the overall single-shell tank (SST) waste retrieval and closure process is described in Appendix I of the Hanford Federal Facility Agreement and Consent Order (HFFACO), along with requirements for the content of TWRWPs. WMA A-AX was placed in assessment monitoring (40 CFR 265.93[d][4]) based on elevated specific conductance measurements (PNNL-15315, p. iii). A groundwater quality assessment plan was developed (PNNL-13022) describing the monitoring activities used in deciding whether WMA B-BX-BY has affected groundwater.

Applicable Consent Decree or TPA Milestones

Federal Facility Agreement and Consent Order, 1989 and amended through June 16, 2014: Milestone M-045-00; Lead Agency Ecology: *Complete the closure of all Single Shell Tank Farms by 01/31/2043*

RISK REVIEW EVALUATION INFORMATION

Completed: Revised August 25, 2015

Evaluated by: K. G. Brown

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

E.7.3. SUMMARY DESCRIPTION

CURRENT LAND USE

DOE Hanford Site for industrial use. All current land-use activities in the 200-East Area are *industrial* in nature (EPA 2012).

DESIGNATED FUTURE LAND USE

Industrial-Exclusive. All four land-use scenarios listed in the Comprehensive Land Use Plan (CLUP) indicate that the 200-West Area (of which the B-BX-BY Tank and Waste Farms EU is a part) is denoted

Industrial-Exclusive (DOE/EIS-0222-F). An industrial-exclusive area is "suitable and desirable for treatment, storage, and disposal of hazardous, dangerous, radioactive, and nonradioactive wastes" (DOE/EIS-0222-F).

PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

The legacy source sites associated with the B-BX-BY Tank and Waste Farms EU are described in Attachment Section E.7.8. Leaks from these tanks total at least 119,500 gallons, including 70,000 gallons from BX-102 and 15,100 gallons from BY-102. Nine of the tanks have unknown leak estimates (PNNL-13022; Templeton 2016). There are also non-tank sources (e.g., cribs, trenches, tile fields and reverse wells) that received large volumes (7.2 to 36.8 Mgal) of contaminated waste and other waste streams that has resulted in extensive vadose zone and groundwater contamination in the areas around the WMA B-BX-BY (PNNL-13022).

Waste Tanks and Ancillary Equipment

The waste tanks in the B-BX-BY Tank and Waste Farms EU are:

- (241-)B-101 (241-B-TK-101)
- (241-)B-102 (241-B-TK-102)
- (241-)B-103 (241-B-TK-103)
- (241-)B-104 (241-B-TK-104)
- (241-)B-105 (241-B-TK-105)
- (241-)B-106 (241-B-TK-106)
- (241-)B-107 (241-B-TK-107)
- (241-)B-108 (241-B-TK-108)
- (241-)B-109 (241-B-TK-109)
- (241-)B-110 (241-B-TK-110)
- (241-)B-111 (241-B-TK-111)
- (241-)B-112 (241-B-TK-112)
- (241-)B-201 (241-B-TK-201)
- (241-)B-202 (241-B-TK-202)
- (241-)B-203 (241-B-TK-203)
- (241-)B-204 (241-B-TK-204)
- (241-)BX-101 (241-BX-TK-101)
- (241-)BX-102 (241-BX-TK-102)
- (241-)BX-103 (241-BX-TK-103)
- (241-)BX-104 (241-BX-TK-104)
- (241-)BX-105 (241-BX-TK-105)
- (241-)BX-106 (241-BX-TK-106)
- (241-)BX-107 (241-BX-TK-107)
- (241-)BX-108 (241-BX-TK-108)
- (241-)BX-109 (241-BX-TK-109)
- (241-)BX-110 (241-BX-TK-110)
- (241-)BX-111 (241-BX-TK-111)
- (241-)BX-112 (241-BX-TK-112)
- (241-)BY-101 (241-BY-TK-101)
- (241-)BY-102 (241-BY-TK-102)
- (241-)BY-103 (241-BY-TK-103)
- (241-)BY-104 (241-BY-TK-104)
- (241-)BY-105 (241-BY-TK-105)
- (241-)BY-106 (241-BY-TK-106)
- (241-)BY-107 (241-BY-TK-107)
- (241-)BY-108 (241-BY-TK-108)
- (241-)BY-109 (241-BY-TK-109)
- (241-)BY-110 (241-BY-TK-110)
- (241-)BY-111 (241-BY-TK-111)
- (241-)BY-112 (241-BY-TK-112)

The ancillary equipment included in the B-BX-BY Tank and Waste Farms EU is listed in the Attachment in Section E.7.8 and primarily consists of pipelines, diversion boxes, and catch tanks.

Groundwater Plumes

The B-BX-BY Tank and Waste Farms EU is in the 200-BP groundwater interest area (GWIA). The current 200-BP plumes associated with B-BX-BY Tank and Waste Farms EU sources that exceed water quality

standards (in this case, drinking water standards) are nitrate, I-129[117], Tc-99, uranium, cyanide, and tritium (H-3) (DOE/RL-2016-09, Rev. 0). Legacy sites within the CP-TF-6 EU are suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-19, Rev. 0). The current Sr-90 plume in the 200-BP GWIA is not associated with this EU. The 200-BP GWIA is being monitored to determine the impact to groundwater prior to determining the path forward for remedial action, with a 200-BP-5 and 200-PO-1 Feasibility Study report and proposed plan(s) due in 2018 (Appendix D, Ecology et al., 1996 [Accessed 27 Feb 2017]). No date or milestone has been scheduled for the final Record of Decision (ROD).

See Appendix D.5 for the CP-GW-1 EU (200-BP GWIA) for additional details.

Operating Facilities: Because of the prohibition on waste additions to the Hanford SSTs,[118] the B-BX-BY Tank and Waste Farms EU components are not considered Operating Facilities for this review. See Section E.1.4 (Appendix E.1) for details.

D&D of Inactive Facilities: Not Applicable.

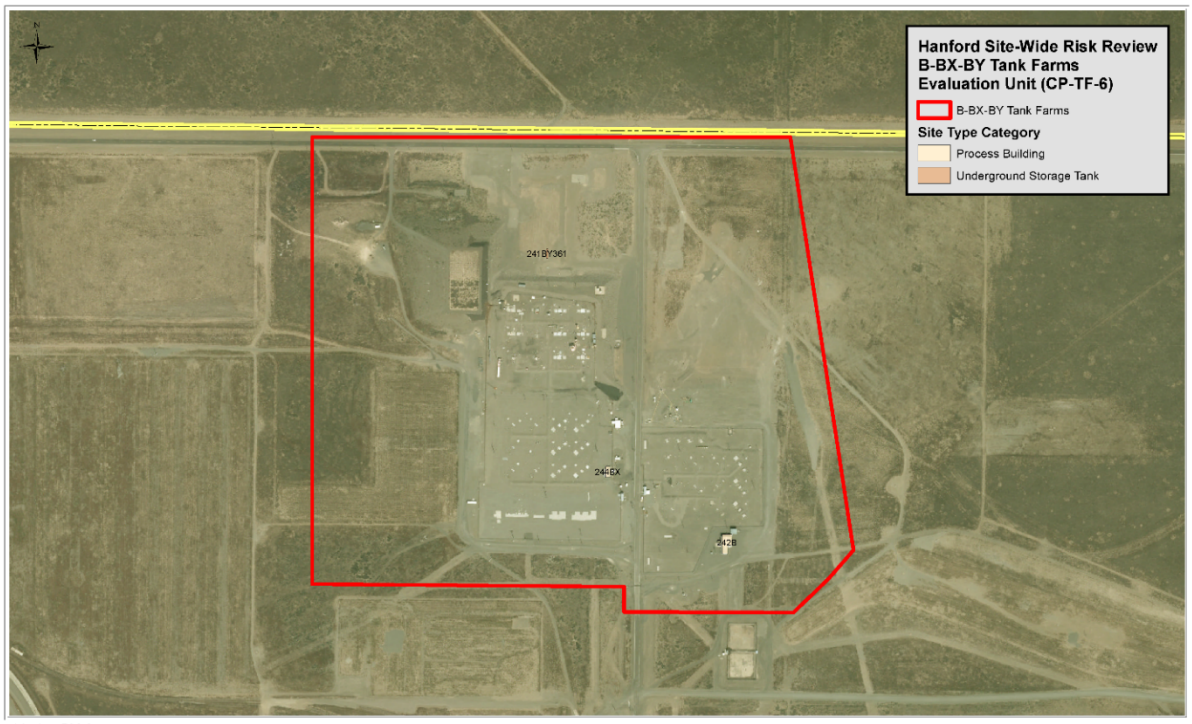
LOCATION AND LAYOUT MAPS

A series of maps are used to illustrate the location of the components within the CP-TF-6 EU and the B-BX-BY Tank and Waste Farms EU relative to the Hanford Site. Figure E.2-1 shows the relationship between the 200-E (200 East) Area (where the B-BX-BY Tank Farms and Waste Management Area B-BX-BY are located) and the Hanford Site. Figure E.7-1 illustrates the B-BX-BY Tank and Waste Farms EU boundary. Figure E.7-2 shows a detailed view of the waste tanks, ancillary equipment, and legacy source units in the B-BX-BY Tank and Waste Farms EU.

[117] The unplanned release 241-BX-102 is listed as a potential source for I-129 in the 200-BP-5 OU (DOE/RL-2014-32, Rev. 0).

[118] Berman presentation on July 29, 2009, titled “Hanford Single-Shell Tank Integrity Program.” Available at www.em.doe.gov.

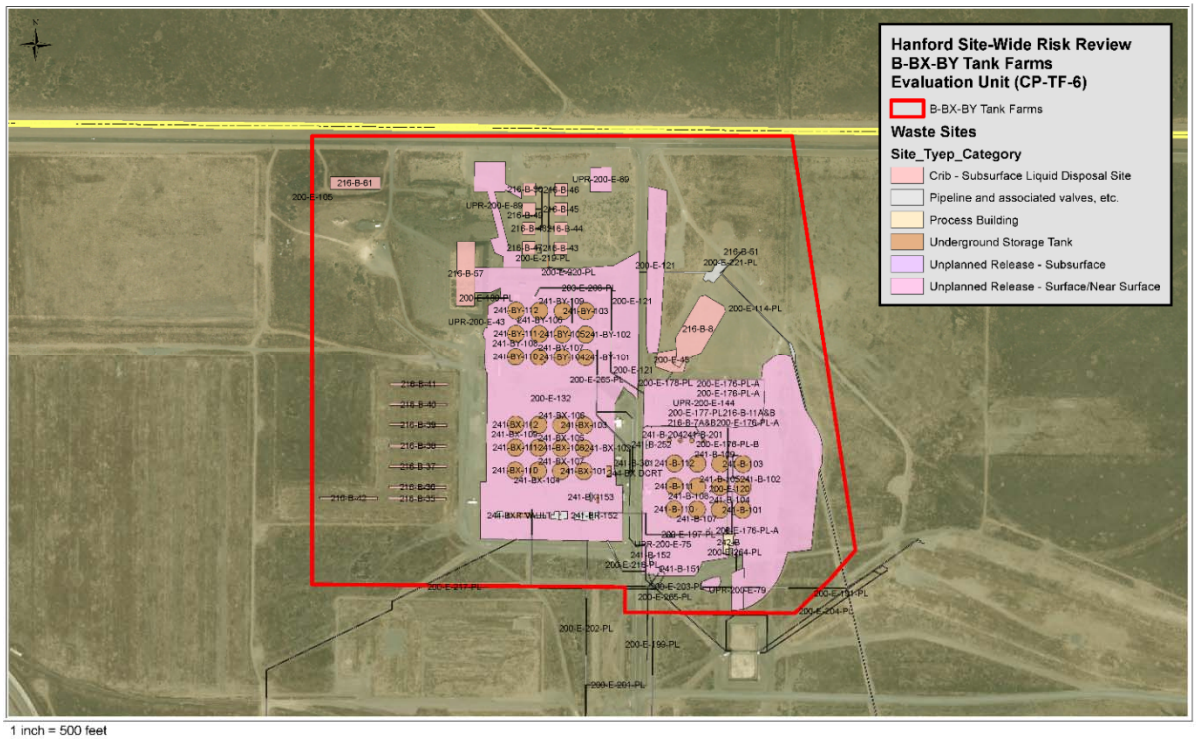
DRAFT



1 inch = 500 feet

Figure E.7-1. Polygon representing the boundary of the B-BX-BY Tank and Waste Farms Evaluation Unit (Attachment Section E.7.8).

DRAFT



1 inch = 500 feet

Figure E.7-2. Hanford B-BX-BY Tank and Waste Farms Evaluation Unit including tanks, legacy source units, and ancillary equipment (Attachment Section E.7.8).

E.7.4. UNIT DESCRIPTION AND HISTORY

EU FORMER / CURRENT USES

Waste Management Area B-BX-BY (WMA B-BX-BY) occupies approximately 20 acres (http://phoenix.pnnl.gov/apps/gw/phoenix.html) consisting of three Tank Farms, each with 12 underground single-shell tanks (SSTs) in additional to ancillary equipment (e.g., diversion boxes, pumps, valves, and pipes); the B Tank Farm also includes four smaller tanks. The tanks contain primarily salt cake from evaporator campaigns B and BY, metal waste from bismuth phosphate process, 1st / 2nd cycle decontamination from bismuth phosphate process, and lanthanum fluoride finishing waste (Remund et al. 1995).

The B Tank Farm was constructed in 1943-44 (RPP-RPT-54913) and includes 12 530-kgal underground waste storage tanks (B-101 through B-112) arranged in four rows of three tanks in a cascade and four smaller 55-kgal tanks. The tanks were designed for non-boiling wastes. The BX Tank Farm was constructed in 1946-47 to store high-level radioactive waste generated by chemical processing of irradiated uranium fuel at the chemical separation plants (RPP-RPT-47562). The BX Tank Farm contains 12 530-kgal tanks arranged in four rows of three tanks in a cascade. The BY Tank Farm was constructed in 1948-49 to store high-level radioactive waste generated from chemical processing of irradiated uranium fuel (RPP-RPT-43704). The BY Tank Farm contains 12 758-kgal underground waste storage tanks (BY-101 through BY-112) arranged in four rows of three tanks in a cascade. The tanks were taken out of service in 1980. The SSTs in WMA B-BX-BY have been interim stabilized (i.e., liquid transferred to DSTs to <50 kgal drainable interstitial liquid and <5 kgal of supernatant). The B-BX-BY Tank Farm tanks are currently awaiting retrieval and closure.

LEGACY SOURCE SITES

Twenty of the 40 SSTs in WMA B-BX-BY are classified as “assumed leakers” (Templeton 2016):

- Ten of the 16 tanks in the B Tank Farm are classified as “assumed leakers”.
- Five of the 12 BX Tank Farm tanks have been declared “assumed leakers”.
- Five of the 12 BY Tank Farm tanks have been declared “assumed leakers”.

Leaks from these tanks total at least 119,500 gallons with 70,000 gallons from BX-102 and 15,100 gallons from BY-102. Nine of the tanks have unknown leak estimates (PNNL-13022; Templeton 2016).

Various non-tank sources (e.g., cribs, trenches, tile fields and reverse wells) received large volumes (7.2 to 36.8 Mgal) of contaminated waste and other waste streams that has resulted in extensive vadose zone and groundwater contamination in the areas around the WMA B-BX-BY (PNNL-13022). These include

- liquid wastes that vary from high level metals waste to large quantities of ferrocyanide scavenged uranium recovery waste taken directly from tanks in the 241-BY Tank Farm and
- large volumes tritium-rich tank condensate generated during the in-tank solidification program.

The 200-BP GWIA is being monitored to determine the impact to groundwater prior to determining the path forward for remedial action, with a 200-BP-5 and 200-PO-1 Feasibility Study report and proposed

plan(s) due in 2018 (Appendix D, Ecology et al., 1996 [Accessed 27 Feb 2017]). No date or milestone has been scheduled for the final Record of Decision (ROD).

WASTE TANKS

See Section E.7.3 for details.

GROUNDWATER PLUMES

The groundwater plumes (nitrate, I-129, Tc-99, uranium, cyanide, and tritium) considered to be associated with the B-BX-BY Tank Farm and co-located liquid waste disposal facilities are described in detail in Section E.7.5 with additional information in Appendix D.5 for the CP-GW-1 EU (200-BP GWIA). Sites within the CP-TF-6 EU, including 216-B-11 A&B Reverse wells; 216-B-7 A&B, 216-B-8, 216-B-36, 216-B-37, 216-B-44 through 216-B-50 Cribs; and 216-B-40 and 216-B-57 Trenches are suspected of being able to contribute mobile contaminants to the saturated zone (i.e., representing migration of contaminants from the waste site to the uppermost aquifer) (DOE/RL-92-19, Rev. 0, Table 2-2).

D&D OF INACTIVE FACILITIES – NOT APPLICABLE

OPERATING FACILITIES – NOT APPLICABLE

Because of the prohibition on waste additions to the Hanford SSTs,[119] the B-BX-BY Tank and Waste Farms EU components are not considered Operating Facilities for this Review.

ECOLOGICAL RESOURCES SETTING

Landscape Evaluation and Resource Classification

The B-BX-BY Tank and Waste Farms EU has been heavily disturbed throughout and primarily contains level 0 and 1 resources. The existing resource level map (DOE/RL-96-32 2013) also shows areas of level 2, and 3 biological resources (Appendix J, Table 3, p. J-128 and Figure 14, p. J-127). Areas of level 3 resources within the evaluation site are associated with point occurrences of sensitive species noted in previous ECAP surveys. Piper's daisy (*Erigeron piperianus*), a Washington state sensitive species, was observed in the southwest corner of the site during the July 16, 2014 survey, and has been observed near that location in past ECAP surveys. However, an occurrence of a sensitive species does not constitute a habitat "patch" as considered in this assessment, but field survey of the southwest corner of B-BX-BY EU confirmed the surrounding habitat is should be classified as level 2 resources. Climax shrubs (big sagebrush; *Artemisia tridentata*) are limited to a small patch in the center and the majority of the habitat patch is dominated by gray rabbitbrush (*Ericameria nauseosa*) (Appendix J, Figure 14, p. J-127).

The amount and proximity of biological resources to the B-BX-BY Tank and Waste Farms EU was examined within the adjacent buffer area, which extends 974 m from the geometric center of the site (equivalent to 736 acres) to encompass a circle. Approximately 43% of the adjacent buffer area is classified as level 3 or higher biological resource in the existing resource classification. The level 3 habitat within the 200-East Area represents multiple locations where Piper's daisy has been found. This species is often found in disturbed and gravelly areas on the 200-Area Plateau. The majority of the level

[119] Berman presentation on July 29, 2009, titled "Hanford Single-Shell Tank Integrity Program." Available at www.em.doe.gov.

3 and level 4 resources are found across the paved road to the north, outside the 200-East boundary fence (Appendix J, Figure 14, p. J-127).

Field Survey

The B-BX-BY Tank Farms evaluation site includes levels 0, 1, 2, and 3 biological resources as classified in the existing resource level map (DOE/RL-96-32 2013) (Appendix J, Table 2, p. J-126 and Figure 14, p. J-127). Most of the areas previously classified as level 3 have been degraded by activities within the EU. Several areas have been revegetated. Areas of level 3 resources within the evaluation site are associated with individual occurrences of sensitive species noted in previous ECAP surveys. Piper's daisy (*Erigeron piperianus*), a Washington state sensitive species, was observed in the southwest corner of the site during the July 2014 survey, and has been observed near that location in past ECAP surveys. Field measurements were taken in the southwest corner of B-BX-BY EU (Appendix J, Table 2, p. J-126).

Animal species (or their sign) observed during the July 2014 survey include horned lark (*Eremophila alpestris*), northern pocket gopher (*Thomomys talpoides*), coyote (*Canis latrans*), and black-tailed jackrabbit (*Lepus californicus*). The black-tailed jackrabbit sign (very old scat) was observed in the southwest corner of the evaluation site. No other sign of recent presence (e.g., runs, fresh scat, animals) was observed. The black-tailed jackrabbit is a Federal Species of Concern and Washington State Candidate species.

CULTURAL RESOURCES SETTING

Cultural resources known to be recorded within the B-BX-BY Tank and Waste Farms EU are limited to the National Register-eligible 242B Building Radioactive Particle Research Laboratory associated with the Manhattan Project/Cold War Era Landscape with no documentation required. All National-Register-eligible Manhattan Project and Cold War Era buildings been documented as described in the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan* (DOE/RL-97-56).

None of the B-BX-BY Tank and Waste Farms EU has been inventoried for archaeological resources and closure and remediation of the tank farms located within the B-BX-BY Tank and Waste Farms EU has been addressed in an NHPA Section 106 review. There is a possibility that intact archaeological material is present in the B-BX-BY Tank and Waste Farms EU because it has not have not been inventoried for archaeological resources (both on the surface and in the subsurface) and particularly where undisturbed soil deposits exist within the B-BX-BY Tank and Waste Farms EU to the west. Within the other extensively disturbed areas, this is unlikely. The closest recorded archaeological site, located within 500 meters of the B-BX-BY Tank and Waste Farms EU consists of two historic-era isolated finds and one historic-era site likely associated with the Pre-Hanford Early Settlers/Farming Landscape and are not considered to be National Register-eligible. Additionally, the Hanford Site Plant Railroad, a contributing property within the Manhattan Project and Cold War Era Historic District, with documentation required is located within 500 meters of the B-BX-BY Tank and Waste Farms 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

Geomorphology, ground disturbance, historic maps, and the lack of cultural resources located within and in the vicinity of B-BX-BY Tank and Waste Farms EU all suggest that the potential for archaeological resources associated with all three landscapes to be present on the surface or within the subsurface within the EU is very low. Because none of the B-BX-BY Tank and Waste Farms EU has been investigated for archaeological sites and pockets of undisturbed soil may exist, it may be appropriate to conduct 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 associated with these landscapes (e.g. East Benton Historical Society, the Franklin County Historical Society, Prosser Cemetery Association, the Reach and B-Reactor Museum Association) may need to occur. Indirect effects are always possible when TCPs are known to be located in the general vicinity. 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.

E.7.5. WASTE AND CONTAMINATION INVENTORY

Table E.7-2 provides inventory estimates of the various source components associated with the B-BX-BY Tank and Waste Farms EU including tank wastes and ancillary equipment, legacy sources including leaks, cribs, trenches, unplanned releases (UPRs), vadose zone sources, saturated zone (plume) estimates, treatment amounts, and remaining vadose zone estimates (i.e., the difference of the vadose zone estimates and the saturated zone and treatment estimates)[120]. This information is further summarized in Figure E.7-3 through Figure E.7-11 before and after planned 99% retrieval[121].

For example, the major sources for Tc-99 and I-129 in the EU before retrieval are the B-BX-BY Tank Farm tanks and past discharges to cribs. The maximum groundwater threat metric (GTM) (Figure E.7-12)[122] is also dominated by the B-BX-BY Tank Farm wastes before retrieval and by past discharges to cribs after planned retrieval; this also applies to Tc-99 and I-129. The tritium and nitrate inventory, both pre- and post-retrieval, is dominated by past discharges to cribs and trenches. For chromium, the B-BX-BY Tank Farm tanks and past discharges to cribs and trenches are major sources before retrieval. After retrieval, past discharges cribs and trenches dominate the source of this primary contaminant. Current uranium inventories are dominated by tank inventories; whereas, post-retrieval sources are primarily related to past leaks. For Sr-90 and Cs-137, the post-retrieval inventory is dominated by ancillary equipment and past leaks. The post-retrieval plutonium isotope inventories are dominated by ancillary equipment and past discharges to cribs.

CONTAMINATION WITHIN PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

The estimated B-BX-BY Tank Farm inventory for the Legacy / Vadose Zone Source Sites (i.e., cribs, trenches, and soil contaminated by tank leaks and unplanned releases) is summarized in Table E.7-2 and further described in Figure E.7-3 through Figure E.7-11 before and after planned 99% retrieval (which

[120] The basis for the saturated and vadose zone estimates are provided in Chapter 6 of the Methodology Report (CRESP 2015a) and examples are provided in the demonstration section for the 200-UP-1 Operable Unit that corresponds to the 200-UP GWIA. These estimates tend to have very high associated uncertainties.

[121] According to the Tri-Party Agreement (Ecology, EPA, and DOE, 1998), retrieval limits for residual wastes are 360 ft^3 and 30 ft^3 for 100-Series and 200-Series tanks, respectively, corresponding to the 99% waste retrieval goal as defined in TPA Milestone M-45-00. For purposes of this Review the 99% and 90% Retrieval Scenarios reflect assumptions described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 and apply only to tank volumes and inventories. They are calculated assuming retrieval of a fully mixed tank of homogeneous composition. For tanks that have been declared "Retrieval Completed" or "Retrieved to Limit of … Technologies" (Templeton, AM 2016, page 9, partially duplicated in Table E.1-7), no further retrieval for either the 99% or 90% retrieval scenario is assumed. This includes tank 241-S-112 and all C Tank Farm tanks except 241-C-105. For tanks that are currently undergoing retrieval (tanks 241-AY-102 and 241-C-105), a retrieval amount equivalent to the 99% and 90% retrieval volumes described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 are calculated.

[122] Maximum of the GTMs for Tc-99 and I-129 only.

will have no impact on the current legacy source site inventories). These values constitute estimates of the initial amounts of contaminants discharged to the vadose zone that are then used to estimate the remaining inventory in the vadose zone as described below (i.e., by difference using the process described in Chapter 6 of the Methodology Report (CRESP 2015a) as revised for the 2015 groundwater monitoring results (DOE/RL-2016-09, Rev. 0) as described in Appendix D.1). These estimates necessarily have large associated uncertainties.

Waste Tanks and Ancillary Equipment

The estimated total inventory for all the B-BX-BY Tank Farm Waste Tanks and Ancillary Equipment is provided in Table E.7-2 for both the 90% and planned 99% retrieval scenarios. The tank-by-tank inventories are provided in Table E.7-3 through Table E.7-6. Safety-related information (i.e., hydrogen generation rates and times to the lower flammability limit are also provided in Table E.7-3. The inventories for the various contaminant in the B-BX-BY Tank Farm tanks vary over several orders of magnitude as does the GTM. This information is further summarized in Figure E.7-3 through Figure E.7-11 before and after planned 99% retrieval and for the maximum GTM in Figure E.7-12.

Vadose Zone Contamination

The estimated inventories for the vadose zone, saturated zone, and treatment amounts are found in Table E.7-2. These inventories represent the vadose zone contamination *outside* the tanks and ancillary equipment (i.e., that are generally available for transport through the environment). These inventories are used to estimate the inventory remaining in the vadose zone using the process described in Chapter 6 of the Methodology Report (CRESP 2015a) as modified for the 2015 groundwater results (Appendix D.1). The focus in this section will be on the Group A and B contaminants in the vadose zone due to their mobility and persistence and potential threats to groundwater. To summarize:

- *Tc-99, I-129* – There are already 200-BP plumes for Tc-99 and I-129; both of these plume are associated with B-BX-BY Tank and Waste Farms EU sources (DOE/RL-2016-09, Rev. 0). The vadose zone inventory is dominated by past discharges to cribs.
- *Sr-90* – There is a current plume for Sr-90; however, this plume is not associated with the B-BX-BY Tank and Waste Farms EU sources. The vadose zone inventory is dominated by ancillary equipment and past leaks. Using an analysis similar to that for Sr-90 in the A-AX Tank and Waste Farms EU (Section E.6.5), a Sr-90 plume related to B-BX-BY Tank and Waste Farms EU sources is not expected in the next 150 years due to retardation in the vadose zone (despite the existing plume, which is relatively small at 0.6 km^2). Sr-90 is not considered a significant threat to the Hanford groundwater. However, the times required for the remaining vadose zone Sr-90 inventory from B-BX-BY Tank and Waste Farms EU sources to decay to values that would result in *Medium* and *Low* ratings are 200+ and 300+ years, respectively, indicating that the vadose zone source is substantial.
- *Chromium* – There is no current plume for chromium (either total or hexavalent). The vadose zone inventory is dominated by past discharges to cribs and trenches.
- *Uranium* – There is an existing uranium plume associated with the 241-BX-102 unplanned release. The vadose zone inventory is dominated by past leaks. The TC&WM EIS groundwater transport analysis (Appendix O, DOE/EIS-0391 2012) indicates that uranium, which already has a current plume, is predicted to exceed the drinking water standard at the B Barrier within the 10,000-year TC&WM EIS evaluation period (Appendix O, DOE/EIS-0391 2012, p. O-59)). Thus there is no basis (related to vadose zone transport results in the TC&WM EIS) to alter the rating for uranium (unlike in Section E.6.5).

- *Cyanide* – There is a current cyanide (CN) plume, which is associated with a release in the 241-B Tank Farm. No vadose source information was available for CN (DOE/RL-2016-09, Rev. 0).

Using the process outlined in Chapter 6 of the Methodology Report (CRESP 2015a) as revised for the 2015 groundwater monitoring results (Appendix D.1), the vadose zone inventories in Table E.7-2 are estimated and used to calculate Groundwater Threat Metric (GTM) values for the Group A and B contaminants remaining in the vadose zone as illustrated in Table E.7-7. Note that the vadose zone (VZ) ratings range from *ND* for Sr-90[123] to *Low* for C-14 to *Medium* for total uranium to *High* for Tc-99, I-129, and chromium (total and hexavalent).

Groundwater Plumes

Legacy waste sites within the CP-TF-6 EU are suspected of be able to contribute mobile contaminants to the saturated zone (DOE/RL-92-19, Rev. 0) and plumes have been linked to CP-TF-6 sources (DOE/RL-2016-09, Rev. 0). In general groundwater plumes are evaluated in separate EUs; however, those portions of groundwater plumes that can be associated with the TF EU (i.e., a plume with sources associated with the TF EU) will be evaluated to provide a better idea of the saturated zone versus remaining vadose zone threats to groundwater. The estimated inventory for the saturated zone contamination is provided in Table E.7-2 where Photoshop was used to estimate the fraction of the plumes considered associated with the B-BX-BY Tank and Waste Farms EU (Attachment 6-4 in the Methodology Report (CRESP 2015a) as revised to accommodate the 2015 groundwater monitoring results described in Appendix D.1[124]). This information is also used to estimate amounts treated and remaining in the vadose zone. For the Group A and B plumes described in the 200-BP GWIA (DOE/RL-2016-09, Rev. 0), apportionment of plumes and ratings from the Group A and B primary contaminants to the B-BX-BY Tank and Waste Farms EU would be as follows:

- *I-129* – There is a very large plume that straddles the 200-BP and 200-PO GWIA, where 200-BP sources include BY Cribs, 216-B-8 Crib, and the 241-BX-102 UPR and primary sources from 200-PO: 216-A-10 Crib, 216-A-29 Ditch, and B Pond (DOE/RL-2016-09, Rev. 0). Since the contribution from the B-BX-BY Complex to the existing plume cannot be determined, the contribution is estimated by ratio the 200-BP sources to the primary sources in 200-PO. The corresponding proportion is 8.5% (Appendix D.1).
- *Tc-99* – There are plumes in the vicinity; the large plumes near the B-BX-BY Tank and Waste Farms EU are considered associated with the EU (and the small plume near 216-B-5 Crib is not) (DOE/RL-2016-09, Rev. 0); the area of these plumes is 94% of the total area (Appendix D.1).
- *Uranium* – There are plumes in the OU; the large plume near the B-BX-BY Tank and Waste Farms EU is considered associated with the EU, and the area of this plume is 94% of the area of the plumes (Appendix D.1).
- *Sr*-90 – There are plumes in the OU; however, there are no major Sr-90 sources identified that are related to B-BX-BY Tank and Waste Farms EU sources (DOE/RL-2016-09, Rev. 0). Thus the contribution is considered insignificant and the ratings would be ND.

[123] The remaining vadose zone inventory for Sr-90 would translate to *Very High* ratings; however, no appreciable Sr-90 plume would be expected in the next 150 years due to transport and decay considerations. A *Low* rating is applied after the Active Cleanup period to account for uncertainties.

[124] From the graphic map files provided by PNNL, the Photoshop Magic Wand Tool was used to select areas representing plumes and then the "Record Measurements" Tool was used to provide areal extents. A Custom Measurement Scale was set to that of the original map.

- *Cyanide* – There are 200-BP plumes that are associated with the B-BX-BY Tank and Waste Farms EU (including the B Complex and BY Cribs) (DOE/RL-2016-09, Rev. 0). The contribution is 100% since the only plumes are associated with these sources. No source inventory data for cyanide was found related to these waste sites. Cyanide could not, therefore, be rated. This is a data gap.

The groundwater plumes associated with the B-BX-BY Tank Farm and co-located liquid waste disposal facilities are described in detail in the Appendix D.5 for the CP-GW-1 EU (200-BP GWIA). Note that Sr-90 (*High*) is the primary current risk driver for the 200-BP GWIA; whereas, Sr-90 is rated as Not Discernible (ND) for the remaining vadose zone contamination (Table E.7-2). This difference is because the source for the current plume driving the High rating for the 200-BP GWIA is not related to CP-TF-6 waste sites (DOE/RL-2016-009, Rev. 0).

Impact of Recharge Rate and Radioactive Decay on Groundwater Ratings

The TC&WM EIS screening groundwater transport analysis (Appendix O, DOE/EIS-0391 2012) indicates that there is an insufficient impact of emplacing the engineered surface barrier (and resulting reduction of infiltrating water) on the predicted peak groundwater concentrations (relative to thresholds) at the B Barrier[125] to impact ratings. This result is not ascribed to an ineffective barrier, but instead to large amounts of contaminants already present in the subsurface and possible influence from sources outside the B-BX-BY Tank and Waste Farms EU. To summarize, the screening groundwater results including sources in addition to those for the B-BX-BY Tank and Waste Farms EU (Appendix O, DOE/EIS-0391 2012) include:

- Tc-99 peak concentration is 26,500 pCi/L (CY 3957) for the No Action Alternative versus 3,570 pCi/L (CY 2056) for Landfill Closure where the threshold value is 900 pCi/L.
- I-129 peak concentration is 58.8 pCi/L (CY 3577) for the No Action Alternative versus 4.5 pCi/L (CY 2056) for Landfill Closure where the threshold value is 1 pCi/L.
- Chromium peak concentration is 864 µg/L (CY 3882) for the No Action Alternative versus 215 µg/L (CY 2050) for Landfill Closure where the threshold value is 100 µg/L (total) or 48 µg/L (hexavalent).
- Uranium peak concentration is 41 µg/L (CY 11,778) for the No Action Alternative versus 4 µg/L (CY 11,778) for Landfill Closure where the threshold value is 30 µg/L.
- No values are reported at the B Barrier for Sr-90 for either scenario, which indicates that peak fluxes (related to the sources considered) were less than 1×10^{-8} Ci/yr (Appendix O, DOE/EIS-0391 2012, p. O-2).

Despite impacts on the predicted peak concentrations, the peak values for Tc-99, I-129, and chromium could exceed thresholds at the B Barrier within 150-200 years and longer for either scenario, and thus ratings will not be altered based on recharge rate scenarios.

Based on the TC&WM EIS screening results, it is assumed that uranium would not reach groundwater in sufficient quantity to exceed the standard for the Landfill scenario; therefore, the Active Cleanup rating

[125] The barrier represents the edge of the infiltration barrier to be constructed over disposal areas that are within 100 meters [110 yards] of facility fence lines (DOE/EIS-0391 2012). The B Barrier is the closest to the B-BX-BY Tank and Waste Farms EU. Despite including sources other than those for the B-BX-BY Tank and Waste Farms EU, the analysis in the TC&WM EIS was considered the best and most consistent information to assess the impact of the engineered surface barrier emplacement.

would not be changed but the Near-term Post-Cleanup rating would be *Low* to account for uncertainties.

For Sr-90, the times required for the remaining vadose zone inventory to decay to values that would result in *Medium* and *Low* ratings are 200+ and 300+ years, respectively. Thus the Sr-90 ratings for the Active Cleanup and Near-term Post-Cleanup periods would not be changed based on decay; however, the transport and decay evaluation above would result in a rating of *Not Discernible* for the Active Cleanup and Near-term Post-Cleanup periods; however, a *Low* rating is given after the Active Cleanup period to address uncertainty.

Columbia River

The process illustrated in Chapter 6 of the Methodology Report (CRESP 2015a) as revised for the 2015 groundwater and Columbia River results (Appendix D.1) is used to evaluate potential impacts to the Columbia River. Note that the evaluation of potential benthic and riparian impacts has a common thread up to the point when the shoreline impact (benthic) or riparian zone impact area is used to define ratings. Thus a common evaluation for the benthic and riparian zone is performed here.

Benthic and Riparian Zone – Current Impacts

Based on the information in the 2015 Hanford Annual Groundwater Report (DOE/RL-2016-09, Rev. 0) and HEIS (http://ehs.hanford.gov/eda/), no plume from the 200-BP GWIA currently intersects the Columbia River at concentrations exceeding the appropriate water quality standard (WQS). Thus current impacts from the B-BX-BY Tank and Waste Farms EU to the Columbia River benthic and riparian ecology would be rated as *Not Discernible*.

Benthic and Riparian Zone – Active Cleanup and Near-term, Post Cleanup for Current Plumes

Because 200-BP plumes associated with the B-BX-BY Tank and Waste Farms EU originate from 200-East, it is possible that a current plume might reach the Columbia River in the next 150 years since the *water* travel time is ~10-30 years from 200-East to the Columbia River (Gephart 2003; PNNL-6415 Rev. 18)[126]. Based on a similar analysis described for the A-AX Tank and Waste Farms EU (Section E.6.5), a *Not Discernible* rating is obtained for radionuclides for the Active Cleanup and Near-term, Post-Cleanup impacts of current plumes on the Columbia River.

For nitrate (Group C chemical with a current plume related to the EU), the predicted peak concentration (16,200 µg/L in CY 2111 from Table O-8, Appendix O, DOE/EIS-0391 2012, p. O-59) is less than the drinking water standard (45,000 µg/L), which leads to a *Not Discernible*[127] rating for the Active Cleanup and Near-term, Post-Cleanup evaluation periods. However, the ratio of the predicted peak concentration (16,200 µg/L in CY 2111) to the ambient water quality criterion (AWQC) of 7,100 µg/L (DOE/RL-2010-117, Rev. 0) exceeds one during the Near-term, Post-Cleanup evaluation period, which would lead to a rating of *Low* for this period. However, well measurements indicate that nitrate and other mobile contaminants in 200-East are unlikely to reach the Columbia River in sufficient quantities to exceed the AWQC. Furthermore, the peak predictions are based on sources other than those from the B-BX-BY Tank and Waste Farms EU. Thus a *Not Discernible* rating is also ascribed to the chemical plumes associated with the B-BX-BY Tank and Waste Farms EU.

[126] Sr-90 and uranium have current plumes but neither is expected to reach the Columbia River in the next 10,000 years. The cyanide plume is also evaluated in Appendix G.5 for the CP-GW-1 EU.

[127] According to the framework (Figure 6-10, Chapter 6, Methodology Report (CRESP 2015a)), a rating of *Not Discernible* is warranted when the plume is not anticipated to reach the River in a concentration exceeding the drinking water standard in the time period being considered. Note that there are sources other than the B-BX-BY Tank and Waste Farms EU considered.

Benthic and Riparian Zone Ecology – Active Cleanup and Near-term, Post Cleanup for Vadose Zone Contaminants

Following the analysis outlined in Section E.6.5 for the A-AX Tank and Waste Farms EU, the vadose zone contaminants (where hexavalent chromium is the possible risk driver) would translate to a (benthic) rating of *Not Discernible* during the Active Cleanup and Near-term, Post-Cleanup periods.

Using the TC&WM EIS screening results would lead to Medium (benthic) and High (riparian) ratings for chromium (and Not Discernible for the others); however, because well measurements indicate that chromium is moving toward the Columbia River much more slowly than assumed in the TC&WM EIS, the plumes are not likely going to reach the Columbia River within the Evaluation periods leading to *Not Discernible* ratings.

Benthic and Riparian Zone – Long-term

Following the analysis outlined in Section E.6.5, there should be no expected adverse effects from radionuclides (for the sources considered in the TC&WM EIS including those for the B-BX-BY Tank and Waste Farms EU) during the TC&WM EIS evaluation period (10,000 years). Similarly, nitrate from the B-BX-BY Tank and Waste Farms EU would pose little additional long-term risk to the Columbia River benthic or riparian ecology. The screening results for chromium (assumed hexavalent) would translate to some additional risk to benthic and riparian receptors (i.e., exceeds the screening threshold) although sources other than the B-BX-BY Tank and Waste Farms EU are included in the evaluation. As indicated in Section E.6.5, this is consistent with the evaluation provided in the TC&WM EIS (DOE/EIS-0391 2012, Chapter 2, p. 2–235 & 2–237).

Threats to the Columbia River Free-flowing Ecology

As described in Section E.2.5, the large dilution effect of the Columbia River on the contamination from the seeps and groundwater upwellings results in *Not Discernible* ratings for the Active Cleanup and Near-term, Post Cleanup periods and insignificant long-term impacts to the free-flowing ecology for all contaminants.

Potential Impact of Recharge Rate on Threats to the Columbia River

Similar to the evaluation in Section E.6.5, the alternatives analysis in the TC&WM EIS would suggest that benthic and riparian zone ratings associated with the B-BX-BY Tank and Waste Farms EU would not change based on surface barrier installation and changes in recharge rates. This result is not due to an ineffective barrier but instead likely due to the large amounts of the contaminants already in the subsurface and possible impact from sources outside the B-BX-BY Tank and Waste Farms EU.

Facilities for D&D – Not Applicable

Operating Facilities – Not Applicable

Because of the prohibition on waste additions to the Hanford SSTs,[128] the B-BX-BY Tank and Waste Farms EU components are not considered Operating Facilities for this Review.

[128] Berman presentation on July 29, 2009, titled "Hanford Single-Shell Tank Integrity Program." Available at www.em.doe.gov.

Table E.7-2. Summary Table of Infrastructure and Subsurface Contamination Inventory for the B-BX-BY Tank and Waste Farms Evaluation Unit (CP-TF-6) [a,b]

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[c]	99% Retrieval Scenario[c]
Infrastructure (Tanks and Ancillary Equipment)				
Tank Waste	Waste (kGal)	7743	774.3	77.43
	Sludge (kGal)	2753	275.3	27.53
	Saltcake (kGal)	4941	494.1	49.41
	Supernatant (kGal)	49	4.9	0.49
Tank Waste (rad)	Am-241 (Ci)	3100	310	31
	C-14 (Ci)	91	9.1	0.91
	Co-60 (Ci)	310	31	3.1
	Cs-137 (Ci)	2100000	210000	21000
	Eu-152 (Ci)	100	10	1
	Eu-154 (Ci)	2000	200	20
	H-3 (Ci)	430	43	4.3
	I-129 (Ci)	2.7	0.27	0.027
	Ni-59 (Ci)	620	62	6.2
	Ni-63 (Ci)	55000	5500	550
	Pu (total) (Ci)	6000	600	60
	Sr-90 (Ci)	2200000	220000	22000
	Tc-99 (Ci)	2000	200	20
	U (total) (Ci)	260	26	2.6
Tank Waste (non-rad)	Cr (kg)	110000	11000	1100
	Hg (kg)	360	36	3.6
	NO3 (kg)	8700000	870000	87000
	Pb (kg)	18000	1800	180
	U (total) (kg)	190000	19000	1900
Ancillary Equipment (rad)	C-14 (Ci)	3.1	3.1	3.1
	Cs-137 (Ci)	18000	18000	18000
	H-3 (Ci)	7.1	7.1	7.1
	I-129 (Ci)	0.031	0.031	0.031

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[(c)]	99% Retrieval Scenario[(c)]
	Pu (total) (Ci)	48	48	48
	Sr-90 (Ci)	46000	46000	46000
	Tc-99 (Ci)	18	18	18
	U (total) (Ci)	1.1	1.1	1.1
Ancillary Equipment (non-rad)	Cr (kg)	710	710	710
	Hg (kg)	5.1	5.1	5.1
	NO3 (kg)	65000	65000	65000
	U (total) (kg)	1500	1500	1500
MUST (rad)	Am-241 (Ci)	0.069	0.069	0.069
	C-14 (Ci)	0.01	0.01	0.01
	Co-60 (Ci)	0.0078	0.0078	0.0078
	Cs-137 (Ci)	1.5	1.5	1.5
	Eu-152 (Ci)	0.00061	0.00061	0.00061
	Eu-154 (Ci)	0.047	0.047	0.047
	H-3 (Ci)	0.26	0.26	0.26
	I-129 (Ci)	0.00021	0.00021	0.00021
	Ni-59 (Ci)	0.00017	0.00017	0.00017
	Ni-63 (Ci)	0.015	0.015	0.015
	Pu (total) (Ci)	0.044	0.044	0.044
	Sr-90 (Ci)	5.6	5.6	5.6
	Tc-99 (Ci)	0.16	0.16	0.16
	U (total) (Ci)	0.00088	0.00088	0.00088
MUST (non-rad)	Cr (kg)	9.3	9.3	9.3
	Hg (kg)	0.013	0.013	0.013
	NO3 (kg)	8300	8300	8300
	U (total) (kg)	1.3	1.3	1.3
Vadose Zone Source (Leaks and Intentional Discharges into Cribs and Trenches)				
Leaks (rad)	C-14 (Ci)	3.8	3.8	3.8
	Cs-137 (Ci)	32000	32000	32000
	H-3 (Ci)	29	29	29
	I-129 (Ci)	0.055	0.055	0.055
	Pu (total) (Ci)	9.5	9.5	9.5

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[(c)]	99% Retrieval Scenario[(c)]
	Sr-90 (Ci)	13000	13000	13000
	Tc-99 (Ci)	29	29	29
	U (total) (Ci)	10	10	10
Leaks (non-rad)	Cr (kg)	310	310	310
	Hg (kg)	0.4	0.4	0.4
	NO3 (kg)	57000	57000	57000
	Pb (kg)	59	59	59
	U (total) (kg)	15000	15000	15000
Cribs (rad)	Am-241 (Ci)	63	63	63
	C-14 (Ci)	8.4	8.4	8.4
	Co-60 (Ci)	6.8	6.8	6.8
	Cs-137 (Ci)	2400	2400	2400
	Eu-152 (Ci)	0.61	0.61	0.61
	Eu-154 (Ci)	47	47	47
	H-3 (Ci)	550	550	550
	I-129 (Ci)	0.17	0.17	0.17
	Ni-59 (Ci)	0.25	0.25	0.25
	Ni-63 (Ci)	22	22	22
	Pu (total) (Ci)	340	340	340
	Sr-90 (Ci)	6500	6500	6500
	Tc-99 (Ci)	130	130	130
	U (total) (Ci)	2.3	2.3	2.3
Cribs (non-rad)	Cr (kg)	24000	24000	24000
	Hg (kg)	13	13	13
	NO3 (kg)	11000000	11000000	11000000
	Pb (kg)	9.7	9.7	9.7
	U (total) (kg)	1400	1400	1400
Trenches (rad)	Am-241 (Ci)	9.4	9.4	9.4
	C-14 (Ci)	1.4	1.4	1.4
	Co-60 (Ci)	4.5	4.5	4.5
	Cs-137 (Ci)	6200	6200	6200
	Eu-152 (Ci)	0.18	0.18	0.18

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[(c)]	99% Retrieval Scenario[(c)]
	Eu-154 (Ci)	13	13	13
	H-3 (Ci)	91	91	91
	I-129 (Ci)	0.031	0.031	0.031
	Ni-59 (Ci)	0.36	0.36	0.36
	Ni-63 (Ci)	50	50	50
	Pu (total) (Ci)	9.6	9.6	9.6
	Sr-90 (Ci)	1200	1200	1200
	Tc-99 (Ci)	8.4	8.4	8.4
	U (total) (Ci)	0.34	0.34	0.34
Trenches (non-rad)	Cr (kg)	5000	5000	5000
	Hg (kg)	5.3	5.3	5.3
	NO3 (kg)	1700000	1700000	1700000
	U (total) (kg)	500	500	500
UPR (rad)	Am-241 (Ci)	0.27	0.27	0.27
	C-14 (Ci)	0.098	0.098	0.098
	Co-60 (Ci)	0.53	0.53	0.53
	Cs-137 (Ci)	910	910	910
	Eu-152 (Ci)	0.024	0.024	0.024
	Eu-154 (Ci)	1.8	1.8	1.8
	H-3 (Ci)	1.4	1.4	1.4
	I-129 (Ci)	0.0022	0.0022	0.0022
	Ni-59 (Ci)	0.02	0.02	0.02
	Ni-63 (Ci)	2	2	2
	Pu (total) (Ci)	0.54	0.54	0.54
	Sr-90 (Ci)	170	170	170
	Tc-99 (Ci)	3.1	3.1	3.1
	U (total) (Ci)	0.0048	0.0048	0.0048
UPR (non-rad)	Cr (kg)	82	82	82
	Hg (kg)	0.057	0.057	0.057
	NO3 (kg)	22000	22000	22000
	Pb (kg)	2.1	2.1	2.1
	U (total) (kg)	6.5	6.5	6.5

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[(c)]	99% Retrieval Scenario[(c)]
Vadose Zone (from Vadose Zone Sources)				
VZ Remaining (rad)	Am-241 (Ci)	73	73	73
	C-14 (Ci)	14	14	14
	Co-60 (Ci)	12	12	12
	Cs-137 (Ci)	42000	42000	42000
	Eu-152 (Ci)	0.81	0.81	0.81
	Eu-154 (Ci)	61	61	61
	H-3 (Ci)	650	650	650
	I-129 (Ci)	0.11	0.11	0.11
	Ni-59 (Ci)	0.63	0.63	0.63
	Ni-63 (Ci)	74	74	74
	Pu (total) (Ci)	360	360	360
	Sr-90 (Ci)	21000	21000	21000
	Tc-99 (Ci)	110	110	110
	U (total) (Ci)	13	13	13
VZ Remaining (non-rad)	Cr (kg)	29000[(d)]	29000[(d)]	29000[(d)]
	Cr-VI (kg)	29000[(d)]	29000[(d)]	29000[(d)]
	Hg (kg)	19	19	19
	NO3 (kg)	13000000	13000000	13000000
	Pb (kg)	71	71	71
	U (total) (kg)	17000	17000	17000
VZ Treatment (rad)	Tc-99 (Ci)	0.035	0.035	0.035
VZ Treatment (non-rad)	NO3 (kg)	39	39	39
	U (total) (kg)	46	46	46
Saturated Zone (from Vadose Zone Sources)				
SZ Inventory (rad)	H-3 (Ci)	18	18	18
	I-129 (Ci)	0.14	0.14	0.14
	Tc-99 (Ci)	59	59	59
SZ Inventory (non-rad)	CN (kg)	3000	3000	3000
	NO3 (kg)	580000	580000	580000
	U (total) (kg)	220	220	220

a. Tanks (SST and DST): Best Basis Inventory (BBI) March 2014; Ancillary Equipment (Anc Eq): Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix D; Unplanned Releases (UPRs): Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0); Ponds: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0); Cribs: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0); Trenches: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0) and Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix S; Leaks: Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix D; MUSTs: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0) and Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix S.

b. All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

c. 99% and 90% Retrieval Scenarios reflect assumptions described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 and apply only to tank volumes and inventories. They are calculated assuming retrieval of a fully mixed tank of homogeneous composition. For tanks that have been declared “Retrieval Completed” or “Retrieved to Limit of … Technologies” (Templeton, AM 2016, page 9, partially duplicated in Table E.1-7), no further retrieval for either the 99% or 90% retrieval scenario is assumed. This includes tank 241-S-112 and all C Tank Farm tanks except 241-C-105. For tanks that are currently undergoing retrieval (tanks 241-AY-102 and 241-C-105), a retrieval amount equivalent to the 99% and 90% retrieval volumes described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 are calculated.

d. Differences in inventories for Cr vs Cr-IV are due to differing Water Quality Standards (WQS) and thus plume extents: 100 mg/L for total chromium vs 48 mg/L for chromium (VI). The difference may not be distinguishable within the number of significant digits (2) displayed.

Table E.7-3. Current Bulk Inventory and Steady State Flammability Results (by Tank) for the B-BX-BY Tank Farms (CP-TF-6)

Tank ID	Tank Type	Capacity (kGal)[a]	Sludge (kGal)[a]	Saltcake (kGal)[a]	Supernatant (kGal)[a]	HGR (ft^3/d)[b]	Days to 25% LFL Barometric[c]	Days to 25% LFL Zero Ventilation[d]
B-101	SST	530	28	76	0	0.52	NA	1824
B-102	SST	530	0	27	4	0.81	NA	1272
B-103	SST	530	1	51	0	0.34	NA	>1826
B-104	SST	530	309	60	0	1.25	NA	475
B-105	SST	530	28	261	0	0.46	NA	1341
B-106	SST	530	121	0	1	0.98	NA	928
B-107	SST	530	86	75	0	0.98	NA	876
B-108	SST	530	27	65	0	0.36	NA	>1826
B-109	SST	530	50	71	1	0.93	NA	987
B-110	SST	530	244	0	0	0.71	NA	1040
B-111	SST	530	241	0	1	1.9	NA	375
B-112	SST	530	14	17	2	0.39	NA	>1826
B-201	SST	55	29	0	0	0.087	NA	411
B-202	SST	55	27	0	2	0.2	391	185
B-203	SST	55	49	0	1	0.3	36	34
B-204	SST	55	48	0	2	0.29	41	37
BX-101	SST	530	43	0	9	0.87	NA	1144
BX-102	SST	530	74	0	0	0.5	NA	>1826
BX-103	SST	530	62	0	11	1.6	NA	572
BX-104	SST	530	97	0	3	0.51	NA	>1826
BX-105	SST	530	42	25	5	0.41	NA	>1826
BX-106	SST	530	10	28	0	0.98	NA	1032
BX-107	SST	530	347	0	0	0.58	NA	1082
BX-108	SST	530	31	0	0	0.34	NA	>1826
BX-109	SST	530	193	0	0	0.74	NA	1090
BX-110	SST	530	65	141	6	0.57	NA	1397

Tank ID	Tank Type	Capacity (kGal)[a]	Sludge (kGal)[a]	Saltcake (kGal)[a]	Supernatant (kGal)[a]	HGR (ft^3/d)[b]	Days to 25% LFL Barometric[c]	Days to 25% LFL Zero Ventilation[d]
BX-111	SST	530	30	94	0	0.4	NA	>1826
BX-112	SST	530	163	0	1	0.47	NA	>1826
BY-101	SST	758	37	328	0	0.9	NA	887
BY-102	SST	758	0	316	0	0.54	NA	1505
BY-103	SST	758	9	403	0	0.72	NA	1046
BY-104	SST	758	45	359	0	1.5	NA	515
BY-105	SST	758	48	433	0	1.01	NA	675
BY-106	SST	758	30	399	0	1.1	NA	692
BY-107	SST	758	16	258	0	1.9	NA	474
BY-108	SST	758	40	182	0	0.8	NA	1263
BY-109	SST	758	24	263	0	0.54	NA	1780
BY-110	SST	758	43	323	0	3	NA	259
BY-111	SST	758	0	402	0	0.68	NA	1179
BY-112	SST	758	2	284	0	0.61	NA	1554

a. Volumes from the Waste Tank Summary Report for Month Ending November 30, 2016 (Templeton, AM 2016).

b. Hydrogen generation rate (ft^3/d) (RPP-5926 Rev. 17). Note in 2001 all 24 tanks were removed from the flammable gas watch list (including T-110 in the T Tank and Waste Farms EU) (Johnson, et al. 2001, p. iii).

c. Time (in days) to 25% of the Lower Flammability Limit (LFL) under a barometric (barom) breathing scenario (RPP-5926, Rev. 17). "NA" indicates that the headspace will not reach specified flammability level.

d. Time (in days) to 25% of the LFL under a zero ventilation scenario (RPP-5926, Rev. 17).

Table E.7-4. Current Primary Contaminant Inventory (by Tank) for the B-BX-BY Tank Farms (CP-TF-6) [(a)]

Tank ID	Baseline Status[(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)
B-101	2001	1400	0.076	NR[(c)]	8.2	1600	8.8	410	0.57
B-102	2001	0.1	0.018	NR	0.0031	440	0.00052	0.026	0.14
B-103	2001	0.52	0.027	NR	0.0046	650	0.00077	0.038	0.21
B-104	2001	5.7	0.23	NR	0.021	11000	0.0028	0.14	0.39
B-105	2001	1.4	0.1	NR	0.016	2900	0.0026	0.13	0.67
B-106	2001	6.3	0.071	NR	0.017	9000	0.0015	0.09	0.42
B-107	2001	4.6	0.23	NR	0.27	9900	0.0038	0.23	0.92
B-108	2001	0.11	0.2	NR	0.73	6900	0.002	0.12	0.93
B-109	2001	0.72	0.3	NR	0.44	920	0.0016	0.078	0.82
B-110	2001	90	1.5	NR	0.7	11000	23	27	0.66
B-111	2001	98	1.9	NR	0.11	130000	39	61	1.5
B-112	2001	0.2	0.52	NR	1.4	7800	0.11	5.4	2
B-201	2001	3.9	0.000019	NR	1.50E-02	14	3.50E-06	0.075	1.10E+00
B-202	2001	8.4	0.000025	NR	3.40E-06	7.4	0.000018	0.00084	2.70E-07
B-203	2001	7.6	0.000047	NR	6.40E-06	1.1	0.000033	0.0016	5.00E-07
B-204	2001	8.3	0.00027	NR	5.90E-06	4.4	0.00003	0.0014	4.60E-07
BX-101	2001	43	0.099	NR	0.77	20000	0.043	60	0.35
BX-102	2001	1.7	0.19	NR	0.42	8800	0.00062	0.031	6.7
BX-103	2001	100	0.22	NR	0.37	15000	0.00055	0.027	1.7
BX-104	2001	330	0.14	NR	3.4	36000	0.0011	0.069	12
BX-105	2001	26	0.61	NR	4.6	31000	0.3	18	10
BX-106	2001	58	0.58	NR	4.2	17000	0.17	11	3.3
BX-107	2001	25	0.52	NR	0.096	23000	0.0054	0.33	0.46
BX-108	2001	3.2	0.035	NR	0.0085	3600	0.00079	0.049	0.25
BX-109	2001	5.9	0.069	NR	0.022	11000	0.003	0.18	1.2
BX-110	2001	6.2	3	NR	8.8	49000	0.69	34	11

Tank ID	Baseline Status[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)
BX-111	2001	2.9	1.9	NR	6.2	30000	0.49	24	6.9
BX-112	2001	20	0.15	NR	0.032	30000	0.0018	0.11	0.24
BY-101	2001	25	7.2	NR	30	170000	2.4	120	27
BY-102	2001	82	5.3	NR	19	83000	1.5	73	20
BY-103	2001	27	7.7	NR	30	120000	2.4	120	29
BY-104	2001	150	7.9	NR	7.9	210000	3.5	220	46
BY-105	2001	120	11	NR	6.7	140000	5	310	62
BY-106	2001	35	6.8	NR	3.1	200000	2.2	20	26
BY-107	2001	19	4.4	NR	2.4	140000	1.2	15	17
BY-108	2001	36	3.3	NR	11	40000	0.84	41	13
BY-109	2001	57	5.4	NR	14	77000	1	50	20
BY-110	2001	60	6.1	NR	8.5	170000	2.7	50	35
BY-111	2001	160	7.3	NR	77	140000	3.3	210	42
BY-112	2001	81	5.8	NR	62	110000	2.7	170	33

a. From Best Basis Inventory (BBI) Summary (March 24, 2014) provided in spreadsheet form by Mark Triplett. All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

b. This is the “Baseline Status” date as reported in the BBI (February 2017) as “Baselined 2001.” It should not be necessarily be considered the decay date for isotope inventories.

c. NR = Not reported for this EU

Table E.7-5. Current Primary Contaminant Inventory[a] and Groundwater Threat Metric (by Tank) for the B-BX-BY Tank Farms (CP-TF-6)

Tank ID	I-129 (Ci)	Ni-59 (Ci)	Ni-63 (Ci)	Pu (total) (Ci)[b]	Sr-90 (Ci)	Tc-99 (Ci)	U (total) (Ci)[c]	GTM (Mm3)[d]
B-101	0.001	0.54	48	1200	150000	1.8	5.3	2
B-102	0.00029	0.033	3	6	98	0.21	0.26	0.23
B-103	0.00043	0.061	5.7	60	350	0.32	1.8	0.35
B-104	0.00091	0.072	7	120	3.40E+03	22	2.9	24
B-105	0.0014	0.3	28	65	6.90E+02	2.6	2.6	2.9
B-106	0.00053	0.008	0.81	23	2.80E+04	5.6	4.4	6.2
B-107	0.0092	0.47	44	54	2900	15	1.4	16
B-108	0.028	1.3	120	3.2	840	0.42	1.7	11
B-109	0.044	2	180	28	270	0.44	28	18
B-110	5.40E-04	0.17	15	160	74000	21	0.18	23
B-111	4.60E-04	1.3	120	170	200000	130	0.16	150
B-112	1.60E-02	2.70E+00	230	0.65	970	11	0.37	13
B-201	7.60E-10	4.90E-06	0.00038	110	180	1.70E-06	1.50E-02	1.90E-06
B-202	0.00E+00	6.50E-06	0.00052	25	290	6.60E-01	0.032	7.30E-01
B-203	0	1.20E-05	0.00098	65	12	4.30E-06	0.0021	4.80E-06
B-204	0.00E+00	1.10E-05	0.00087	55	0.44	7.50E-05	0.0015	8.30E-05
BX-101	0.013	0.63	54	350	57000	9.8	16	11
BX-102	0.031	1.4	120	12	80000	0.14	2.6	13
BX-103	0.035	1.6	140	1500	140000	0.071	3.9	14
BX-104	0.03	0.77	70	320	1.10E+05	4.70E+01	40	52
BX-105	0.021	6.5	600	92	72000	60	19	67
BX-106	0.02	3.1	280	110	6.60E+04	1.20E+01	1.1	13
BX-107	0.0011	0.026	3.4	120	1.30E+04	7.00E+01	2.7	78
BX-108	0.0003	0.0045	0.44	10	2.00E+04	2.60E+00	1.7	2.9
BX-109	0.0014	0.018	1.5	14	110000	1.1	11	1.2
BX-110	0.085	17	1500	27	7.70E+03	7.30E+01	2.8	81

Tank ID	I-129 (Ci)	Ni-59 (Ci)	Ni-63 (Ci)	Pu (total) (Ci)[b]	Sr-90 (Ci)	Tc-99 (Ci)	U (total) (Ci)[c]	GTM (Mm3)[d]
BX-111	0.055	12	1000	17	4900	44	0.29	48
BX-112	0.00035	0.0083	1.1	150	4300	16	0.57	17
BY-101	0.21	59	5100	35	110000	160	5.7	170
BY-102	0.16	36	3100	84	13000	120	4.9	130
BY-103	0.23	58	5000	32	20000	170	8.5	180
BY-104	0.24	58	5300	180	330000	170	18	190
BY-105	0.32	83	7600	150	130000	46	13	130
BY-106	0.15	53	4600	32	97000	150	6.2	160
BY-107	0.16	29	2500	23	55000	96	9.3	110
BY-108	0.11	21	1800	45	110000	72	11	80
BY-109	0.18	26	2300	66	9100	110	3.5	130
BY-110	0.21	45	4100	99	140000	130	18	150
BY-111	0.22	55	5000	190	24000	160	7.5	180
BY-112	0.17	45	4100	100	20000	130	8.6	140

a. From Best Basis Inventory (BBI) Summary (February 2017). All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

b. Sum of plutonium isotopes 238, 239, 240, 241, and 242

c. Sum of uranium isotopes 232, 233, 234, 235, 236, and 238

d. The Groundwater Threat Metric (GTM) shown for tanks is equal to the maximum of the GTM for Tc-99 and I-129.

Table E.7-6. Current Primary Contaminant Inventory (by Tank) for the B-BX-BY Tank Farms (CP-TF-6) [(a)]

Tank ID	CCl4 (kg)	CN (kg)	Cr (kg)	Cr-VI (kg)	Hg (kg)	NO3 (kg)	Pb (kg)	TBP (kg)	TCE (kg)	U (total) (kg)
B-101	NR	NR	480	NR	21	91000	390	NR	NR	7600
B-102	NR	NR	170	NR	0.57	22000	43	NR	NR	390
B-103	NR	NR	310	NR	1.1	37000	83	NR	NR	2600
B-104	NR	NR	1100	NR	8.4	560000	1900	NR	NR	3800
B-105	NR	NR	1700	NR	5.8	180000	590	NR	NR	4700
B-106	NR	NR	260	NR	21	120000	210	NR	NR	6500
B-107	NR	NR	260	NR	2	160000	440	NR	NR	1900
B-108	NR	NR	130	NR	1.6	41000	970	NR	NR	1400
B-109	NR	NR	1400	NR	1.8	94000	880	NR	NR	9100
B-110	NR	NR	1000	NR	1.4	240000	670	NR	NR	260
B-111	NR	NR	1300	NR	11	95000	1800	NR	NR	230
B-112	NR	NR	420	NR	0.38	33000	170	NR	NR	57
B-201	NR	NR	480	NR	0.083	7100	41	NR	NR	22
B-202	NR	NR	340	NR	0.04	8100	87	NR	NR	43
B-203	NR	NR	680	NR	0	14000	69	NR	NR	2.2
B-204	NR	NR	710	NR	0	11000	63	NR	NR	0.0014
BX-101	NR	NR	1900	NR	33	11000	490	NR	NR	11000
BX-102	NR	NR	67	NR	7	22000	540	NR	NR	1700
BX-103	NR	NR	82	NR	2.1	15000	1100	NR	NR	1500
BX-104	NR	NR	2900	NR	8.9	30000	490	NR	NR	37000
BX-105	NR	NR	7300	NR	11	30000	480	NR	NR	7900
BX-106	NR	NR	340	NR	2.8	42000	150	NR	NR	650
BX-107	NR	NR	1800	NR	1.1	260000	120	NR	NR	4000
BX-108	NR	NR	110	NR	14	49000	110	NR	NR	2500
BX-109	NR	NR	160	NR	75	220000	740	NR	NR	17000
BX-110	NR	NR	5900	NR	0.52	440000	180	NR	NR	1200
BX-111	NR	NR	1200	NR	0.3	410000	110	NR	NR	340

Tank ID	CCl4 (kg)	CN (kg)	Cr (kg)	Cr-VI (kg)	Hg (kg)	NO3 (kg)	Pb (kg)	TBP (kg)	TCE (kg)	U (total) (kg)
BX-112	NR	NR	1200	NR	0.25	62000	130	NR	NR	840
BY-101	NR	NR	4300	NR	18	900000	610	NR	NR	7800
BY-102	NR	NR	2800	NR	0.72	180000	180	NR	NR	700
BY-103	NR	NR	5500	NR	1.1	570000	500	NR	NR	1400
BY-104	NR	NR	8700	NR	22	590000	480	NR	NR	10000
BY-105	NR	NR	1900	NR	21	1400000	430	NR	NR	9000
BY-106	NR	NR	2000	NR	14	810000	420	NR	NR	6600
BY-107	NR	NR	610	NR	7.4	330000	230	NR	NR	4500
BY-108	NR	NR	390	NR	19	230000	470	NR	NR	11000
BY-109	NR	NR	2100	NR	0.55	130000	160	NR	NR	630
BY-110	NR	NR	7500	NR	23	240000	1100	NR	NR	10000
BY-111	NR	NR	5700	NR	1.1	370000	250	NR	NR	1100
BY-112	NR	NR	33000	NR	1.5	140000	200	NR	NR	4600

a. From Best Basis Inventory (BBI) Summary (February 2017). All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

b. NR = Not reported for this EU

Table E.7-7. Summary of the Evaluation of Current Threats to Groundwater as a Protected Resource from Remaining Vadose Zone (VZ) Contamination associated with the B-BX-BY Tank and Waste Farms Evaluation Unit (CP-TF-6)

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} [d]	VZ GTM (Mm^3)	VZ Rating[e]
C-14	A	2000 pCi/L	0.25	0	1.82	1.37E+01 Ci	---	---	1.37E+01 Ci	6.87E+00	*Low*
I-129	A	1 pCi/L	0.25	0.2	1.82	2.54E-01 Ci	1.41E-01 Ci	---	1.13E-01 Ci	4.61E+01	*Medium*
Sr-90	B	8 pCi/L	0.25	22	1.82	2.11E+04 Ci	---	---	2.11E+04 Ci	1.64E+04	*ND*[f]
Tc-99	A	900 pCi/L	0.25	0	1.82	1.69E+02 Ci	5.86E+01 Ci	3.48E-02 Ci	1.11E+02 Ci	1.23E+02	*High*
CCl_4	A	5 µg/L	0.25	0	1.82	---	---	---	---	---	*ND*
CN	B	200 µg/L	0.25	0	1.82	---[g]	2.98E+03 kg	---	---	---	---[g]
Cr	B	100 µg/L	0.25	0	1.82	2.91E+04 kg	---	---	2.91E+04 kg	2.91E+02	*High*
Cr-VI	A	48 µg/L[b]	0.25	0	1.82	2.91E+04 kg	---	---	2.91E+04 kg	6.07E+02	*High*
TCE	B	5 µg/L	0.25	2	1.82	---	---	---	---	---	*ND*
U(tot)	B	30 µg/L	0.25	0.8	1.82	1.73E+04 kg	2.15E+02 kg	4.58E+01 kg	1.71E+04 kg	8.33E+01	*Medium*

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

b. "Model Toxics Control Act–Cleanup" (WAC 173-340) Method B groundwater cleanup level for hexavalent chromium. Other WQS values represent drinking water standards.

c. Treatment amounts from the 2015 Hanford Annual Groundwater Report (DOE/RL-2016-09, Rev. 0). No active remedial actions are being performed in the 200-BP GWIA.

d. The remaining vadose zone inventory is estimated by difference (CRESP 2015a; Appendix D.1) and thus has a high associated uncertainty.

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

f. Sr-90 will decay significantly over the Active and Near-term, Post-Cleanup periods but not enough to lower ratings. Transport analysis suggests that Sr-90 will be relatively immobile in the vadose zone in the future leading to an *ND* rating.

g. Though a cyanide plume is associated with the BT Cribs and B Tank farm, no source inventory data was found related to these waste sites. Cyanide could not, therefore, be rated. This is a data gap.

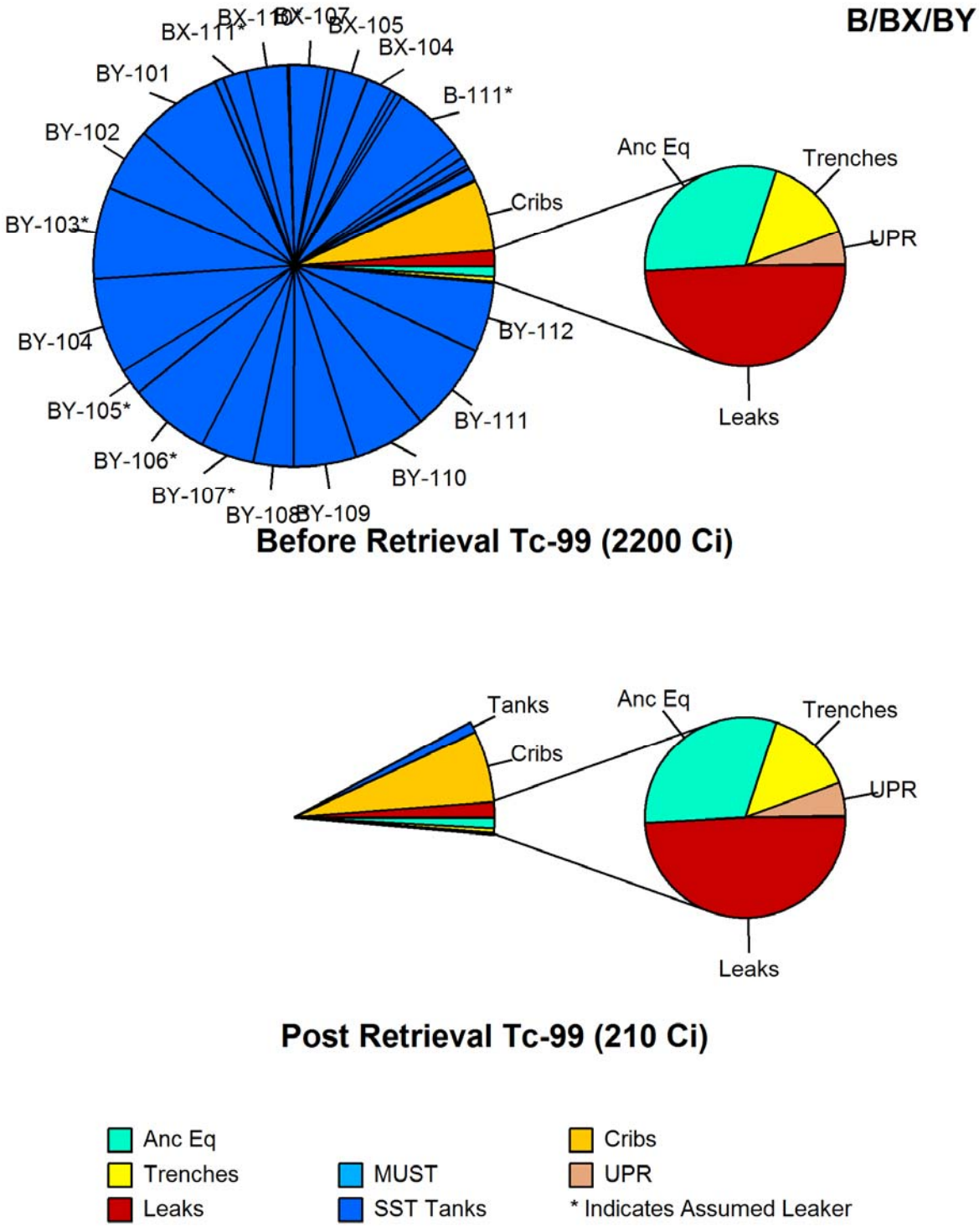


Figure E.7-3. B-BX-BY Tank and Waste Farms Evaluation Unit Inventory Estimates for Tc-99 Before and After 99% Retrieval

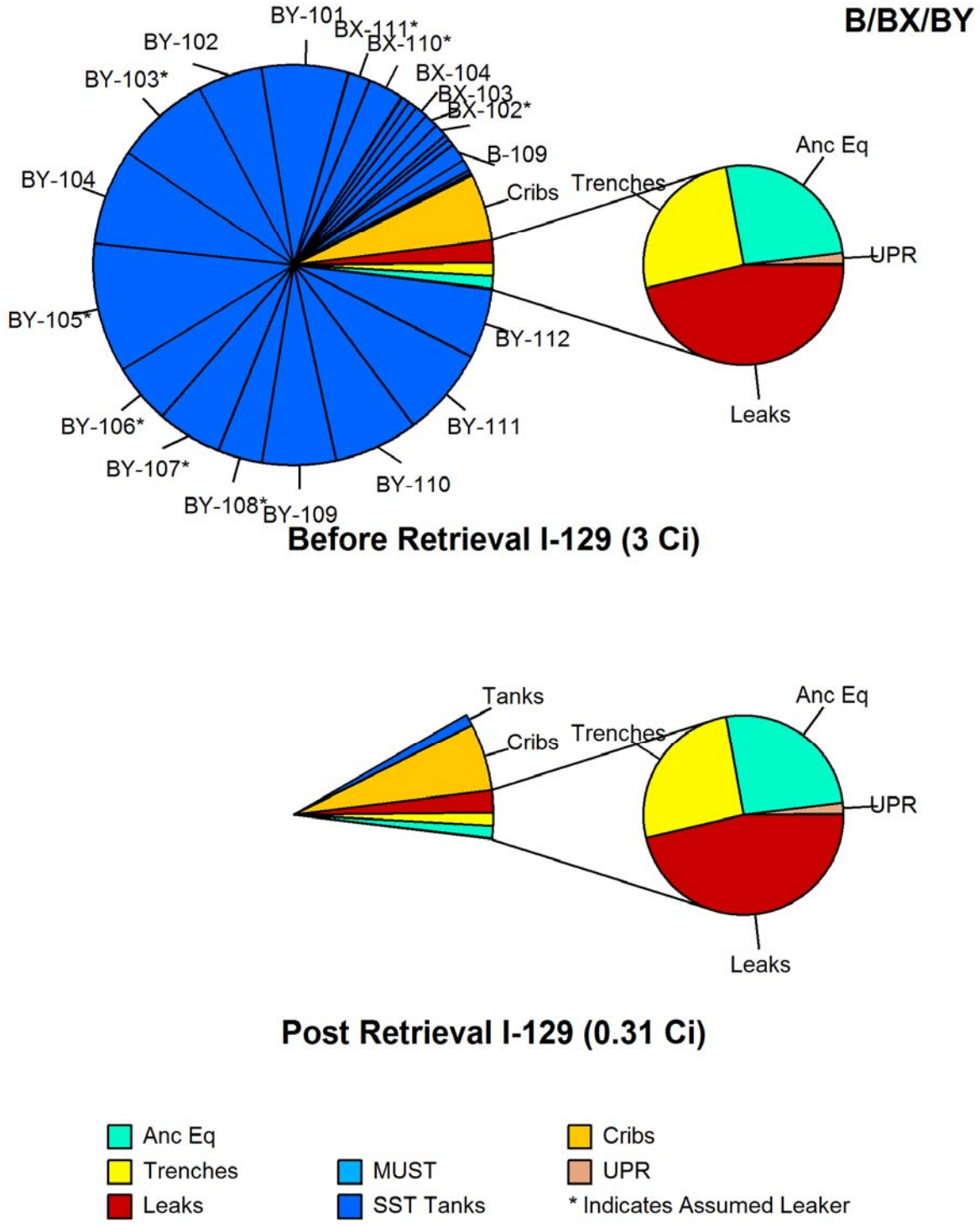


Figure E.7-4. B-BX-BY Tank and Waste Farms Evaluation Unit Inventory Estimates for I-129 Before and After 99% Retrieval

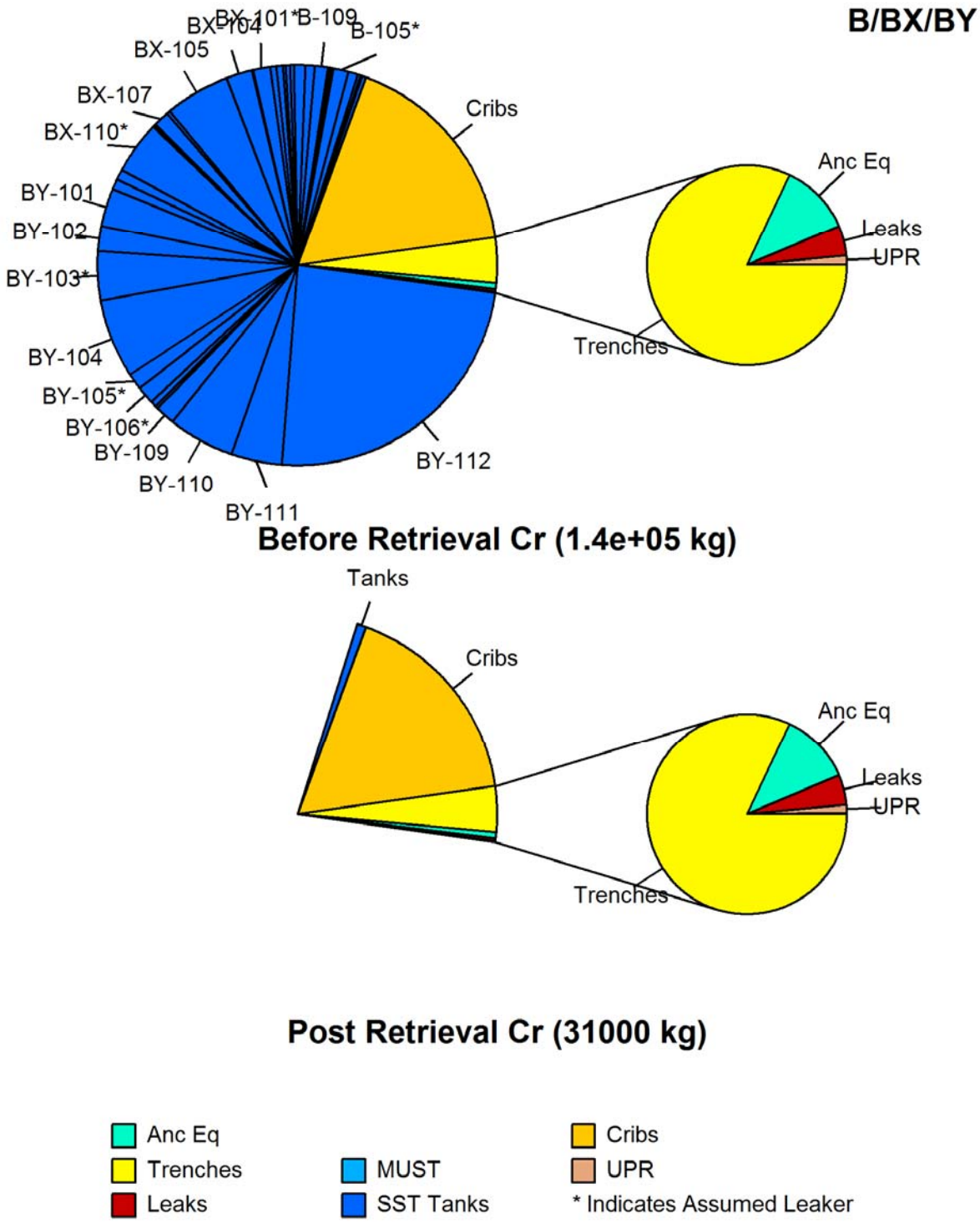


Figure E.7-5. B-BX-BY Tank and Waste Farms Evaluation Unit Inventory Estimates for Chromium Before and After 99% Retrieval

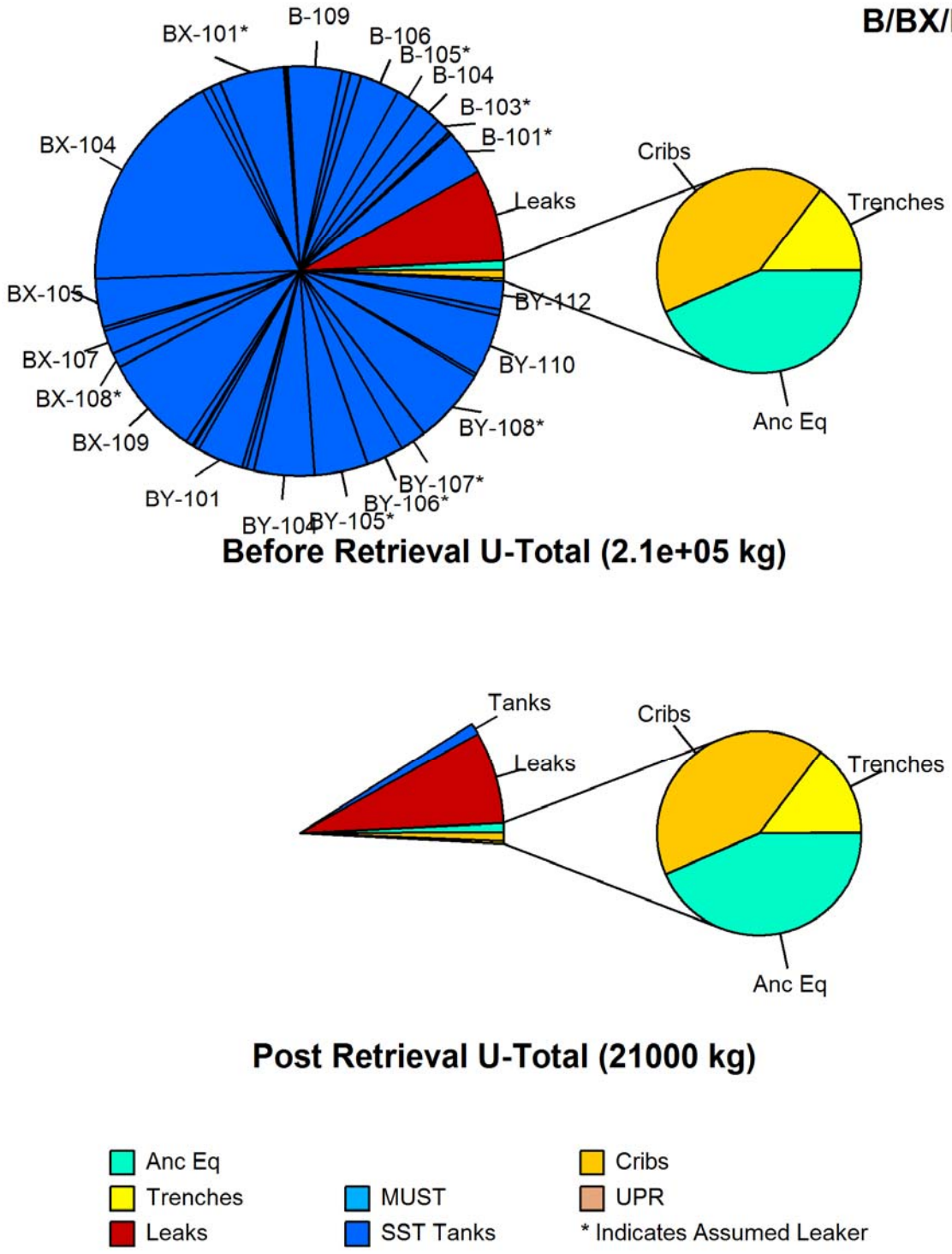


Figure E.7-6. B-BX-BY Tank and Waste Farms Evaluation Unit Inventory Estimates for U(tot) Before and After 99% Retrieval

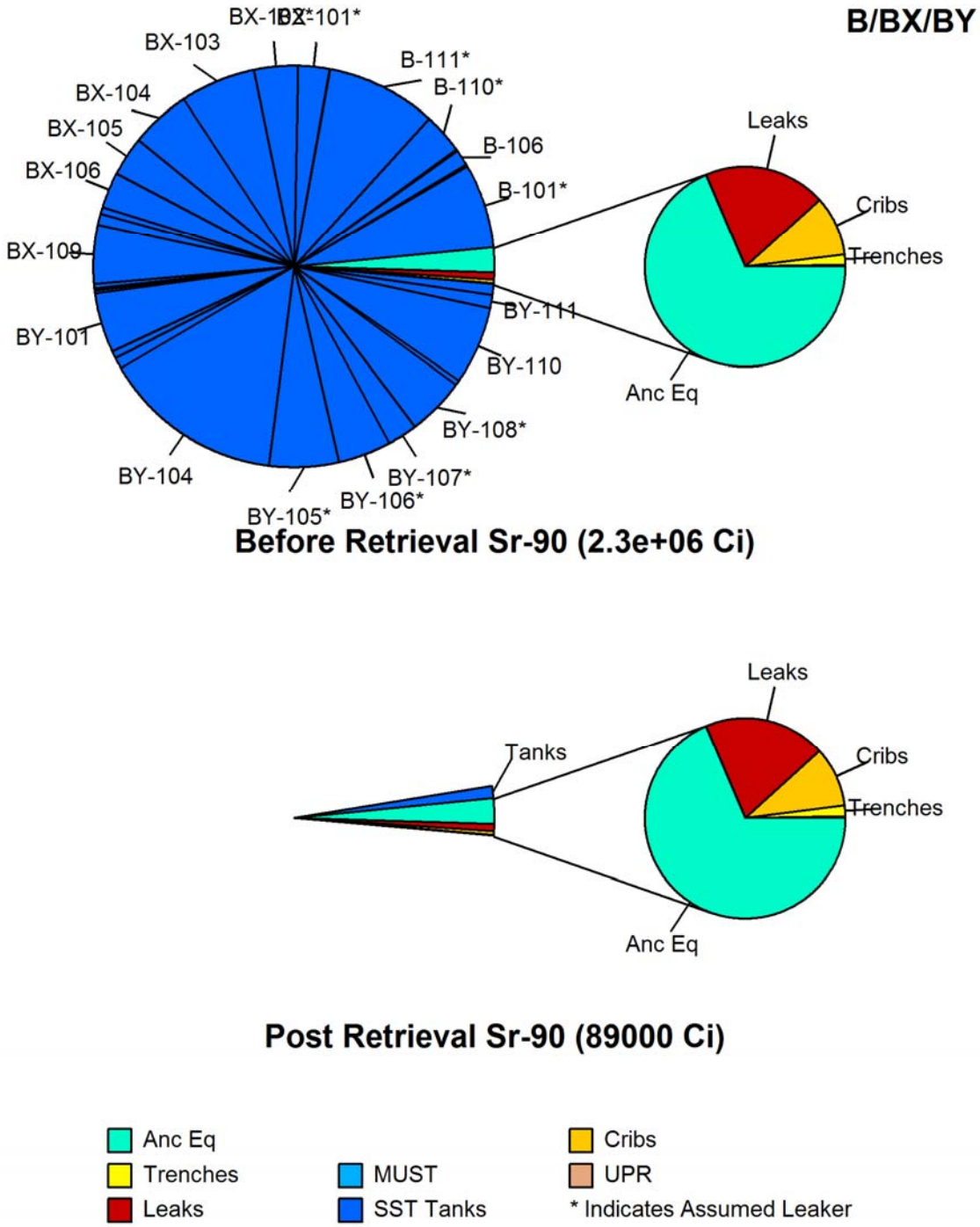


Figure E.7-7. B-BX-BY Tank and Waste Farms Evaluation Unit Inventory Estimates for Sr-90 Before and After 99% Retrieval

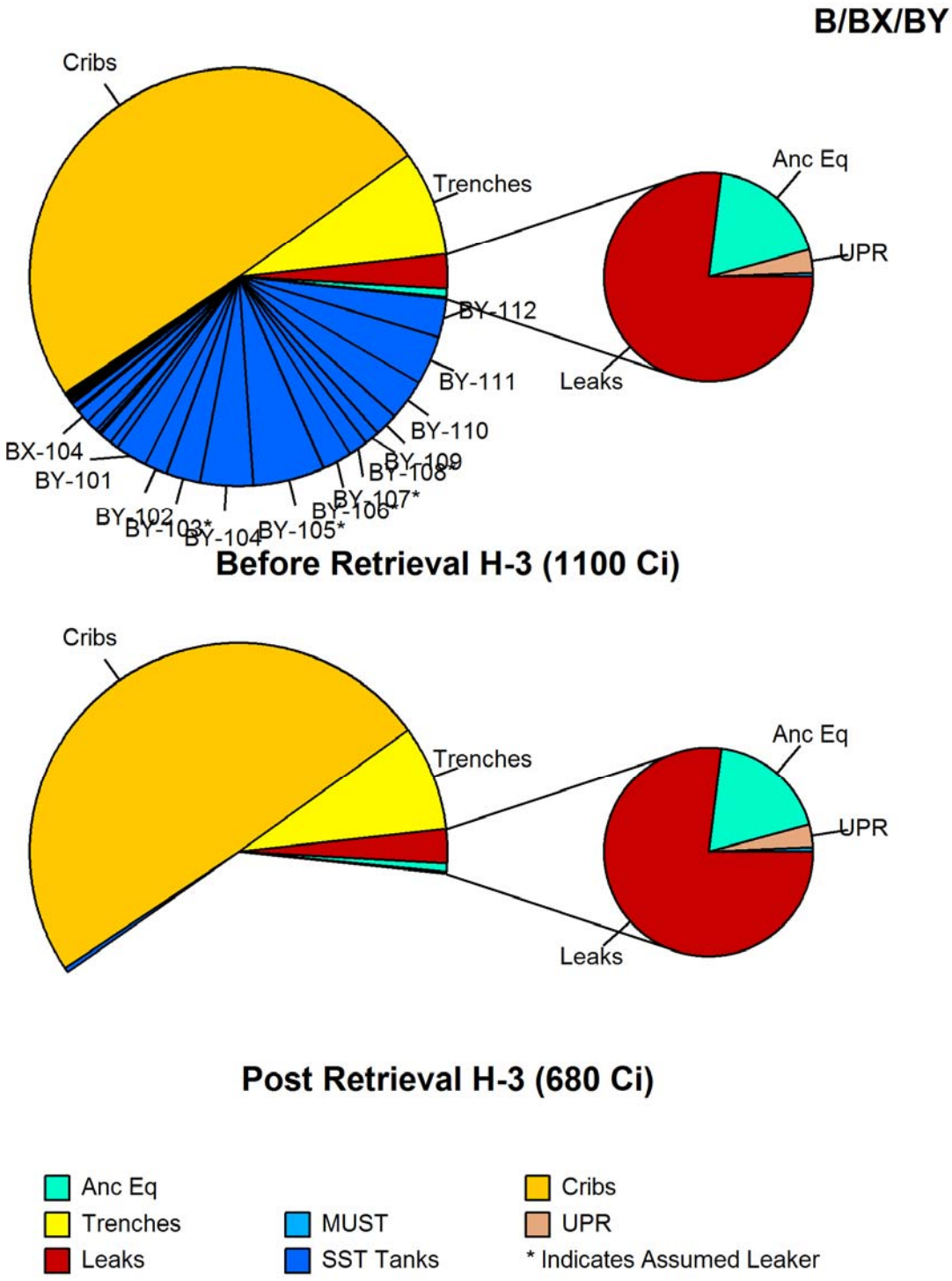


Figure E.7-8. B-BX-BY Tank and Waste Farms Evaluation Unit Inventory Estimates for Tritium (H-3) Before and After 99% Retrieval

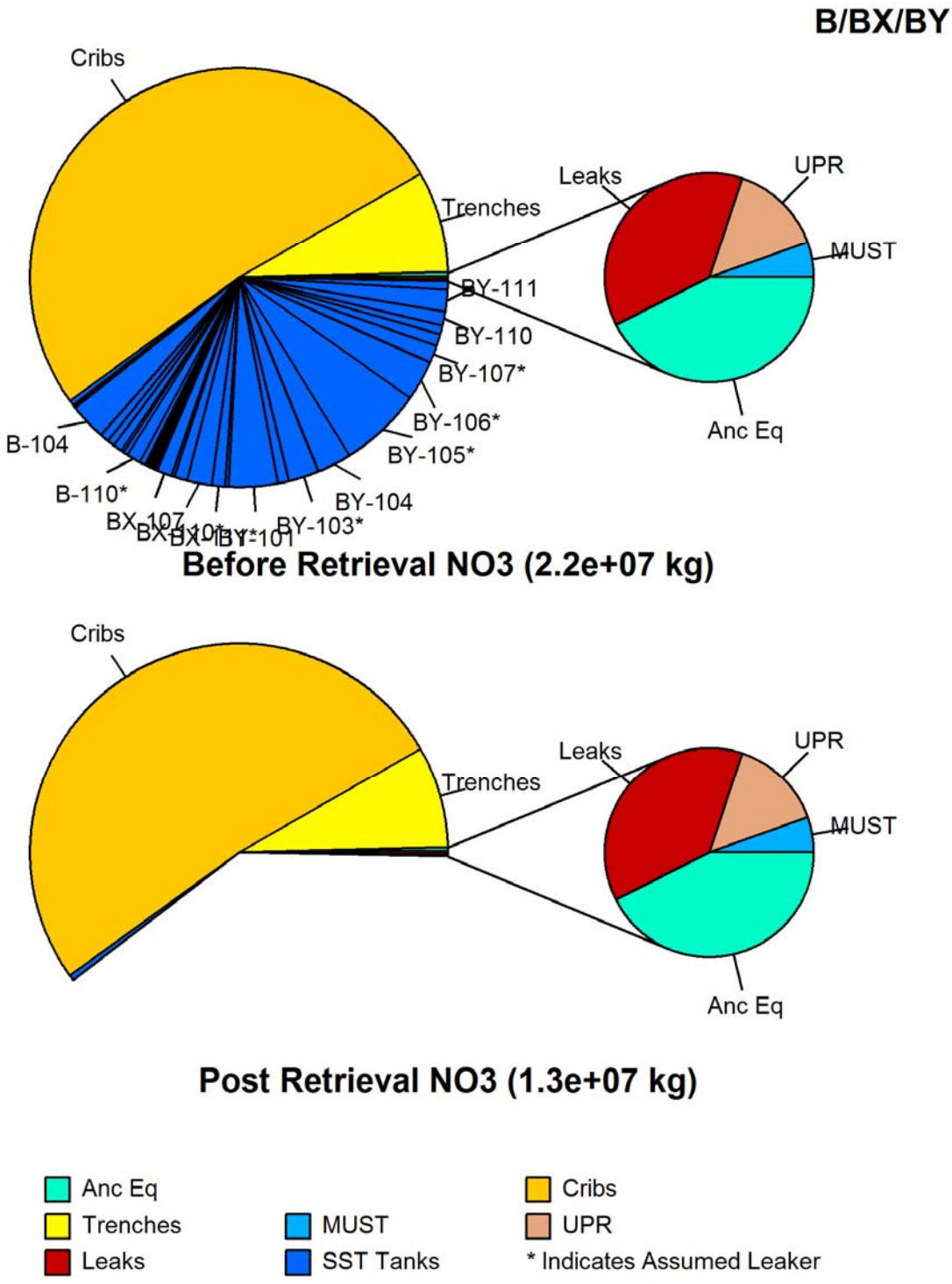


Figure E.7-9. B-BX-BY Tank and Waste Farms Evaluation Unit Inventory Estimates for Nitrate (NO3) Before and After 99% Retrieval

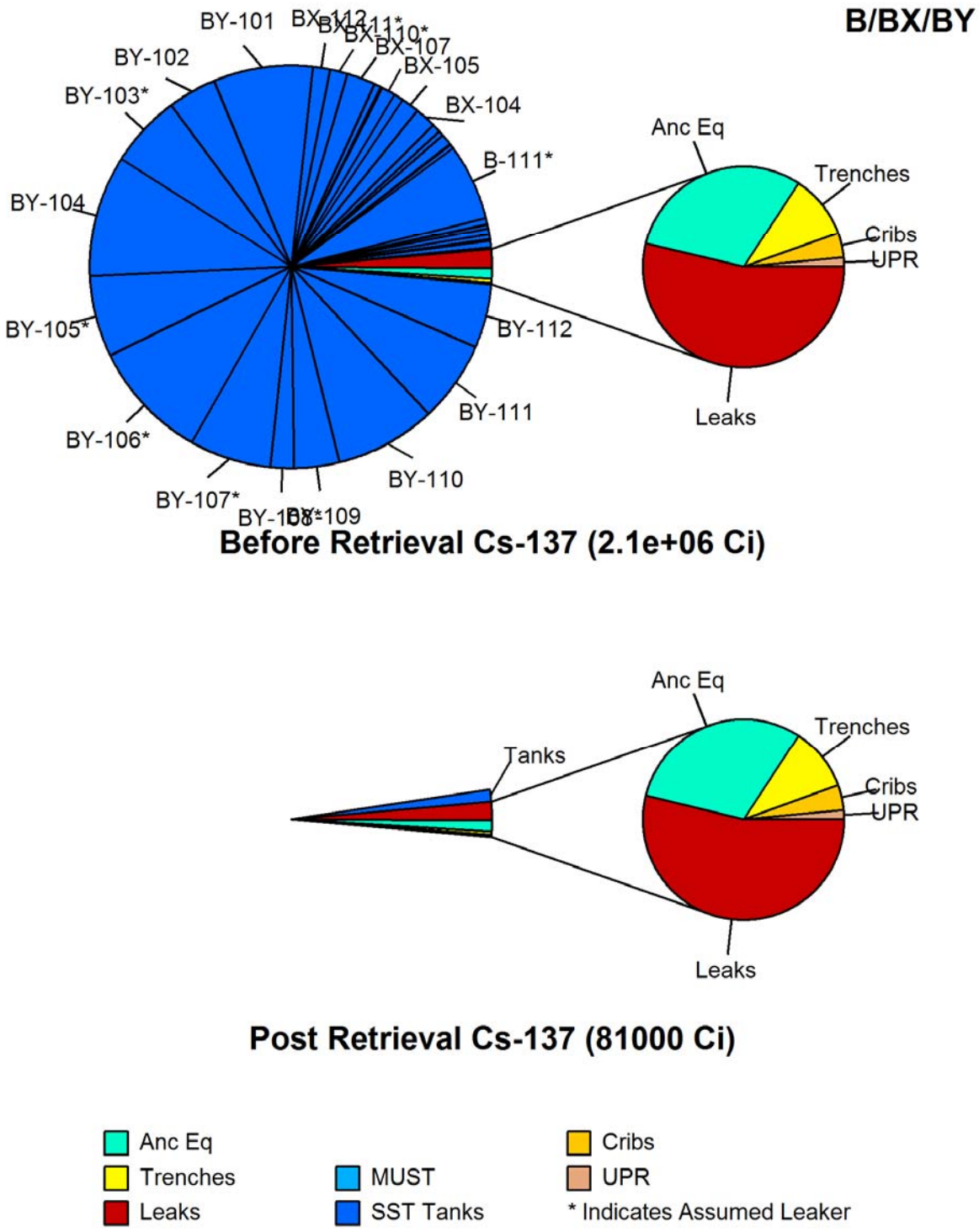


Figure E.7-10. B-BX-BY Tank and Waste Farms Evaluation Unit Inventory Estimates for Cs-137 Before and After 99% Retrieval

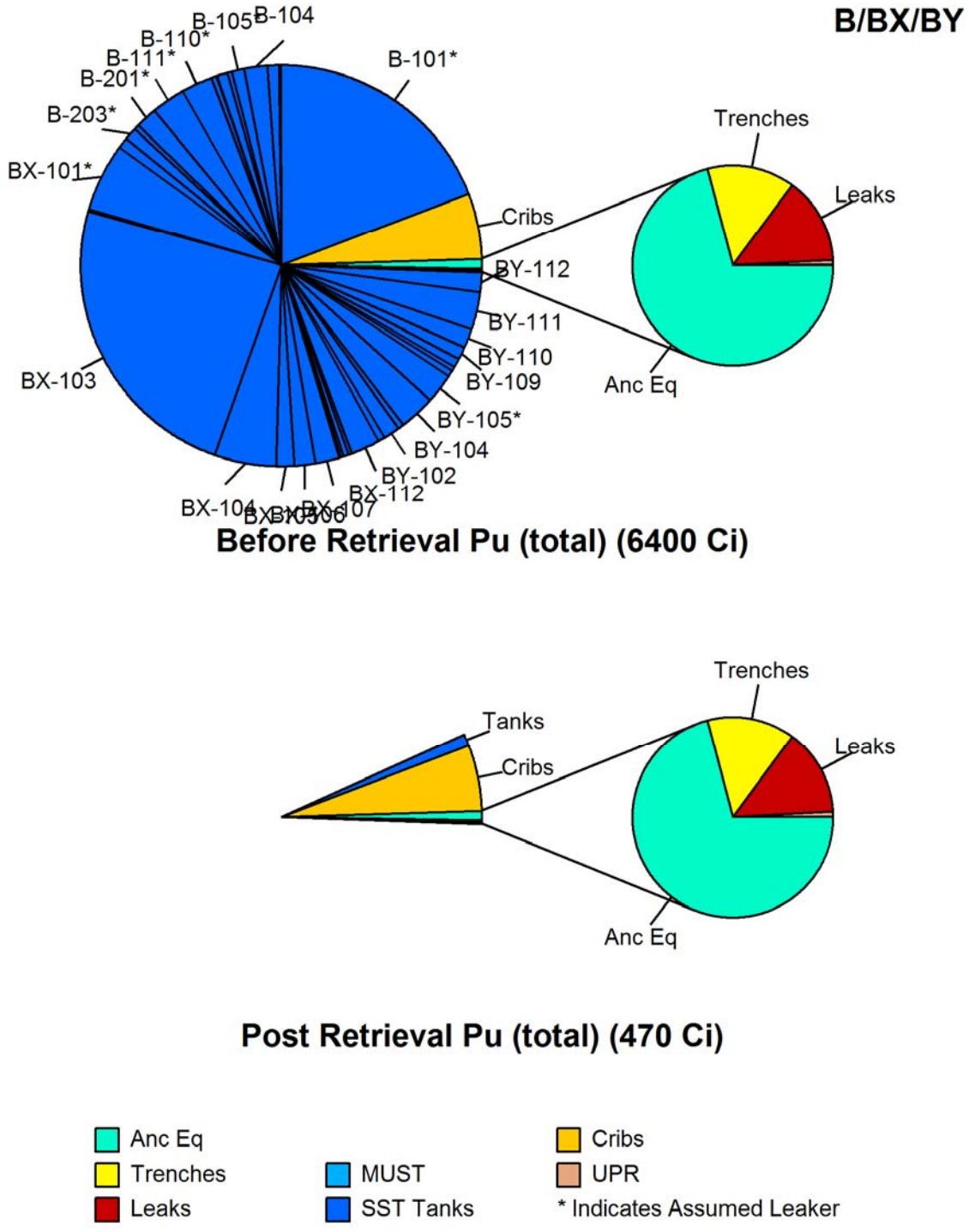


Figure E.7-11. B-BX-BY Tank and Waste Farms Evaluation Unit Inventory Estimates for Plutonium (total) Before and After 99% Retrieval

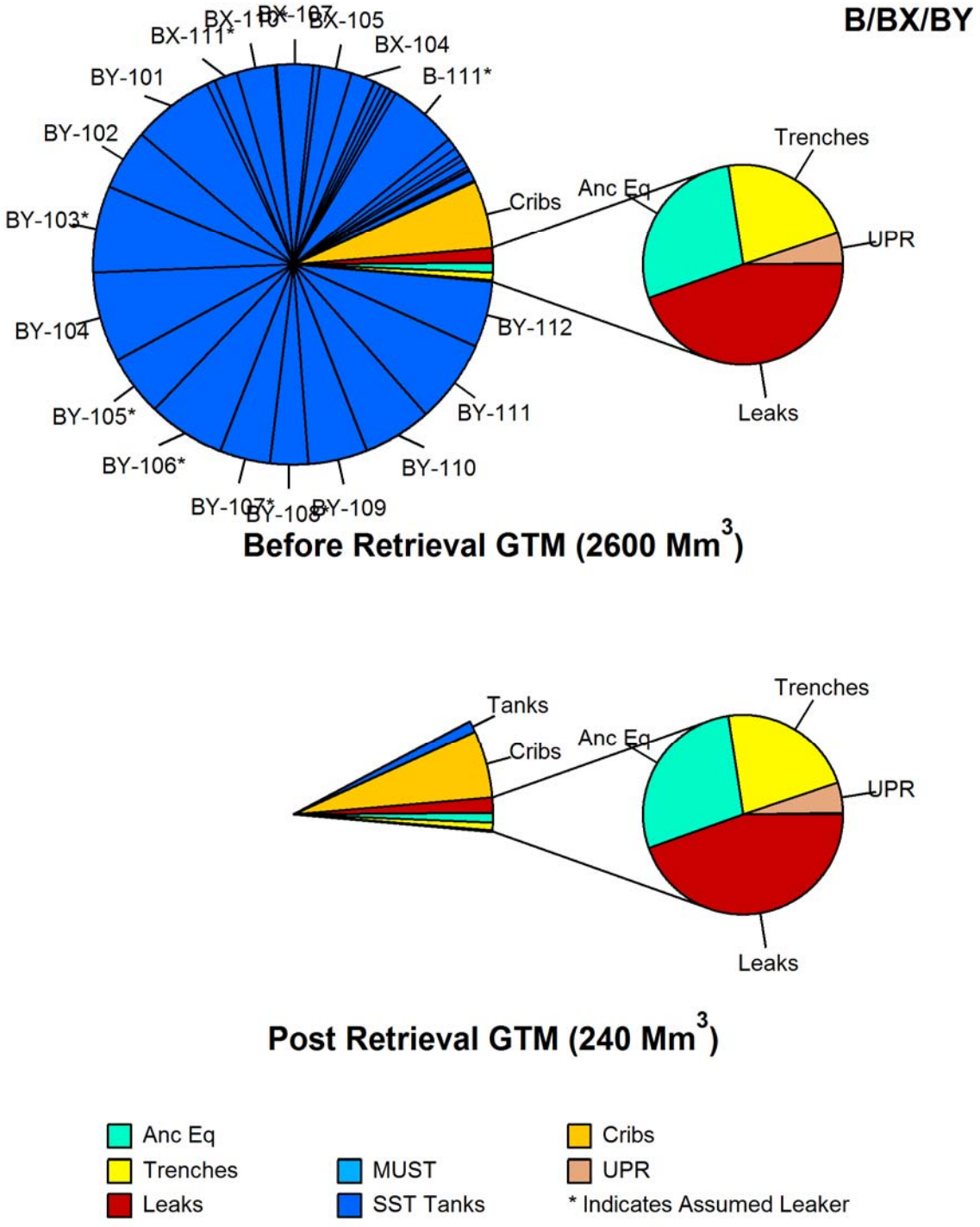


Figure E.7-12. B-BX-BY Tank and Waste Farms Evaluation Unit Maximum Groundwater Threat Metric (GTM) of I-129 and Tc-99 Estimates Before and After 99% Retrieval

E.7.6. POTENTIAL RISK/IMPACT PATHWAYS AND EVENTS

CURRENT CONCEPTUAL MODEL

A common safety analysis was performed for all the single- and double-shell tanks including pathways and barriers (safety scenarios that dominate risk, safety systems and controls, barriers to release, failure mechanisms, pathways and receptors, time frames for exposure). See Section E.1.6 in Appendix E.1 for details.

POPULATIONS AND RESOURCES CURRENTLY AT RISK OR POTENTIALLY IMPACTED

Facility Worker, Co-located Person, and Public

A common analysis was performed for the Facility Worker, Co-located Person, and Public. See Section E.1.6 (Appendix E.1) for details.

Groundwater

The current groundwater plumes (nitrate, I-129, Tc-99, total uranium, cyanide, and tritium) associated with the B-BX-BY Tank and Waste Farms EU and liquid waste disposal facilities are described in Section E.7.5 and further details including ratings are provided in the Appendix D.5 for the CP-GW-1 EU (200-BP GWIA).

As shown in Table E.7-7 (Section E.7.5), the vadose zone (VZ) GTM values for the Group A and B primary contaminants range from *Not Discernible* (*ND*) for Sr-90 (which has an inventory that would translate to a *High* rating but appears relatively immobile in the area as described in Section E.7.5) to *Low* for C-14 to *Medium* for total uranium to *High* for Tc-99, I-129, and chromium (total and hexavalent). Though a cyanide plume is associated with the BT Cribs and B Tank farm, no source inventory data was found related to these waste sites. Cyanide could not, therefore, be rated. This is a data gap. The Sr-90 will decay significantly during the Active and Near-term, Post Cleanup periods, but not sufficiently to impact future ratings; however, the transport analysis (Section E.7.5) indicates that Sr-90 would not impact groundwater within the next 150 years (impacting future ratings) resulting in a *Not Discernible* (*ND*) rating through the Active Cleanup period and *Low* afterwards (to address uncertainties). A similar transport analysis indicates that a surface barrier emplacement would result in no large uranium plume; a rating of *Low* is assigned after the Active Cleanup period to represent uncertainty. The overall current rating for groundwater impact from vadose zone sources is *High*.

Columbia River

As described in Section E.7.5, there are no plumes associated with the B-BX-BY Tank and Waste Farms EU that currently intersect the Columbia River, which corresponds to *Not Discernible* ratings for all evaluation periods.

As described in Section E.7.5, TC&WM EIS screening results indicate that peak concentrations in the nearshore region of the Columbia River were below benchmarks for wildlife receptors and benthic invertebrates and aquatic biota leading to a *Not Discernible* rating for radionuclides for both benthic and riparian receptors for all evaluation periods.

For chemicals, only nitrate and chromium (assumed hexavalent) are predicted in the TC&WM EIS to have concentrations (from sources including those other than the B-BX-BY Tank and Waste Farms EU) that could exceed thresholds in the near-shore ecology as described in Section E.7.5. Nitrate has a *Not Discernible* rating for current conditions (since the plume is not in contact with the Columbia River) for the benthic and riparian ecology as well as for the Active Cleanup and Near-term, Post-Cleanup periods.

Hexavalent chromium, which has a *Not Discernible* rating for current conditions (since the plume is not in contact with the Columbia River), would have *Medium* and High ratings for benthic and riparian zones, respectively, based on screening TC&WM EIS are instead rated ND for these receptors and time periods because recent well data suggest that the chromium plume would move toward the Columbia River at a much slower rate than predicted.

The large dilution effect of the Columbia River results in a rating of *Not Discernible* for the free-flowing ecology for all evaluation periods.

Additional information concerning potential threats to the Columbia River from B-BX-BY Tank Farm and co-located liquid waste disposal facilities is provided in the Appendix D.5 for the CP-GW-1 EU (200-BP-5 GW OU).

Ecological Resources

- Animal species (or their sign) observed during July 2014 survey include horned lark, northern pocket gopher, coyote, and black-tailed jackrabbit.
- Almost 70% of the EU consists of level 0 and level 1 habitat; level 2 habitats within the EU are fragmented by roadways, buildings, and infrastructure.
- Individual occurrences of level 3 resources associated with the sensitive plant species Piper's daisy have been previously documented at the B-BX-BY evaluation site and a single occurrence of Piper's daisy was noted within the EU during the survey. However, there are no patches of level 3 or higher habitat greater than 0.5 ac within the evaluation site;
- Cleanup activities would result in no net change in the amount of level 3 or higher habitats within a 0.97 km radius;
- Loss of individual Piper's daisy (level 3 species) from within the EU would not be expected to affect population viability for this species.
- Habitats within the B-X-BY Tank Farm are highly fragmented and lie within the 200-East Area. Loss of remaining level 2 or level 3 habitat associated with remediation actions would not be expected to significantly alter habitat connectivity outside the 200 East Area.

Cultural Resources

- There are no known recorded archaeological sites or TCPs located within the EU.
- The 242B Building Radioactive Particle Research Laboratory is a contributing property within the Manhattan Project and Cold War Era Historic District, with no documentation required, that is located within the B-BX-BY Tank and Waste Farms 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.

Archaeological sites and TCPs located within 500 meters of the EU

- Two isolated finds and one small site which may be associated with the Pre-Hanford Landscape are located within 500 meters of the B-BX-BY Tank and Waste Farms EU. All three are considered to be National Register ineligible.
- The Hanford Site Plant Railroad, a contributing property within the Manhattan Project and Cold War Era Historic District, with documentation required is located within 500 meters of the B-BX-BY Tank and Waste Farms 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.

Closest Recorded TCP

- There are two recorded TCPs associated with the Native American Precontact and Ethnographic Landscape that are visible from the B-BX-BY Tank and Waste Farms EU.

CLEANUP APPROACHES AND END-STATE CONCEPTUAL MODEL

Selected or Potential Cleanup Approaches

A common analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

Contaminant Inventory Remaining at the Conclusion of Planned Active Cleanup Period

See Section E.7.5 including Table E.7-2 and Figure E.7-3 through Figure E.7-11 for the inventory information after planned 99% retrieval. Furthermore, a more general analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

Risks and Potential Impacts Associated with Cleanup

A common analysis was performed for all the single- and double-shell tanks for workers and the Public. See Section E.1.6 (Appendix E.1) for details.

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

Facility Worker, Co-located Person, and Public

A common analysis was performed for the Facility Worker, Co-located Person, and Public. See Section E.1.6 (Appendix E.1) for details.

Groundwater

As described in Section E.7.5, there will be a continuing impact during this period to groundwater (as a protected resource) from those mobile B-BX-BY Tank and Waste Farms EU primary contaminants currently with plumes that exceed thresholds. These impacts are described in Appendix D.5 for the CP-GW-1 EU (200-BP GWIA).

Furthermore, there are primary (e.g., tank wastes) and secondary contaminant sources (legacy source sites) in the vadose zone that pose risk to groundwater. The vadose zone (VZ) GTM values for the Group A and B primary contaminants for the B-BX-BY Tank and Waste Farms EU range from *Not Discernible* (*ND*) for Sr-90 to *Low* for C-14 to *Medium* for total uranium to *High* for Tc-99, I-129, and chromium (total and hexavalent). The Sr-90 will decay significantly during these periods, but not sufficiently to impact ratings; however, the transport analysis (Section E.7.5) indicates that Sr-90 is not expected to impact groundwater in the next 150 years; however, a rating of *Low* is assigned for Sr-90 after the Active Cleanup period to address uncertainties. The total uranium would likely be less than the standard after emplacement of a surface barrier and thus the rating would be *Low* after the Active Cleanup period (also to address uncertainty). These evaluations correspond to an overall rating of *High* for the Active Cleanup and Near-Term, Post-Cleanup periods.

The final action record of decision for the 200-BP-5 OU has not been scheduled; thus groundwater will likely be treated in the future to help address the aforementioned groundwater contamination.

It is considered unlikely that additional groundwater resources would be impacted as a result of either interim remedial actions (e.g., pump and treat) or final closure activities (that are not covered in the Ecological or Cultural Resources results).

Columbia River

As described in Section E.7.5, impacts from radiological contaminants to the Columbia River benthic and riparian ecology for the Active Cleanup and Near-term, Post Cleanup periods are rated as *Not Discernible*. Nitrate has a rating of *Not Discernible* for the benthic and riparian ecology for the Active Cleanup and Near-term, Post Cleanup periods. Chromium (assumed hexavalent) would have ratings of *Medium* and *High* for the benthic and riparian zone receptors, respectively, based on the TC&WM EIS screening analysis; however, recent well data suggests that a chromium plume from this area would move toward the Columbia River as a much slower rate than that predicted resulting in *Not Discernible* ratings for these receptors and evaluation periods. The large dilution effect of the Columbia River on the contamination from the seeps and groundwater upwellings produces *Not Discernible* ratings for all contaminants for the Active Cleanup and Near-term, Post Cleanup periods.

Additional information on groundwater plumes and potential threats associated with the B-BX-BY Tank Farm and liquid waste disposal facilities are described in Appendix D.5 for the CP-GW-1 EU (200-BP GWIA).

It is considered unlikely that additional benthic or riparian resources would be impacted as a result of either interim remedial actions (e.g., pump and treat) or final closure activities (that are not covered in the Ecological or Cultural Resources results).

Ecological Resources

See Section E.1.6 (Appendix E.1) for details.

Cultural Resources

See Section E.1.6 (Appendix E.1) for details.

ADDITIONAL RISKS AND POTENTIAL IMPACTS IF CLEANUP IS DELAYED

A common analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

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

A common analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

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

Table E.7-8. Summary of Populations and Resources at Risk or Potentially Impacted after Cleanup

Population or Resource		Impact Rating	Comments
Human	Facility Worker	Low	Workers will be low risk from exposure to direct radiation and waste contaminants after waste retrieval, grouting, and capping.
	Co-located Person	Low	These persons will be at low risk from exposure to direct radiation and waste contaminants after waste retrieval, grouting, and capping.
	Public	Not Discernible (ND)	The Tank Farms will be in secure and controlled areas that prevent intentional and inadvertent intruders. No complete groundwater pathway and no impact from air pathway.
Environmental	Groundwater (A&B) from vadose zone[a]	*Low* (Sr-90, C-14, and U(tot)) *High* (Tc-99, I-129, Cr-tot, Cr-VI) **Overall**: *High*	Current GTM values for Group A and B primary contaminants (Table E.7-7): *ND* (Sr-90), *Low* (C-14), *Medium* (U(tot)) and *High* (Tc-99, I-129, total and hexavalent chromium). Little predicted impact from changes in recharge rates and transport consideration to impact ratings for Tc-99, I-129, total and hexavalent chromium transport. Recharge rate impacts uranium rating (*Medium* to *Low*) and transport considerations result in Sr-90 rating of *Low* to address uncertainty. Cyanide could not be rated because no source inventory related to these waste sites could be found. This is a data gap.
	Columbia River from vadose zone[a]	Benthic: *ND* (radionuclides) *ND* (chemicals) Riparian: *ND* (radionuclides) *ND* (chemicals) Free-flowing: *ND* (all)	TC&WM EIS screening results used to evaluate benthic and riparian receptors (Section E.7.5). Only nitrate (*ND* for both benthic and riparian) and hexavalent chromium (*Medium* for benthic and *High* for riparian) are predicted to have concentrations

Population or Resource		Impact Rating	Comments
		Overall: *ND*	(including sources other than B-BX-BY) that could threaten the near-shore ecology. However, well data indicate slower movement of chromium toward the river resulting in *ND* ratings. Dilution factor of greater than 100 million between River and upwelling.
	Ecological Resources[b]	ND to Low	Continued monitoring could result in some disturbance to EU, and buffer lands. Remediation may improve habitat (and increased monitoring may lead to increases in exotic species or changes in vegetation species composition).
Social	Cultural Resources[b]	**Native American:** Direct: Unknown Indirect: Known **Historic Pre-Hanford:** Direct: Known Indirect: Unknown **Manhattan/Cold War**: Direct: None Indirect: None	Permanent indirect effects to viewshed are possible from capping. Permanent effects may be possible due to presence of contamination if capping occurs. No other expected cultural resources impacts.

a. Groundwater threat for Group A and B contaminants remaining in the vadose zone or to the Columbia River for all primary contaminants. Threats from existing plumes associated with the B-BX-BY Tank and Waste Farms EU are described in Section E.7.5 and Appendix D.5 (CP-GW-1) for the 200-BP Groundwater Interest Area.

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

As described in Section E.7.5, the TC&WM ecological screening analysis indicate that that exposure to radioactive contaminants from peak groundwater discharge was below screening levels at the Columbia River near-shore region, indicating there should be no expected adverse effects from radionuclides. Furthermore, results of the corresponding TC&WM screening evaluation for chemicals indicated that predicted chromium and nitrate concentrations could exceed screening values (i.e., Hazard Quotient of unity) in the near-shore region. The predicted nitrate peak concentration was in the past and would be unlikely to exceed human or aquatic standards in the future. On the other hand, unless treated chromium (assumed hexavalent) may impact benthic and riparian receptors (i.e., concentrations could exceed screening levels). This is consistent with the evaluation in the TC&WM EIS.

For more information, see Section E.1.6.

E.7.7. SUPPLEMENTAL INFORMATION AND CONSIDERATIONS

A common analysis was performed for all the single- and double-shell tanks. See Section E.1.7 for details.

E.7.8. ATTACHMENT – B-BX-BY TANK FARMS EVALUATION UNIT WIDS REVIEW

Hanford Site-Wide Risk Review

Evaluation Unit:	B-BX-BY Tank Farms
ID:	CP-TF-6
Group:	Tank Farm
Operable Unit Cross-Walk:	WMA B/BX/BY 200-DV-1 200-EA-1
Related EU:	CP-LS-7 CP-GW-1
Sites & Facilities:	B-BX-BY tank farms, ancillary structures, associated liquid waste sites, and associated soils contamination.
Key Data Sources Docs:	RPP-13033 RPP-23405 RPP-40545 RPP-PLAN-40145 RPP-10435

Figure 1. Site Map with Evaluation Unit Boundaries and Tank Locations

Attached:

- Waste Site and Facility List
- Site Map with Evaluation Unit Boundaries and Associated Waste Sites
- Site Map with Evaluation Unit Boundaries and Associated Facilities

Prepared by: AMG, 08/29/2014
Reviewed by: GVL, 08/29/2014
Revisions: AMG, 09/10/2014

Hanford Site-Wide Risk Review
CP-TF-6 (B-BX-BY Tank Farms)
Waste Site and Facility List

Site Code	Name, Aliases, Description	Site Status	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation
200-E-105	200-E-105; Soil Contamination Area on the 216-B-61 Crib	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
200-E-114-PL	200-E-114-PL; 216-BC-2805; 2805-E1, 2805-E2, 2805-E3 and 2805-E4; Pipeline from 216-BY-201 to 216-BC-201; Pipeline from 241-BY Tank Farm to 241-C Tank Farm and BC Cribs Trenches	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	200-BC-1	
200-E-120	200-E-120; Contaminated Soil at 241-B Tank Farm; Contamination Migration Beyond the 241-B fence	Inactive	Contamination Migration	Unplanned Release - Surface/Near Surface	WMA B/BX/B	
200-E-121	200-E-121; Soil Contamination Area East and West of Baltimore Avenue	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	200-EA-1	
200-E-132	200-E-132; 241-BX/BY Tank Farm Contaminated Soil; Contamination Migration Beyond the 241-BX/BY fence	Inactive	Contamination Migration	Unplanned Release - Surface/Near Surface	WMA B/BX/B	
200-E-176-PL-A	200-E-176-PL-A; Pipeline from 242-B to 216-B-11-A&B, Portion of pipeline outside the 241-B fence	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-176-PL-B	200-E-176-PL-B; Pipeline from 242-B to 216-B-11-A&B, Portion of pipeline inside the 241-B fence	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-177-PL	200-E-177-PL; Pipeline Rerouting Waste from 216-B-8 Crib Pipeline to 216-B-11A&B Reverse Wells	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-178-PL	200-E-178-PL; Pipeline from Tank 241-B-110 to 216-B-8 Crib and Tile Field	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-180-PL	200-E-180-PL; 216-B-57 Crib Pipeline	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-191-PL	200-E-191-PL; 216-B-63 Pipeline; Pipeline from 207-B Valve Pit to 216-B-63 Ditch	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-197-PL	200-E-197-PL; Encased Pipelines Between 241-BR-152 Diversion Box and 241-B Tank Farm; Lines 9002, 9006, 9010, 9014, 9017, 9020, 9031, 9032, 9035, 9037, 9038, 9041, 9044 and 9047	Inactive	Encased Tank Farm Pipeline	Pipeline and associated valves, etc.	WMA B/BX/B	
200-E-199-PL	200-E-199-PL; Lines V204, V206, V208, V209, V211, V213, V215, and V285; Tank Farm Lines from 241-B-154 Diversion Box to 241-B Tank Farm	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-201-PL	200-E-201-PL; Lines V315 and V319; Transfer Lines from 241-BX-155 to Diversion Boxes in 241-B Tank Farm	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-202-PL	200 E 202 PL; Lines V315, V316, V317, V318 and V319; Transfer Lines from 241-BX-155 Diversion Box to 241-BX-153 Diversion Box	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-203-PL	200-E-203-PL; Line 9712; Pipeline from 241-BYR-154 Diversion Box to 216-B-2-2 Ditch	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-204-PL	200-E-204-PL; Pipeline to 216-B-2-1 and 216-B-2-2 Ditches	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-208-PL	200-E-208-PL; Lines V304 and V305 from 241-BY Tank Farm to 241-B-252 Diversion Box	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	WMA B/BX/B	
200-E-216-PL	200-E-216-PL; Lines V235, V236, V237, V242, C251, V252, and V253; Transfer Lines Between 241-BX-153, 241-B-151 and 241-B-152 Diversion Boxes	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	WMA B/BX/B	
200-E-217-PL	200-E-217-PL; Encased Transfer Line from 241-ER-151 Diversion Box to 241-BX Tank Farm; Lines 9808, 9653, 9719 and V225	Inactive	Encased Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-219-PL	200-E-219-PL; BY Crib Distribution Pipelines; Pipelines from 216-BY-201 Flush Tank to 216-B-43, 216-B-44, 216-B-45, 216-B-46, 216-B-47, 216-B-48, 216-B-49, and 216-B-50 Cribs	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	

Note that only those waste sites with a WIDS (Waste Information Data System) Classification of "Accepted" are shown, along with non-duplicate facilities, identified via the Hanford Geographic Information System (HGIS).

Hanford Site-Wide Risk Review
CP-TF-6 (B-BX-BY Tank Farms)
Waste Site and Facility List

Site Code	Name, Aliases, Description	Site Status	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation
200-E-220-PL	200-E-220-PL; Pipeline from 241-BY Tank Farm to 216-BY-201 Flush Tank and Monitoring Pit	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-221-PL	200-E-221-PL; BC Crib Pipeline Drain Line; Pipeline to 216-B-51 French Drain	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-264-PL	200-E-264-PL; Pipeline from 242-B Evaporator Building to 207-B Retention Basin	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-265-PL	200-E-265-PL; 241-BY and 241-BX Tank Farm Cooling Water Pipeline to 207-B Retention Basin	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-281-PL	200-E-281-PL; Line V306; Pipeline from 241-B Tank Farm to 216-B-7A and 216-B-7B Cribs	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-284	200-E-284; Septic Tank East of 241-BY-102	Inactive	Septic Tank	Septic System	TBD	X
200-E-45	200-E-45; Contaminated Pump Run-in Caisson; Health Instrument Shaft; HI Shaft	Inactive	Silo	Crib - Subsurface Liquid Disposal Site	200-DV-1	
200-E-59	200-E-59; 241-BY-ITS2 Condenser Vessel; 241-BY-ITS2-TK-1; IMUST; ITS-2	Inactive	Storage Tank	Underground Storage Tank	WMA B/BX/B	
200-E-60	200 E 60; 241 BY ITS2 Heater Flush Tank; 241 BY ITS2 TK 2; IMUST; Inactive Miscellaneous Underground Storage Tank; ITS-2	Inactive	Storage Tank	Underground Storage Tank	WMA B/BX/B	
216-B-11A&B	216-B-11A&B; 216-B-11B; 242-B-1 Crib; 216-B-11 Crib; 216-B-11A & B	Inactive	French Drain	Crib - Subsurface Liquid Disposal Site	200-DV-1	
216-B-35	216-B-35; 216-B-35 Trench; 216-BX-1 Trench; 241-BX-1 Grave	Inactive	Trench	Crib - Subsurface Liquid Disposal Site	200-DV-1	
216-B-36	216-B-36; 216-B-36 Trench; 216-BX-2 Trench; 241-BX-2 Grave	Inactive	Trench	Crib - Subsurface Liquid Disposal Site	200-DV-1	
216-B-37	216-B-37; 216-B-37 Trench; 216-BX-3 Trench; 241-BX-3 Grave	Inactive	Trench	Crib - Subsurface Liquid Disposal Site	200-DV-1	
216-B-38	216-B-38; 216-B-38 Trench; 216-BX-4 Trench; 241-BX-4 Grave	Inactive	Trench	Crib - Subsurface Liquid Disposal Site	200-DV-1	
216-B-39	216-B-39; 216-B-39 Trench; 216-BX-5 Trench; 241-BX-5 Grave	Inactive	Trench	Crib - Subsurface Liquid Disposal Site	200-DV-1	
216-B-40	216-B-40; 216-B-40 Trench; 216-BX-6 Trench; 241-BX-6 Grave; 241-BX-6 Trench	Inactive	Trench	Crib - Subsurface Liquid Disposal Site	200-DV-1	
216-B-41	216-B-41; 216-B-41 Trench; 216-BX-7 Trench; 241-BX-7 Grave	Inactive	Trench	Crib - Subsurface Liquid Disposal Site	200-DV-1	
216-B-42	216-B-42; 216-B-42 Trench; 216-BX-8 Trench; 241-BX-8 Grave	Inactive	Trench	Crib - Subsurface Liquid Disposal Site	200-DV-1	
216-B-43	216-B-43; 216-BY-1 Cavern; 216-BY-1 Crib	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	200-DV-1	
216-B-44	216-B-44; 216-BY-2 Cavern; 216-BY-2 Crib	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	200-DV-1	
216-B-45	216-B-45; 216-BY-3 Cavern; 216-BY-3 Crib	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	200-DV-1	
216-B-46	216-B-46; 216-BY-4 Cavern; 216-BY-4 Crib	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	200-DV-1	
216-B-47	216-B-47; 216-BY-5 Cavern; 216-BY-5 Crib	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	200-DV-1	
216-B-48	216-B-48; 216-BY-6 Cavern; 216-BY-6 Crib	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	200-DV-1	
216-B-49	216-B-49; 216-BY-7 Cavern; 216-BY-7 Crib	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	200-DV-1	
216-B-50	216-B-50; 216-BY-8 Cavern; 216-BY-8 Crib	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	200-DV-1	
216-B-51	216-B-51; 216-BY-9 Crib	Inactive	French Drain	Crib - Subsurface Liquid Disposal Site	200-EA-1	
216-B-57	216-B-57; 216-B-57 Enclosed Trench; Hanford Prototype Barrier; 200-BP-1 Prototype Barrier	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	200-DV-1	
216-B-61	216-B-61; 216-B-61 Crib	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	Not Applic	
216-B-7A&B	216-B-7A&B; 216-B-7B Sump; 241-B-1 and 2 Cribs; 241-B-201 Crib; 216-B-7 Crib; 216-B-7A & B; 216-B-7A Sump	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	200-DV-1	
216-B-8	216-B-8; 216-B-8TF; 241-B-3 Crib	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	200-DV-1	
216-BY-201	216-BY-201; 216-BY-47; 241-BY Flush Tank; IMUST; Inactive Miscellaneous Underground Storage Tank; Supernatant Disposal Flush Tank	Inactive	Settling Tank	Underground Storage Tank	200-EA-1	
241-B-101	241-B-101; 241-B-TK-101	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	

Note that only those waste sites with a WIDS (Waste Information Data System) Classification of "Accepted" are shown, along with non-duplicate facilities, identified via the Hanford Geographic Information System (HGIS).

Hanford Site-Wide Risk Review
CP-TF-6 (B-BX-BY Tank Farms)
Waste Site and Facility List

Site Code	Name, Aliases, Description	Site Status	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation
241-B-102	241-B-102; 241-B-TK-102	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-B-103	241-B-103; 241-B-TK-103	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-B-104	241-B-104; 241-B-TK-104	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-B-105	241-B-105; 241-B-TK-105	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-B-106	241-B-106; 241-B-TK-106	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-B-107	241-B-107; 241-B-TK-107	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-B-108	241-B-108; 241-B-TK-108	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-B-109	241-B-109; 241-B-TK-109	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-B-110	241-B-110; 241-B-TK-110	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-B-111	241-B-111; 241-B-TK-111	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-B-112	241-B-112; 241-B-TK-112	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-B-151	241-B-151; 241-B-151 Diversion Box	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA B/BX/B	
241-B-152	241-B-152; 241-B-152 Diversion Box	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA B/BX/B	
241-B-153	241-B-153; 241-B-153 Diversion Box	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA B/BX/B	
241-B-201	241-B-201; 241-B-TK-201	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241 B 202	241-B-202; 241-B-TK-202	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-B-203	241-B-203; 241-B-TK-203	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-B-204	241-B-204; 241-B-TK-204	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-B-252	241-B-252; 241-B-252 Diversion Box	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA B/BX/B	
241-B-301	241-B-301; 241-B-301B; 241-B-301-B Catch Tank; Drain Lines V238 and V312; IMUST; Inactive Miscellaneous Underground Storage Tank	Inactive	Catch Tank	Underground Storage Tank	WMA B/BX/B	
241-BR-152	241-BR-152; 241-BR-152 Diversion Box	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA B/BX/B	
241-BX-101	241-BX-101; 241-BX-TK-101	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-BX-102	241-BX-102; 241-BX-TK-102	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-BX-103	241-BX-103; 241-BX-TK-103	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-BX-104	241-BX-104; 241-BX-TK-104	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-BX-105	241-BX-105; 241-BX-TK-105	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-BX-106	241-BX-106; 241-BX-TK-106	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-BX-107	241-BX-107; 241-BX-TK-107	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-BX-108	241-BX-108; 241-BX-TK-108	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-BX-109	241-BX-109; 241-BX-TK-109	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-BX-110	241-BX-110; 241-BX-TK-110	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-BX-111	241-BX-111; 241-BX-TK-111	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-BX-112	241-BX-112; 241-BX-TK-112	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-BX-153	241-BX-153; 241-BX-153 Diversion Box	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA B/BX/B	
241-BX-302A	241-BX-302A; 241-BX-302-A Catch Tank; 9053; 9253; 9453; Drain Lines V357; IMUST; Inactive Miscellaneous Underground Storage Tank	Inactive	Catch Tank	Underground Storage Tank	WMA B/BX/B	
241-BXR-151	241-BXR-151; 241-BXR-151 Diversion Box	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA B/BX/B	
241-BXR-152	241-BXR-152; 241-BXR-152 Diversion Box	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA B/BX/B	
241-BXR-153	241-BXR-153; 241-BXR-153 Diversion Box; Line 9453	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA B/BX/B	
241-BY-101	241-BY-101; 241-BY-TK-101	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-BY-102	241-BY-102; 241-BY-TK-102	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-BY-103	241-BY-103; 241-BY-TK-103	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-BY-104	241-BY-104; 241-BY-TK-104	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-BY-105	241-BY-105; 241-BY-TK-105	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	

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Hanford Site-Wide Risk Review
CP-TF-6 (B-BX-BY Tank Farms)
Waste Site and Facility List

Site Code	Name, Aliases, Description	Site Status	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation
241-BY-106	241-BY-106; 241-BY-TK-106	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-BY-107	241-BY-107; 241-BY-TK-107	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-BY-108	241-BY-108; 241-BY-TK-108	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-BY-109	241-BY-109; 241-BY-TK-109	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-BY-110	241-BY-110; 241-BY-TK-110	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-BY-111	241-BY-111; 241-BY-TK-111	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-BY-112	241-BY-112; 241-BY-TK-112	Inactive	Single-Shell Tank	Underground Storage Tank	WMA B/BX/B	
241-BYR-152	241-BYR-152; 241-BYR-152 Diversion Box	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA B/BX/B	
241-BYR-153	241-BYR-153; 241-BYR-153 Diversion Box	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA B/BX/B	
241-BYR-154	241-BYR-154; 241-BYR-154 Diversion Box	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA B/BX/B	
242-B	242-B; 242-B Evaporator	Inactive	Evaporator	Process Building	Not Applic	
242-B-151	242-B-151; 242-B Evaporator Building Diversion Box	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA B/BX/B	
244-BX DCRT	244-BX DCRT; 244-BX Double-Contained Receiver Tank; 244-BX Receiver Tank; 244-BX Receiver Vault; 244-BX RT; 244-BX-TK/SMP	Inactive	Receiver Tank	Underground Storage Tank	WMA B/BX/B	
244-BXR VAULT	244-BXR Vault; 244-BXR VAULT; IMUST; Inactive Miscellaneous Underground Storage Tank; Lines 9765 and 7453; 244-BXR Receiving Vault	Inactive	Receiving Vault	Underground Storage Tank	WMA B/BX/B	
2607-E9	2607-E9; 2607-E9 Septic System; 242B/BL Septic Tank and Drain Field	Inactive	Septic Tank	Septic System	200-EA-1	X
2607-EB	2607-EB; 241-BY-254 (ITS #2) Sanitary Septic System	Inactive	Septic Tank	Septic System	TBD	X
2607-EF	2607-EF; Septic Tank West of 241-BX Tank Farm	Inactive	Septic Tank	Septic System	TBD	X
UPR-200-E-101	UPR-200-E-101; Radioactive Spill Near 242-B Evaporator; UN-200-E-101; UN-216-E-101; UN-216-E-30	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	200-EA-1	
UPR-200-E-105	UPR-200-E-105; Liquid Release in the 241-BY Tank Farm; UN-200-E-105	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-E-108	UPR-200-E-108; 241-B-102 Tank Release; UN-200-E-108	Inactive	Unplanned Release	Unplanned Release - Subsurface	Not Applic	
UPR-200-E-109	UPR-200-E-109; Release from 241-B-104; UN-200-E-109	Inactive	Unplanned Release	Unplanned Release - Subsurface	Not Applic	
UPR-200-E-110	UPR-200-E-110; 241-BY Valve Pit Release; UN-200-E-110	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-E-116	UPR-200-E-116; 241-BY-112 Flush Release; UN-200-E-116	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-E-127	UPR-200-E-127; 241-B-107 Leak; UN-200-E-127	Inactive	Unplanned Release	Unplanned Release - Subsurface	Not Applic	
UPR-200-E-128	UPR-200-E-128; 241-B-110 Leak; UN-200-E-128	Inactive	Unplanned Release	Unplanned Release - Subsurface	Not Applic	
UPR-200-E-129	UPR-200-E-129; 241-B-201 Leak; UN-200-E-129	Inactive	Unplanned Release	Unplanned Release - Subsurface	Not Applic	
UPR-200-E-130	UPR-200-E-130; 241-B-203 Leak; UN-200-E-130	Inactive	Unplanned Release	Unplanned Release - Subsurface	Not Applic	
UPR-200-E-131	UPR-200-E-131; 241-BX-102 Release; UN-200-E-131	Inactive	Unplanned Release	Unplanned Release - Subsurface	Not Applic	
UPR-200-E-132	UPR-200-E-132; 241-BX-102 Tank Leak; UN-200-E-132	Inactive	Unplanned Release	Unplanned Release - Subsurface	Not Applic	
UPR-200-E-133	UPR-200-E-133; 241-BX-108 Leak; UN-200-E-133	Inactive	Unplanned Release	Unplanned Release - Subsurface	Not Applic	
UPR-200-E-134	UPR-200-E-134; 241-BY-103 Tank Leak; UN-200-E-134	Inactive	Unplanned Release	Unplanned Release - Subsurface	Not Applic	
UPR-200-E-135	UPR-200-E-135; 241-BY-108 Tank Leak; UN-200-E-135	Inactive	Unplanned Release	Unplanned Release - Subsurface	Not Applic	
UPR-200-E-144	UPR-200-E-144; Soil Contamination North of 241-B; UN-216-E-44	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	200-EA-1	
UPR-200-E-38	UPR-200-E-38; Release from 241-B-152; UN-200-E-38; UN-216-E-4	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-E-4	UPR-200-E-4; 241-B-151 Diversion Box Contamination Spread; UN-200-E-4	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-E-43	UPR-200-E-43; Road Contamination Near 241-BY Tank Farm; UN-200-E-43	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	200-EA-1	

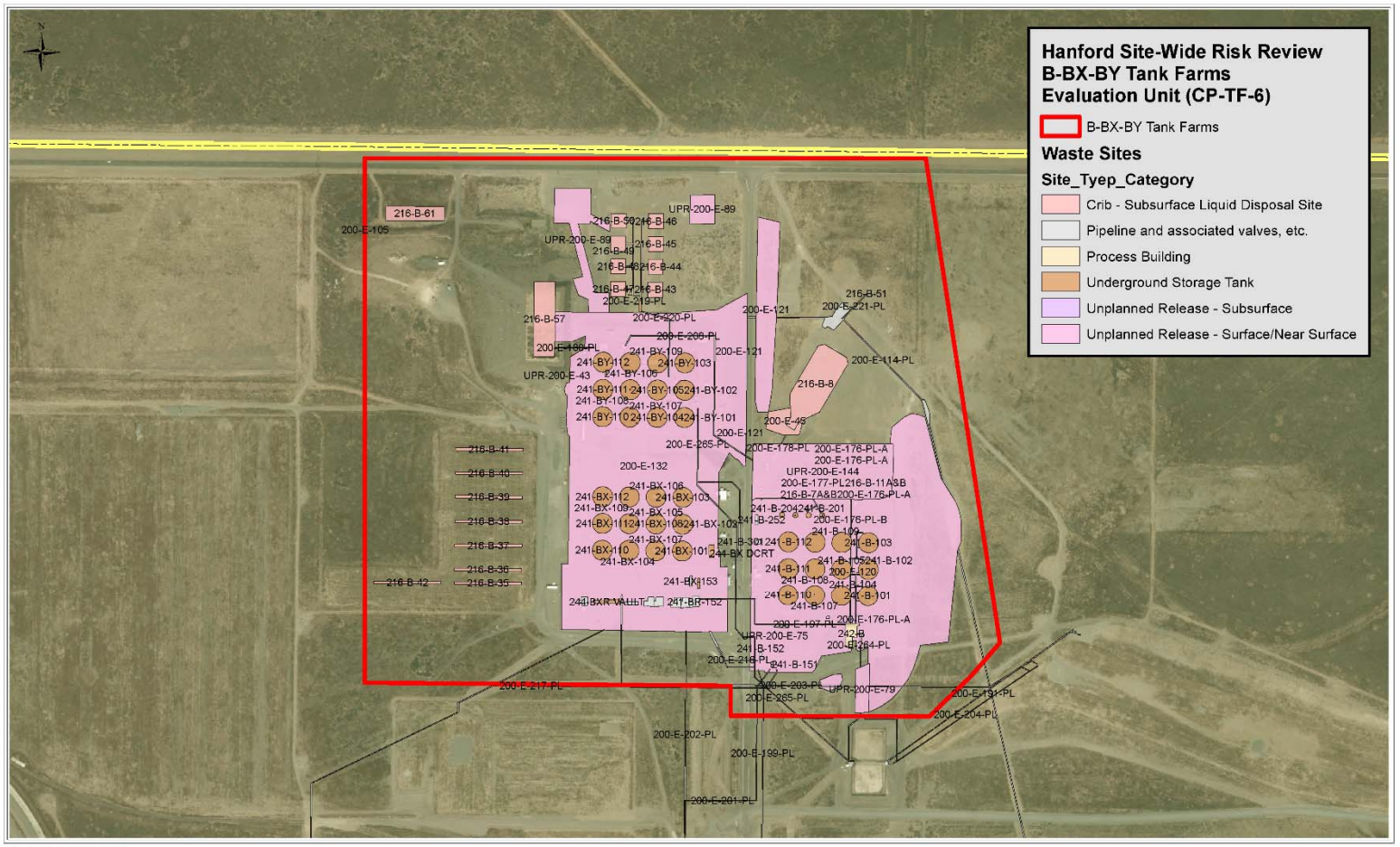
Note that only those waste sites with a WIDS (Waste Information Data System) Classification of "Accepted" are shown, along with non-duplicate facilities, identified via the Hanford Geographic Information System (HGIS).

Hanford Site-Wide Risk Review
CP-TF-6 (B-BX-BY Tank Farms)
Waste Site and Facility List

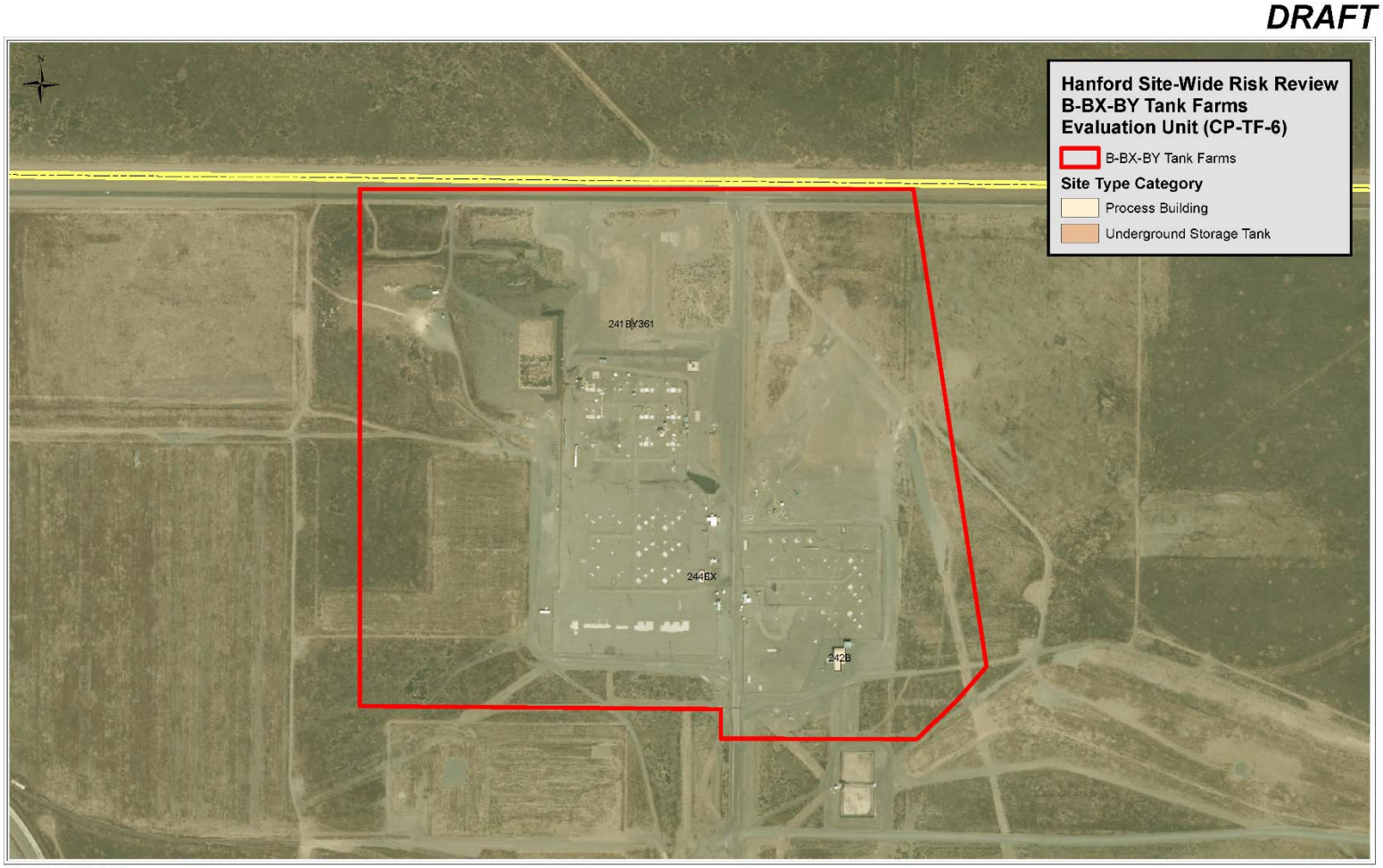
Site Code	Name, Aliases, Description	Site Status	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation
UPR-200-E-5	UPR-200-E-5; 241-BX-102 Tank Overflow; UN-200-E-5	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-E-73	UPR-200-E-73; 241-B-151 Diversion Box Contamination; UN-200-E-73; UN-216-E-1	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-E-74	UPR-200-E-74; 241-B-152 Diversion Box Contamination; UN-200-E-74; UN-216-E-2	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-E-75	UPR-200-E-75; 241-B-153 Diversion Box Contamination; UN-200-E-75; UN-216-E-3	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-E-76	UPR-200-E-76; 241-B-152 Pipeline Break; UN-200-E-76; UN-216-E-4	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-E-79	UPR-200-E-79; 200-E-264-PL Line Break; 242-B to 207-B Line Break; UN-200-E-79; UN-216-E-7	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	TBD	
UPR-200-E-89	UPR-200-E-89; Contamination Migration to the North, East & West of BX-BY Tank Farms; UN-200-E-89; UN-216-E-17	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	200-EA-1	
UPR-200-E-9	UPR-200-E-9; Liquid Overflow at 216-BY-201; UN-200-E-9	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	200-EA-1	
241B701	INSTRUMENT AIR COMPRESSOR BUILDING	INACTIVE	BUILDING	Infrastructure Building		X
241BY254	CONTROL HOUSE AND COMPRESSOR, ITS2	INACTIVE	BUILDING	Infrastructure Building		X
241BY301	CONTROL HOUSE IN-TANK SOLIDIFICATION	INACTIVE	BUILDING	Infrastructure Building		X
241BY302	COMPRESSOR HOUSE, ITS1	INACTIVE	BUILDING	Infrastructure Building		X
241BY361	FLUSH TANK -- UNDERGROUND	INACTIVE	TANK	Underground Storage Tank		
242B	RADIOACTIVE PARTICLE RESEARCH LABORATORY	INACTIVE	BUILDING	Process Building		
242BL	CASK LOADING BUILDING	INACTIVE	BUILDING	Infrastructure Building		X
244BX	SALT WELL RECEIVER VAULT	INACTIVE	BUILDING	Process Building		
244BX271	ELECTRICAL INSTRUMENT CONTROL BLDG	ACTIVE	BUILDING	Infrastructure Building		X
250800000	SIREN EAST OF BALTIMORE SOUTH OF 241B	ACTIVE	STRUCTURE	Process Building		X
2724B	RAD MONITORING AND PROTECTIVE CLOTHING BLDG	INACTIVE	BUILDING	Infrastructure Building		X
2724BX	RAD MONITORING AND PROTECTIVE CLOTHING BLDG	INACTIVE	BUILDING	Infrastructure Building		X
2724BY	RAD MONITORING AND PROTECTIVE CLOTHING BLDG	INACTIVE	BUILDING	Infrastructure Building		X
2724BYA	RAD MONITORING AND PROTECTIVE CLOTHING BLDG	INACTIVE	BUILDING	Infrastructure Building		X
MO114	CHANGE TRAILER AT 241BY	INACTIVE	BUILDING	Infrastructure Building		X
MO299	CHANGE TRL BX AND BY TANK FARM	ACTIVE	BUILDING	Infrastructure Building		X
MO824	CHANGE TRAILER AT 241BX TANK FARM	ACTIVE	BUILDING	Infrastructure Building		X
MO825	CHANGE TRAILER NORTH OF 2724B	ACTIVE	BUILDING	Infrastructure Building		X

Note that only those waste sites with a WIDS (Waste Information Data System) Classification of "Accepted" are shown, along with non-duplicate facilities, identified via the Hanford Geographic Information System (HGIS).

DRAFT



1 inch = 500 feet


DRAFT
Hanford Site-Wide Risk Review
B-BX-BY Tank Farms
Evaluation Unit (CP-TF-6)
B-BX-BY Tank Farms
Site Type Category
Process Building
Underground Storage Tank
241 BY361
244BX
242B
1 inch = 500 feet

APPENDIX E.8

Tank Waste and Farm

CP-TF-7 (C Tank Waste and Farm)
Evaluation Unit Summary Template

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PART E.8. CP-TF-7 C SINGLE-SHELL TANK WASTE AND FARM (200-E)

E.8.1. EXECUTIVE SUMMARY

Much of the information related to the C Tank and Waste Farms Evaluation Unit (EU) is organized around the corresponding Waste Management Area (namely WMA C) that is regulated under the Resource Conservation and Recovery Act (RCRA) and Washington's Hazardous Waste Management Act (HWMA, RCW 70.105) and its implementing requirements (Washington's Dangerous Waste Regulations, WAC 173-303) (Johnson&Chou 1999).

EU LOCATION

East-Central part of 200-East on the Hanford Reservation; Central Plateau

RELATED EUS

T Tank Waste and Farms (CP-TF-1), S-SX Tank Waste and Farms (CP-TF-2), TX-TY Tank Waste and Farms (CP-TF-3), U Tank Waste and Farms (CP-TF-4), A-AX Tank Waste and Farms (CP-TF-5), B-BX-BY v (CP-TF-6), 200-East DST Waste and Farms (CP-TF-8), 200-West DST Waste and Farms (CP-TF-9), 200-E Groundwater Plumes (CP-GW-1), 200-W Groundwater Plumes (CP-GW-1), and 200 Area Waste Transfer Pipeline (CP-LS-7)

PRIMARY CONTAMINANTS, CONTAMINATED MEDIA AND WASTES

The TC&WM EIS describes tank wastes as including radioactive (tritium or H-3, C-14, Sr-90, Tc-99, I-129, Cs-137, U-233, U-234, U-235, U-238, Np-237, Pu-239, and Pu-240)[129] and non-radioactive contaminants (chromium, mercury, nitrate, lead, total uranium, and PCBs) of potential concern (DOE/EIS-0391 2012, Appendix D). The tank wastes contain saltcake, sludge, and supernatant phases. Contaminated media related to the C Tank Farm include ancillary equipment and surrounding vadose zone (including cribs and trenches) down to the saturated zone (for some mobile contaminants) from past and current discharges. The 2015 Groundwater Monitoring Report (DOE/RL-2016-09, Rev. 0) lists tank wastes including nitrate, I-129, Tc-99, uranium, Sr-90, cyanide, and H-3 for the 200-BP groundwater interest area (GWIA) that is used to geographically represent contaminant migration from the 200-BP-5 OU for monitoring purposes; the Tc-99 plume (including the small portion in the 200-PO GWIA) and perhaps nitrate are associated with C Tank and Waste Farms EU sources.

After evaluating the contaminants associated with C Tank Farm tanks, ancillary equipment, legacy sources, and contaminated vadose zone, the primary contaminants from the tank wastes that drive human health risk to groundwater for the C Tank Farms Evaluation Unit are: Tc-99, I-129, Sr-90, H-3, chromium, uranium, cyanide, and nitrate. Those primary contaminants that may drive risk from groundwater discharge to the Columbia River are nitrate and chromium; however, any potential impacts are highly uncertain (i.e., Section E.6.1 presents an evaluation for an analogous area). Cs-137 and Sr-90 are important from a safety standpoint and uranium isotopes, plutonium isotopes, and tritium are iconic

[129] Other isotopes considered include U-232 and U-236 and Pu-238, Pu-241, and Pu-242 to be consistent with other EUs. These additional uranium and plutonium isotopes are included in the totals presented but are not used for rating because 1) uranium toxicity impacts (represented by total uranium drives corresponding risks and 2) plutonium has been found relatively immobile in the Hanford subsurface and has not been identified as a risk driver for groundwater impacts.

constituents; these contaminants are included in the inventory summary even though they are not considered risk drivers for impacts to or from groundwater in this review. The other 200-BP plumes (i.e., I-129, uranium, Sr-90, cyanide, and tritium) that are not associated with C Tank and Waste Farms EU sources are described in Appendix D.5 for the CP-GW-1 EU (200-BP GWIA).

BRIEF NARRATIVE DESCRIPTION

Waste Management Area C (WMA C) occupies approximately 8.5 acres (http://phoenix.pnnl.gov/) with 16 underground single-shell tanks (SSTs) in additional to ancillary equipment (e.g., diversion boxes, pumps, valves, and pipes). The tanks contain primarily 1st cycle decontamination from bismuth phosphate process, aluminum cladding Purex wastes, metal waste from bismuth phosphate process, and ferrocyanide sludge (Remund et al. 1995). The C Tank Farm tanks were taken out of service between 1970 and 1980 (Horton & Narbutovskih 2001).

The C Tank Farm was constructed in 1943-44 (Horton & Narbutovskih 2001, p. 2.2) and includes 12 530-kgal underground waste storage tanks (C-101 through C-112) and four smaller 55-kgal tanks (C-201 through C-204). The C Tank Farm tanks were designed for non-boiling wastes. Six of the 16 tanks in the C Tank Farm are classified as “assumed leakers” (Templeton 2016). Leaks from these tanks are at least 29,250 gallons and range from 350 gallons (C-204 before 1988) to 20,000 gallons (C-101 in 1980).

There are also various non-tank sources that received large volumes of contaminated waste and other waste streams that has resulted in vadose zone and groundwater contamination in the areas around the WMA C including fourteen documented unplanned releases including surface spills and leaks from transfer lines, diversion boxes, catch tanks, and vaults (Horton & Narbutovskih 2001).

The SSTs in WMA C were previously interim stabilized (i.e., liquid transferred to DSTs to <50 kgal drainable interstitial liquid and <5 kgal of supernatant). Tank waste retrieval is in progress in the C Tank Farm (Templeton 2016, p. 9):

- Retrieval has been declared “Retrieval Completed” in ten of the C Tank Farm tanks (C-103, C-104, C-106, C-110 through C-112, and C-201 through C-204).
- Retrieval has been declared retrieved to various limits of technology in five tanks (C-101, C-102, C-107, C-108, and C-109).
- Retrieval is in progress in the remaining tank (C-105).

SUMMARY TABLES OF RISKS AND POTENTIAL IMPACTS TO RECEPTORS

Table E.8-1 provides a summary of nuclear and industrial safety related consequences from the CP-TF-7 (C Tank and Waste Farms EU) to humans and impacts to important physical Hanford Site resources. Receptors are described in Section E.1.6 (Appendix E.1).

Table E.8-1. CP-TF-7 (C Tank Farm) impact Rating Summary for Human Health (unmitigated basis with mitigated basis provided in parentheses (e.g., "High (Low)").

Population or Resource		Evaluation Time Period[a]: Active Cleanup (to 2064) — Current Condition: Maintenance & Monitoring (M&M)	Evaluation Time Period[a]: Active Cleanup (to 2064) — From Cleanup Actions: Retrieval & Closure
Human Health	Facility Worker[b]	***M&M***: Low-High[d] (Low-High)[d] ***Soil***: Not Discernible (ND)-High (ND-Low)	***Preferred method***: High (Low) ***Alternative***: High (Low)
	Co-located Person[b]	***M&M***: Low-Moderate (Low) ***Soil***: ND (ND)	***Preferred method***: Low-Moderate (Low) ***Alternative***: Low-Moderate (Low)
	Public[b]	***M&M***: Low (Low) ***Soil***: ND (ND)	***Preferred method***: Low (Low) ***Alternative***: Low (Low)
Environmental	Groundwater (A&B) from vadose zone[c]	*Medium* -- I-129, Tc-99 *Low* -- C-14, Cr(tot), Cr-VI *ND*[f] -- Sr-90, U(tot) **Overall**: *Medium*	*Medium* -- I-129[f], Tc-99 *Low* -- C-14, Cr(tot), Cr-VI *ND*[f] -- Sr-90, U(tot) **Overall**: *Medium*
	Columbia River from vadose zone[c]	Benthic: ND (rad & chem) Riparian: ND (rad & chem) Free-flowing: ND (rad & chem) **Overall**: ND	Benthic: ND (rad & chem[g]) Riparian: ND (rad & chem[g]) Free-flowing: ND (rad & chem) **Overall**: ND
	Ecological Resources[e]	ND	ND to Medium
Social	Cultural Resources[e]	**Native American:** Direct: Known Indirect: Known **Historic Pre-Hanford:** Direct: Known Indirect: Unknown **Manhattan/Cold War:** Direct: Known Indirect: Known	**Native American:** Direct: Known Indirect: Known **Historic Pre-Hanford:** Direct: Known Indirect: Unknown **Manhattan/Cold War:** Direct: Known Indirect: Known

a. A rating for cultural resources is 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.

b. Evaluated in Section E.1.6 (Appendix E.1).

c. Groundwater threat for Group A and B contaminants remaining in the vadose zone or to the Columbia River for all primary contaminants. Threats from existing plumes associated with the C Tank and Waste Farms EU are described in Section E.8.5 and Appendix D.5 (CP-GW-1) for the 200-BP-5 Groundwater Operable Unit.

d. Industrial safety consequences range from low to high (based on the evaluation scale used) for both mitigated (with controls) and unmitigated (without controls). Mitigated radiological and toxicological consequences to facility workers are high (unmitigated) and low (mitigated).

e. 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.

f. The inventory of Sr-90 and total uranium in the vadose zone would translate to a *High* and *Low* rating, respectively. The Tc-99 inventory would also translate to a *Low* rating. However, transport considerations based on the screening evaluations in the TC&WM EIS indicate that total uranium, Sr-90, nor Tc-99 (in this rare case) is likely to impact groundwater during the evaluation period (Section E.8.5). Total uranium, Sr-90, and Tc-99 are given *Not Discernible* (*ND*) ratings for the Active Cleanup period and *Low* ratings afterwards to account for uncertainties in the evaluation. Thus these primary contaminants are not considered risk drivers for the T Tank and Waste Farms EU during the evaluation period.

g. The information from Appendix P from the TC&WM EIS would suggest that hexavalent chromium would have *Medium* and *High* ratings for benthic and riparian zone impacts, respectively. However, current well data suggest that chromium is moving much more slowly than predicted in the TC&WM EIS evaluation resulting in *Not Discernible* (*ND*) ratings.

SUPPORT FOR RISK AND IMPACT RATINGS FOR EACH POPULATION OR RESOURCE

Human Health

The current and cleanup-related consequences related to work being conducted at the Tank Farms in the 200 Areas (Hanford Central Plateau) was evaluated in Section E.1.6 (Appendix E.1).

Groundwater, Vadose Zone, and Columbia River

Current

C Tank Farm contaminants are currently impacting the vadose zone and groundwater (where the 216-C-8 Crib is not suspected of being able to contribute mobile contaminants to groundwater (DOE/RL-92-19, Rev. 0); however, other CP-TF-7 sites may have impacted the vadose and groundwater), and treatment is not predicted to decrease concentrations to below thresholds before active cleanup commences. Secondary sources (e.g., total and hexavalent chromium) in the vadose also threaten to continue to impact groundwater in the future, including the Active Cleanup period[130]. As described in the TC&WM EIS (and summarized in Section E.8.5), there are significant impacts on peak concentrations in groundwater (with an impact on ratings as described in Section E.8.5) but not the near-shore region of the Columbia River during or after cleanup. Thus the values for these receptors are the same as those shown in Table E.8-8.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

See Section E.1.1.

[130] Note that Sr-90, which has a large vadose zone source that would translate to a *High* rating if mobile in the local Hanford subsurface, is not considered a significant threat to groundwater due to its limited mobility in the Hanford subsurface. The total uranium would translate to a *Low* rating (if mobile); however, uranium is also limited in mobility in the local area. See Section E.8.5 for details.

Ecological Resources

Current
No resources on site, but about 15% level 3 resources on buffer. If no trucks, ND effects currently.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches
No resources on EU, but about 15% level 3 resources on buffer area. Remediation could result in truck disturbance, increases in exotic species, and changes in species composition in buffer.

Cultural Resources

Current
Manhattan Project/Cold War significant resources have already been mitigated. Area is very disturbed and there are no known recorded archaeological resources within the EU. Traditional cultural places are visible from EU.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches
Because area has not been investigated either on the surface or subsurface, archaeological investigations may need to occur within pockets of undisturbed land if any prior to remediation. Potential for intact archaeological material to be present is very low.

Considerations for Timing of the Cleanup Actions

See Section E.1.1 (Appendix E.1).

Near-Term, Post-Cleanup Risks and Potential Impacts

See Section E.1.1 (Appendix E.1).

E.8.2. ADMINISTRATIVE INFORMATION

OU AND/OR TSDF DESIGNATION(S):

The C Tank and Waste Farms Evaluation Unit (EU), denoted *CP-TF-7 – C Tank Farm*, consists of 16 waste tanks, ancillary structures, associated liquid waste sites, and soils contamination; much of this EU is contained within Waste Management Area C (WMA C). WMA C is regulated under the Resource Conservation and Recovery Act (RCRA) as modified in 40 CFR Part 265, Subpart F and Washington State's Hazardous Waste Management Act (HWMA, RCW 70.105 and its implementing requirements in the Washington State dangerous waste regulations [WAC 173-303-400]).

COMMON NAME(S) FOR EU:

There is no common name for the C Tank and Waste Farms EU because the EU is comprised of elements from other waste management units including Waste Management Area C (WMA C) that includes the 241-C (or C) Tank Farm.

The C Tank Farm contains 16 waste tanks (C-101 through C-112 and C-201 through C-204); these tanks often are designated as 241-C-101 through 241-C-112 and 241-C-201 through 241-C-204. Other components in the EU are listed below in the *Primary EU Source Components* section.

KEY WORDS:

C Tank Farm, 241-C Tank Farm, waste tanks, tank farm, Waste Management Area C, WMA C

REGULATORY STATUS

Regulatory Basis

DOE is the responsible agency for the closure of all single-shell tank (SST) waste management areas (WMAs) through post closure, in close coordination with other closure and cleanup activities of the Hanford Central Plateau. Washington State has a program that is authorized under RCRA and implemented through the HWMA and its associated regulations; Ecology is the lead regulatory agency responsible for the closure of the SST system. Please refer to Section E.1.2 (Appendix E.1) for more information.

Applicable Regulatory Documentation

The relationship among the tank waste retrieval work plans (TWRWP) and the overall single-shell tank (SST) waste retrieval and closure process is described in Appendix I of the Hanford Federal Facility Agreement and Consent Order (HFFACO), along with requirements for the content of TWRWPs. WMA C was placed in assessment monitoring (40 CFR 265.93[d][4]) based on elevated specific conductance measurements (DOE/RL-2009-77, p. iii). A groundwater quality assessment plan was developed (DOE/RL-2009-77, p. iii) describing the monitoring activities used in deciding whether WMA C has affected groundwater.

Applicable Consent Decree or TPA Milestones

Federal Facility Agreement and Consent Order, 1989 and amended through June 16, 2014: Milestone M-045-00; Lead Agency Ecology: *Complete the closure of all Single Shell Tank Farms by 01/31/2043*

RISK REVIEW EVALUATION INFORMATION

Completed: Revised August 25, 2015

Evaluated by: K. G. Brown

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

E.8.3. SUMMARY DESCRIPTION

CURRENT LAND USE

DOE Hanford Site for industrial use. All current land-use activities in the 200-East Area are *industrial* in nature (EPA 2012).

DESIGNATED FUTURE LAND USE

Industrial-Exclusive. All four land-use scenarios listed in the Comprehensive Land Use Plan (CLUP) indicate that the 200-West Area (of which the C Tank and Waste Farms EU is a part) is denoted *Industrial-Exclusive* (DOE/EIS-0222-F). An industrial-exclusive area is “suitable and desirable for treatment, storage, and disposal of hazardous, dangerous, radioactive, and nonradioactive wastes” (DOE/EIS-0222-F).

PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

The legacy source sites associated with the C Tank and Waste Farms EU are described in Attachment Section E.8.8. To summarize, there are various non-tank sources that received large volumes of contaminated waste and other waste streams that has resulted in vadose zone and groundwater contamination in the areas around the WMA C including fourteen documented unplanned releases (UPRs) including surface spills and leaks from transfer lines, diversion boxes, catch tanks, and vaults (Horton & Narbutovskih 2001). Six of the 16 tanks in the C Tank Farm are classified as "assumed leakers" with total leaks estimated of at least 29,250 gallons and ranging from 350 gallons (C-204 in 1988) to 20,000 gallons (C-101 in 1980) (Templeton 2016).

Waste Tanks and Ancillary Equipment

The waste tanks in the C Tank and Waste Farms EU are:

- (241-)C-101 (241-C-TK-101)
- (241-)C-102 (241-C-TK-102)
- (241-)C-103 (241-C-TK-103)
- (241-)C-104 (241-C-TK-104)
- (241-)C-105 (241-C-TK-105)
- (241-)C-106 (241-C-TK-106)
- (241-)C-107 (241-C-TK-107)
- (241-)C-108 (241-C-TK-108)
- (241-)C-109 (241-C-TK-109)
- (241-)C-110 (241-C-TK-110)
- (241-)C-111 (241-C-TK-111)
- (241-)C-112 (241-C-TK-112)
- (241-)C-201 (241-C-TK-201)
- (241-)C-202 (241-C-TK-202)
- (241-)C-203 (241-C-TK-203)
- (241-)C-204 (241-C-TK-204)

The ancillary equipment included in the C Tank and Waste Farms EU is listed in the Attachment in Section E.8.8 and primarily consists of pipelines, diversion boxes, and catch tanks.

Groundwater Plumes

The C Tank and Waste Farms EU is in the 200-BP groundwater interest area (GWIA). The current 200-BP plumes that exceed water quality standards (in this case, drinking water standards) are nitrate, I-129, Tc-99, uranium, Sr-90, cyanide, and H-3 (DOE/RL-2016-09, Rev. 0). The Tc-99 plume (that straddles the 200-BP and 200-PO GWIAs) and perhaps the nitrate plume are associated with C Tank and Waste Farms EU sources (DOE/RL-2016-09, Rev. 0). The 200-BP GWIA is being monitored to determine the impact to groundwater prior to determining the path forward for remedial action, with a 200-BP-5 and 200-PO-1 Feasibility Study report and proposed plan(s) due in 2018 (Appendix D, Ecology et al., 1996 [Accessed 27 Feb 2017]). No date or milestone has been scheduled for the final Record of Decision (ROD).

See Appendix D.5 for the CP-GW-1 EU for additional details.

Operating Facilities: Because of the prohibition on waste additions to the Hanford SSTs,[131] the C Tank and Waste Farms EU components are not considered Operating Facilities for this review. See Section E.1.4 (Appendix E.1) for details.

D&D of Inactive Facilities: Not Applicable.

[131] Berman presentation on July 29, 2009, titled "Hanford Single-Shell Tank Integrity Program." Available at www.em.doe.gov.

LOCATION AND LAYOUT MAPS

A series of maps are used to illustrate the location of the components within the CP-TF-5 EU and the C Tank and Waste Farms EU relative to the Hanford Site. Figure E.2-1 shows the relationship between the 200-E (200 East) Area (where the C Tank Farm and Waste Management Area C are located) and the Hanford Site. Figure E.8-1 illustrates the C Tank and Waste Farms EU boundary. Figure E.8-2 shows a detailed view of the waste tanks, ancillary equipment, and legacy source units in the C Tank and Waste Farms EU.

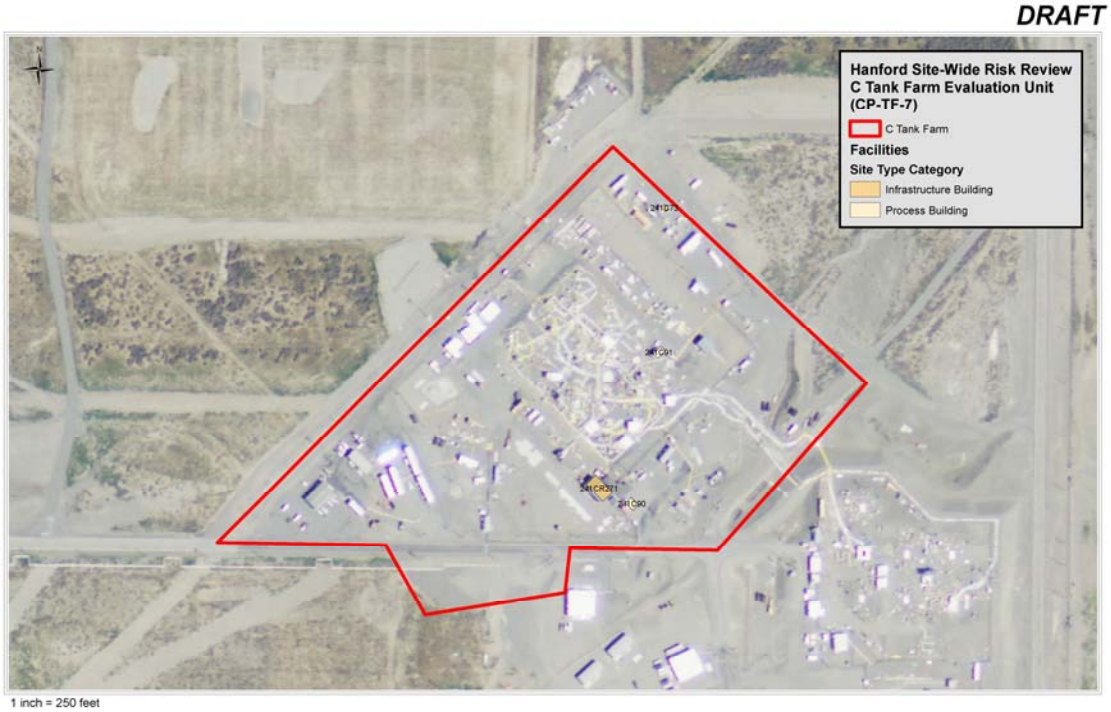


Figure E.8-1. Polygon representing the boundary of the C Tank and Waste Farms Evaluation Unit (Attachment Section E.8.8).

DRAFT

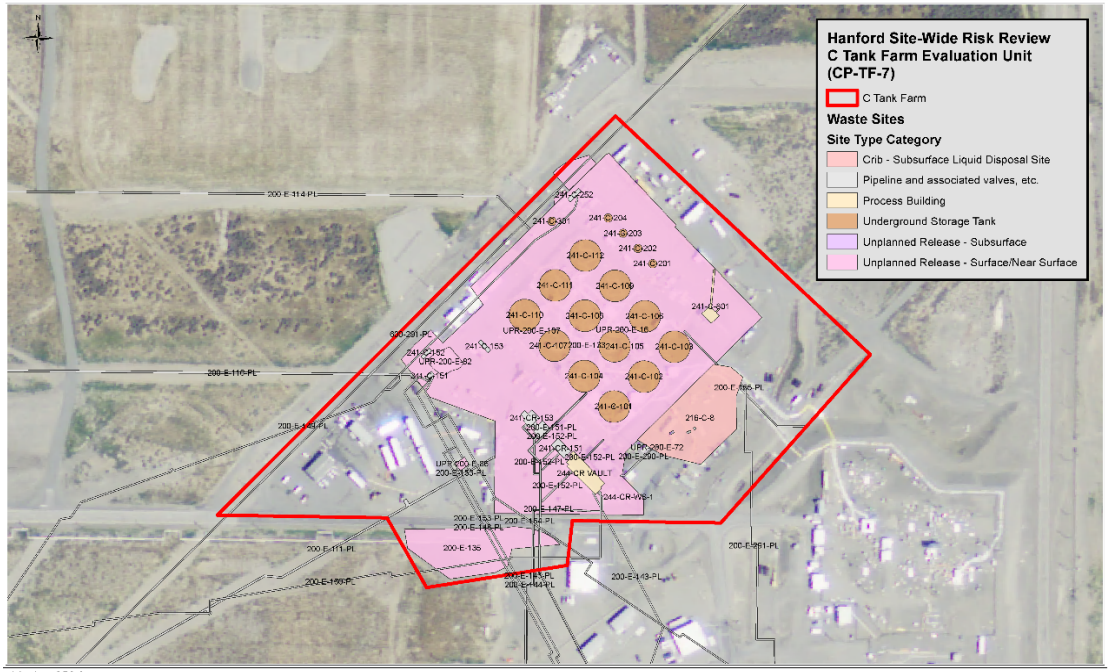


Figure E.8-2. Hanford C Tank and Waste Farms Evaluation Unit including tanks, legacy source units, and ancillary equipment (Attachment Section E.8.8).

E.8.4. UNIT DESCRIPTION AND HISTORY

EU FORMER / CURRENT USES

Waste Management Area C (WMA C) occupies approximately 8.5 acres (estimated using http://phoenix.pnnl.gov/apps/gw/phoenix.html) with 16 underground single-shell tanks (SSTs) in additional to ancillary equipment (e.g., diversion boxes, pumps, valves, and pipes). The tanks contain primarily 1st cycle decontamination from bismuth phosphate process, aluminum cladding Purex wastes, metal waste from bismuth phosphate process, and ferrocyanide sludge (Remund et al. 1995).

The C Tank Farm was constructed in 1943-44 (Horton & Narbutovskih 2001, p. 2.2) and includes 12 530-kgal underground waste storage tanks (C-101 through C-112) and four smaller 55-kgal tanks (C-201 through C-204). The C Tank Farm tanks were designed for non-boiling wastes. The C Tank Farm tanks were taken out of service between 1970 and 1980 (Horton & Narbutovskih 2001). The SSTs in WMA C were previously interim stabilized (i.e., liquid transferred to DSTs to <50 kgal drainable interstitial liquid and <5 kgal of supernatant). Tank waste retrieval is in progress in the C Tank Farm (Templeton 2016):

- Retrieval has been declared “Retrieval Completed” in ten of the C Tank Farm tanks (C-103, C-104, C-106, C-110 through C-112, and C-201 through C-204).
- Retrieval has been declared retrieved to various limits of technology in five tanks (C-101, C-102, C-107, C-108, and C-109).
- Retrieval is in progress in the remaining tank (C-105).

LEGACY SOURCE SITES

Six of the 16 tanks in the C Tank Farm are classified as "assumed leakers" (Templeton 2016). Total leaks from these tanks are estimated of at least 29,250 gallons, and range from 350 gallons (C-204 before 1988) to 20,000 gallons (C-101 in 1980).

Various non-tank sources received large volumes of contaminated waste and other waste streams that has resulted in vadose zone and groundwater contamination in the areas around the WMA C including fourteen documented unplanned releases including surface spills and leaks from transfer lines, diversion boxes, catch tanks, and vaults (Horton & Narbutovskih 2001). The 200-BP GWIA is being monitored to determine the impact to groundwater prior to determining the path forward for remedial action, with a 200-BP-5 and 200-PO-1 Feasibility Study report and proposed plan(s) due in 2018 (Appendix D, Ecology et al., 1996 [Accessed 27 Feb 2017]). No date or milestone has been scheduled for the final Record of Decision (ROD).

WASTE TANKS

See Section E.8.3 for details.

GROUNDWATER PLUMES

The groundwater plumes (Tc-99 and nitrate) considered to be associated with the C Tank Farm and co-located liquid waste disposal facilities are described in detail in Section E.8.5 with additional information in the Appendix D.5 for the CP-GW-1 EU (200-BP GWIA). The 216-C-8 Crib is not suspected of being able to contribute mobile contaminants to the saturated zone (i.e., representing migration of contaminants from the waste site to the uppermost aquifer) (DOE/RL-92-19, Rev. 0, Table 2-2); however, other CP-TF-7 sites (e.g., UPRs) have been linked to Tc-99 and possibly nitrate plumes in the area (DOE/RL-2016-09, Rev. 0).

D&D OF INACTIVE FACILITIES – NOT APPLICABLE

OPERATING FACILITIES – NOT APPLICABLE

Because of the prohibition on waste additions to the Hanford SSTs,[132] the C Tank and Waste Farms EU components are not considered Operating Facilities for this Review.

ECOLOGICAL RESOURCES SETTING

Landscape Evaluation and Resource Classification:

The EU for C Tank Farm consists of level 0 habitat except for a very small area (0.1 acre) of level 2 habitat. The amount and proximity of biological resources to the C Tank and Waste Farms EU was examined within the adjacent landscape buffer area radiating 483 m from the geometric center of the EU (equivalent to 181 acres). No level 3 or greater habitat occurs within the EU. If remediation actions result in the loss of level 2 habitat within the EU, this change would only represent a 0.1% difference in available level 2 habitat resources at the landscape level. A little more than 15% of the combined total area (EU plus adjacent landscape buffer area) consists of level 3 or greater habitats. Some of the level 3

[132] Berman presentation on July 29, 2009, titled "Hanford Single-Shell Tank Integrity Program." Available at www.em.doe.gov.

resources in the combined total area are individual occurrences of sensitive plant species (likely Piper's daisy, *Erigeron piperianus*).

Field Survey:

Visual survey and vehicle reconnaissance of the C Tank and Waste Farms EU confirmed that the area is primarily level 0 habitat (Appendix J, Figure 17, p. J-138) with disturbed and graveled surfaces as shown in (Appendix J, Figure 18, p. J-139). Because the site is primarily industrial, no field measurements of vegetation were recorded. No wildlife were observed within the EU during the October survey. Previous ECAP surveys in 2010 noted the presence of mountain cottontail (*Sylvilagus nuttallii*) in the area.

CULTURAL RESOURCES SETTING

Cultural resources known to be located within the C Tank and Waste Farms EU are limited to the 271-CR Service and Office Building a contributing property within the Manhattan Project/Cold War Era Landscape with no documentation required. All documentation has been addressed as described in the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan* (DOE/RL-97-56). There are no known archaeological sites, or TCPs known to be recorded within the C Tank and Waste Farms EU. None of the C Tank and Waste Farms EU has been inventoried for archaeological resources. Closure and remediation of the tank farms located within the C Tank and Waste Farms EU has been addressed in an NHPA Section 106 review. Given the extensive ground disturbance within the C Tank and Waste Farms EU, it is unlikely but there is a possibility that intact archaeological material is present in the C Tank and Waste Farms EU because it has not have not been inventoried for archaeological resources (both on the surface and in the subsurface) and particularly if undisturbed soil deposits exist within the C Tank and Waste Farms EU.

Two National Register-eligible properties associated with the Manhattan Project/Cold War Era Landscape with documentation required (Hanford Site Plant Railroad and the 2707AR Sludge Vault Change House) are located within 500 meters of the C Tank and Waste Farms EU. Both have been documented as described in the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan* (DOE/RL-97-56). Additionally one isolated find associated with the Native American Precontact and Ethnographic Landscape has been located within 500 meters of the C Tank and Waste Farms EU. This isolated find is not considered to be eligible for the National Register of Historic Places.

Historic maps indicate that there is no evidence of historic settlement in or near the C Tank and Waste Farms EU. Geomorphology and extensive ground disturbance further indicates a low potential for the presence of intact archaeological resources associated with all three landscapes to be present subsurface within the C Tank and Waste Farms EU. Because none of the C Tank and Waste Farms EU has been investigated for archaeological sites and it is possible but unlikely that pockets of undisturbed soil exist, it may be appropriate to conduct 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 associated with these landscapes (e.g. East Benton Historical Society, the Franklin County Historical Society, Prosser Cemetery Association, the Reach, and B-Reactor Museum Association) may need to occur. Indirect effects are always possible when TCPs are known to be located in the general vicinity. 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.

E.8.5. WASTE AND CONTAMINATION INVENTORY

Table E.8-2 provides inventory estimates of the various source components associated with the C Tank and Waste Farms EU including tank wastes and ancillary equipment, legacy sources including leaks, cribs, trenches, unplanned releases (UPRs), vadose zone sources, saturated zone (plume) estimates, treatment amounts, and remaining vadose zone estimates (i.e., the difference of the vadose zone estimates and the saturated zone and treatment estimates)[133]. This information is further summarized in Figure E.8-3 through Figure E.8-11 before and after planned 99% retrieval[134].

For example, the major sources for Tc-99 in the EU before retrieval are the C Tank Farm tanks, past leaks, unplanned releases, and ancillary equipment where past leaks, unplanned releases, and ancillary equipment dominate post-retrieval inventories. The major sources for I-129 before retrieval are the C Tank Farm tanks, unplanned releases, and ancillary equipment where unplanned releases and ancillary equipment dominate post-retrieval inventories. The maximum groundwater threat metric (GTM) (Figure E.8-12)[135] is dominated by the C Tank Farm wastes before retrieval and by unplanned releases, leaks, and ancillary equipment after planned retrieval. The tritium inventory is dominated by unplanned releases after planned retrieval is complete. The nitrate, chromium, and Cs-137 vadose zone inventories are dominated by ancillary equipment, unplanned releases, and leaks. Post-retrieval vadose zone sources for uranium, Sr-90, and plutonium isotopes are largely from ancillary equipment.

CONTAMINATION WITHIN PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

The estimated C Tank Farm inventory for the Legacy / Vadose Zone Source Sites (i.e., cribs, trenches, and soil contaminated by tank leaks and unplanned releases) is summarized in Table E.8-2 and further described in Figure E.8-3 through Figure E.8-11 before and after planned 99% retrieval (which will have no impact on the legacy source site inventories). These values constitute estimates of the initial amounts of contaminants discharged to the vadose zone that are then used to estimate the remaining inventory in the vadose zone as described below (i.e., by difference using the process described in Chapter 6 of the Methodology Report (CRESP 2015a) as revised for the 2015 groundwater monitoring results (DOE/RL-2016-09, Rev. 0) as described in Appendix D.1). These estimates necessarily have large associated uncertainties.

[133] The basis for the saturated and vadose zone estimates are provided in Chapter 6 of the Methodology Report (CRESP 2015a) and examples are provided in the demonstration section for the 200-UP-1 Operable Unit that corresponds to the 200-UP GWIA. These estimates tend to have very high associated uncertainties.

[134] According to the Tri-Party Agreement (Ecology, EPA, and DOE, 1998), retrieval limits for residual wastes are 360 ft^3 and 30 ft^3 for 100-Series and 200-Series tanks, respectively, corresponding to the 99% waste retrieval goal as defined in TPA Milestone M-45-00. For purposes of this Review the 99% and 90% Retrieval Scenarios reflect assumptions described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 and apply only to tank volumes and inventories. They are calculated assuming retrieval of a fully mixed tank of homogeneous composition. For tanks that have been declared "Retrieval Completed" or "Retrieved to Limit of … Technologies" (Templeton, AM 2016, page 9, partially duplicated in Table E.1-7), no further retrieval for either the 99% or 90% retrieval scenario is assumed. This includes tank 241-S-112 and all C Tank Farm tanks except 241-C-105. For tanks that are currently undergoing retrieval (tanks 241-AY-102 and 241-C-105), a retrieval amount equivalent to the 99% and 90% retrieval volumes described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 are calculated.

[135] Maximum of the GTMs for Tc-99 and I-129 only.

Waste Tanks and Ancillary Equipment

The estimated total inventory for all the C Tank Farm Waste Tanks and Ancillary Equipment is provided in Table E.8-2 for both the 90% and planned 99% retrieval scenarios. The tank-by-tank inventories are provided in Table E.7-3 through Table E.7-6. Safety-related information (i.e., hydrogen generation rates and times to the lower flammability limit are also provided. The inventories for the various contaminant in the C Tank Farm tanks vary over several orders of magnitude as does the GTM. This information is further summarized in Figure E.8-3 through Figure E.8-11 before and after planned 99% retrieval and for the maximum GTM in Figure E.8-12.

Vadose Zone Contamination

The estimated inventories for the vadose zone, saturated zone, and treatment amounts are found in Table E.8-2. These inventories represent the vadose zone contamination *outside* the tanks and ancillary equipment (i.e., that generally available for transport through the environment). These are used to estimate the inventory remaining in the vadose zone using the process described in Chapter 6 of the Methodology Report (CRESP 2015a) as modified for the 2015 groundwater results (Appendix D.1). The focus in this section will be on the Group A and B primary contaminants in the vadose zone due to their mobility and persistence and potential threats to groundwater. To summarize:

- *Tc-99* – There is a current plume for Tc-99 that is associated with C Tank and Waste Farms EU sources (DOE/RL-2016-09, Rev. 0). The vadose zone inventory is dominated by past leaks, unplanned releases, and ancillary equipment.
- *I-129* – There is a current plume for I-129 that is not associated with C Tank and Waste Farms EU sources. The vadose zone inventory is dominated by unplanned releases and ancillary equipment.
- *Sr-90 and uranium* – There are current plumes for Sr-90 and total uranium that are not associated with C Tank and Waste Farms EU sources. The vadose zone inventory is dominated by ancillary equipment. Based on analyses similar to those in Section E.6.5 (using the A Barrier[136]), the Sr-90 and uranium are not considered likely to reach the groundwater in sufficient quantities to impact this resource in the next 150 years. For Sr-90, the times required for the remaining vadose zone inventory to decay to values that would result in *Medium* and *Low* ratings are 60 and 150 years, respectively. Thus the Sr-90 rating for the Near-term Post-Cleanup period would be *Medium* (with no change to the Active period rating); however, transport considerations indicate that the Sr-90 would not likely impact groundwater in the future. Thus total uranium and Sr-90 are not considered significant threats to the Hanford groundwater.
- *Chromium* – There is not a current plume for chromium. The vadose zone inventory is dominated by ancillary equipment, unplanned releases, and leaks.

Using the process outlined in Chapter 6 of the Methodology Report (CRESP 2015a) as revised for the 2015 groundwater monitoring results (Appendix D.1), the vadose zone inventories in Table E.8-2 are estimated and used to calculate Groundwater Threat Metric (GTM) values for the Group A and B primary contaminants remaining in the vadose zone as illustrated in Table E.8-7. Note that the vadose

[136] The barrier represents the edge of the infiltration barrier to be constructed over disposal areas that are within 100 meters [110 yards] of facility fence lines (DOE/EIS-0391 2012). The A Barrier is the closest to the C Tank and Waste Farms EU. Despite including sources other than those for the C Tank and Waste Farms EU, the analysis in the TC&WM EIS was considered reasonable to assess the travel time of these constituents in the subsurface.

zone (VZ) ratings range from *Not Discernible* (*ND*) for total uranium and Sr-90[137] to *Low* for C-14 and chromium (total and hexavalent) to *Medium* for I-129 and Tc-99.

Groundwater Plumes

The 216-C-8 Crib within the CP-TF-7 EU is not suspected of be able to contribute mobile contaminants to the saturated zone (DOE/RL-92-19, Rev. 0); however, the 200-BP plume for Tc-99 and possibly nitrate have been linked to other CP-TF-7 sources (DOE/RL-2016-09, Rev. 0). In general groundwater plumes are evaluated in separate EUs; however, those portions of groundwater plumes that can be associated with the TF EU (i.e., a plume with sources associated with the TF EU) will be evaluated to provide a better idea of the saturated zone versus remaining vadose zone threats to groundwater. The estimated inventory for the saturated zone contamination is provided in Table E.8-2 where Photoshop was used to estimate the fraction of the plumes considered associated with the C Tank and Waste Farms EU (Attachment 6-4 in the Methodology Report (CRESP 2015a) as revised to accommodate the 2015 groundwater monitoring results described in Appendix D.1[138]). This information is also used to estimate amounts treated and remaining in the vadose zone. For the groundwater plumes described in the 200-BP GWIA (DOE/RL-2016-09, Rev. 0), apportionment of plumes and ratings from the Group A and B primary contaminants to the C Tank and Waste Farms EU is as follows:

- *I-129* – There are plumes in the GWIA; however, there are no major I-129 sources were identified related to the C Tank and Waste Farms EU (DOE/RL-2016-09, Rev. 0). Thus the contribution is considered insignificant.
- *Tc-99* – There are plumes in the GWIA, including one that straddles the 200-BP and 200-POO GWIAs that is associated with the EU. The area of this plume is 5% of the 200-BP area and 61% of the 200-PO total plume area (Appendix D.1).
- *Uranium* – There are plumes in the GWIA; however, there are no sources related to the C Tank and Waste Farms EU, and thus the plume is considered insignificant.
- *Sr*-90 – There are plumes in the GWIA; however, there are no major Sr-90 sources identified related to the C Tank and Waste Farms EU (DOE/RL-2016-09, Rev. 0). Thus the contribution is considered insignificant.
- *Cyanide* – There are plumes in the GWIA; however, there are no major cyanide sources identified related to the C Tank and Waste Farms EU (DOE/RL-2016-09, Rev. 0). Thus the contribution is considered insignificant.

The Group A groundwater plume for Tc-99 associated with the C Tank Farm and co-located liquid waste disposal facilities is also described in detail in the Appendix D.5 for the CP-GW-1 EU (200-BP and 200-PO GWIAs). Note that Sr-90 (*High*) is the primary risk driver for the 200-BP GWIA (Appendix D.5). However, the Tc-99 and possible nitrate plumes associated with the B-BX-BY TF EU are relatively small (e.g.,

[137] The remaining vadose zone inventories for total uranium and Sr-90 would translate to *Low* and *High* ratings, respectively. However, no appreciable Sr-90 or total uranium plume from C TF EU sources would be expected in the next 150 years due to transport considerations; however, total uranium may impact groundwater after the 150-year period. Thus *Low* ratings are applied to the period after Active Cleanup is completed to account for uncertainties.

[138] From the graphic map files provided by PNNL, the Photoshop Magic Wand Tool was used to select areas representing plumes and then the "Record Measurements" Tool was used to provide areal extents. A Custom Measurement Scale was set to that of the map.

approximatey 5% of the total 200-BP plume areas for Tc-99); therefore, the risk associated with this TF EU is driven largely by vadose zone sources (Table E.8-7).

Impact of Recharge Rate and Radioactive Decay on Groundwater Ratings

The TC&WM EIS screening groundwater transport analysis (Appendix O, DOE/EIS-0391 2012) can be used to gauge the possible impact of emplacing the engineered surface barrier (and resulting reduction of infiltrating water) on the predicted peak groundwater concentrations. Since an analysis is not provided for the "C Barrier", that analysis for the A Barrier (Section E.6.5)[139], which is reasonably proximate to the C Tank and Waste Farms EU is used here. Despite the large impacts on the predicted peak concentrations, the peak values for I-129 and hexavalent chromium may exceed thresholds at the A Barrier within 150-200 years (including sources other than those from the C Tank and Waste Farms EU) and thus ratings will not be modified even though the impacts may be large. The peak predicted concentration for Tc-99 does not exceed the threshold during the TC&WM EIS evaluation period (10,000 years); thus the Tc-99 saturated zone rating for the Near-term, Post-Cleanup period would correspond to a *Not Discernible* (*ND*) rating but is assigned a *Low* rating to address uncertainties.

Based on the TC&WM EIS screening results, it is assumed that uranium would not reach groundwater in sufficient quantity to exceed the standard during the Active Cleanup and Near-term Post-Cleanup periods. Thus the uranium would result in *Not Discernible* (*ND*) ratings for the Active Cleanup period but is also assigned a *Low* rating for the Near-term Post-Cleanup period to address uncertainty.

For Sr-90, the times required for the remaining vadose zone inventory to decay to values that would result in *Medium* and *Low* ratings are 60 and 150 years, respectively. Thus the Sr-90 ratings for the Active Cleanup and Near-term Post-Cleanup periods would be *High* and *Medium*, respectively, based on decay considerations. However, transport considerations based on the TC&WM EIS screening evaluations indicate that Sr-90 is unlikely to impact groundwater in the future, which would lead to a *Not Discernible* rating for the Active Cleanup period and a *Low* rating for the Near-term Post-Cleanup period to again address uncertainty.

Columbia River

The process illustrated in Chapter 6 of the Methodology Report (CRESP 2015a) is used to evaluate potential impacts to the Columbia River. Note that the evaluation of potential benthic and riparian impacts has a common thread up to the point when the shoreline impact (benthic) or riparian zone impact area is used to define ratings. Thus a common evaluation for the benthic and riparian zone is performed here.

Benthic and Riparian Zone – Current Impacts

Based on the information in the 2013 Hanford Annual Groundwater Report (DOE/RL-2014-32, Rev. 0) and HEIS (http://ehs.hanford.gov/eda/), no plume from the 200-BP GWIA currently intersects the Columbia River at concentrations exceeding the appropriate water quality standard (WQS). Thus current impacts from the C Tank and Waste Farms EU to the Columbia River benthic and riparian ecology would be rated as *Not Discernible* (*ND*).

[139] The barrier represents the edge of the infiltration barrier to be constructed over disposal areas that are within 100 meters [110 yards] of facility fence lines (DOE/EIS-0391 2012). The A Barrier is the closest to the C Tank and Waste Farms EU. Despite including sources other than those for the C Tank and Waste Farms EU, the analysis in the TC&WM EIS was considered a reasonable source of information to assess the impact of the engineered surface barrier emplacement.

Benthic and Riparian Zone – Active Cleanup and Near-term, Post Cleanup for Current Plumes
Because 200-BP plumes (Tc-99 and possibly nitrate) associated with the C Tank and Waste Farms EU originate from 200-East, it is possible that a current plume might reach the Columbia River in the next 150 years since the *water* travel time is ~10-30 years from 200-East to the Columbia River (Gephart 2003; PNNL-6415 Rev. 18). Based on a similar analysis described for the A-AX Tank and Waste Farms EU (Section E.6.5), a *Not Discernible* (*ND*) rating is obtained for Tc-99 for the Near-term, Post-Cleanup impacts on the Columbia River[140]. For nitrate, a *Not Discernible* (*ND*) rating is obtained for the Active Cleanup and Near-term, Post-Cleanup periods.

Benthic Ecology – Active Cleanup and Near-term, Post Cleanup for Vadose Zone Contaminants
Following the analysis outlined in Section E.6.5 for the A-AX Tank and Waste Farms EU, the vadose zone contaminants (where hexavalent chromium is the possible risk driver) would translate to a (benthic) rating of *Not Discernible* (*ND*) during the Active Cleanup and Near-term, Post-Cleanup periods.

Using the TC&WM EIS screening results would lead to *Medium* (benthic) and *High* (riparian) ratings for chromium (and Not Discernible for the others); however, because well measurements indicate that chromium is moving toward the Columbia River much more slowly than assumed in the TC&WM EIS, the plumes are not likely going to reach the Columbia River within the Evaluation periods leading to *Not Discernible* (*ND*) ratings.

Benthic and Riparian Zone – Long-term
Following the analysis outlined in Section E.6.5, there should be no expected adverse effects from radionuclides during the TC&WM EIS evaluation period (10,000 years). Similarly, nitrate from the C Tank and Waste Farms EU would pose little additional long-term risk to the Columbia River benthic or riparian ecology. The screening results for chromium (assumed hexavalent) would translate to some additional risk to benthic and riparian receptors (i.e., exceeds the screening threshold) although sources other than the C Tank and Waste Farms EU are included in the evaluation. As indicated in Section E.6.5, this is consistent with the evaluation provided in the TC&WM EIS (DOE/EIS-0391 2012, Chapter 2, p. 2-235 & 2-237).

Potential Impact of Recharge Rate on Threats to the Columbia River
Similar to the evaluation in Section E.6.5, the alternatives analysis in the TC&WM EIS would suggest that benthic and riparian zone ratings associated with the C Tank and Waste Farms EU would not change based on surface barrier installation and changes in recharge rates. This is not due to an ineffective barrier but instead likely due to the large amounts of the contaminants already in the subsurface and possible impact from sources outside the C Tank and Waste Farms EU.

Threats to the Columbia River Free-flowing Ecology
As described in Section E.2.5, the large dilution effect of the Columbia River on the contamination from the seeps and groundwater upwellings results in *Not Discernible* (*ND*) ratings for the Active Cleanup and Near-term, Post Cleanup periods and insignificant long-term impacts to the free-flowing ecology for all contaminants.

[140] Sr-90 and uranium have current plumes but neither is neither associated with the C TF EU nor expected to reach the Columbia River in the next 10,000 years (DOE/EIS-0391 2012). The cyanide plume, which is also not associated with the C TF EU, is evaluated in Appendix G.5 for the CP-GW-1 EU.

Facilities for D&D – Not Applicable

Operating Facilities – Not Applicable

Because of the prohibition on waste additions to the Hanford SSTs,[141] the C Tank and Waste Farms EU components are not considered Operating Facilities for this Review.

[141] Berman presentation on July 29, 2009, titled "Hanford Single-Shell Tank Integrity Program." Available at www.em.doe.gov.

Table E.8-2. Summary Table of Infrastructure and Subsurface Contamination Inventory for the C Tank and Waste Farms Evaluation Unit (CP-TF-7) [a,b]

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[c]	99% Retrieval Scenario[c]
Infrastructure (Tanks and Ancillary Equipment)				
Tank Waste	Waste (kGal)	91	88	64
	Sludge (kGal)	91	88	64
	Saltcake (kGal)	0	0	0
	Supernatant (kGal)	0	0	0
Tank Waste (rad)	Am-241 (Ci)	500	460	180
	C-14 (Ci)	0.37	0.33	0.11
	Co-60 (Ci)	12	12	12
	Cs-137 (Ci)	340000	300000	36000
	Eu-152 (Ci)	3.8	3.8	3.8
	Eu-154 (Ci)	66	66	66
	H-3 (Ci)	13	11	1.4
	I-129 (Ci)	0.069	0.063	0.017
	Ni-59 (Ci)	12	12	11
	Ni-63 (Ci)	1300	1300	1200
	Pu (total) (Ci)	630	600	350
	Sr-90 (Ci)	590000	550000	250000
	Tc-99 (Ci)	15	13	3.4
	U (total) (Ci)	21	20	9.9
Tank Waste (non-rad)	Cr (kg)	300	89	68
	Hg (kg)	18	8.1	7.0
	NO3 (kg)	3900	1900	1700
	Pb (kg)	550	360	340
	U (total) (kg)	28000	12000	10000
Ancillary Equipment (rad)	C-14 (Ci)	0.22	0.22	0.22
	Cs-137 (Ci)	14000	14000	14000
	H-3 (Ci)	1.6	1.6	1.6
	I-129 (Ci)	0.014	0.014	0.014

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[(c)]	99% Retrieval Scenario[(c)]
	Pu (total) (Ci)	300	300	300
	Sr-90 (Ci)	130000	130000	130000
	Tc-99 (Ci)	5	5	5
	U (total) (Ci)	7	7	7
Ancillary Equipment (non-rad)	Cr (kg)	79	79	79
	Hg (kg)	5.5	5.5	5.5
	NO3 (kg)	9300	9300	9300
	Pb (kg)	330	330	330
	U (total) (kg)	1600	1600	1600
Vadose Zone Source (Leaks and Intentional Discharges into Cribs and Trenches)				
Leaks (rad)	C-14 (Ci)	0.15	0.15	0.15
	Cs-137 (Ci)	18000	18000	18000
	H-3 (Ci)	1.2	1.2	1.2
	I-129 (Ci)	0.0026	0.0026	0.0026
	Pu (total) (Ci)	0.59	0.59	0.59
	Sr-90 (Ci)	260	260	260
	Tc-99 (Ci)	6.6	6.6	6.6
	U (total) (Ci)	0.0054	0.0054	0.0054
Leaks (non-rad)	Cr (kg)	42	42	42
	Hg (kg)	0.021	0.021	0.021
	NO3 (kg)	4800	4800	4800
	Pb (kg)	6.9	6.9	6.9
	U (total) (kg)	2.9	2.9	2.9
Cribs (rad)	Cs-137 (Ci)	3.00E-05	3.00E-05	3.00E-05
	Pu (total) (Ci)	1.60E-06	1.60E-06	1.60E-06
	Sr-90 (Ci)	0.00025	0.00025	0.00025
	U (total) (Ci)	2.60E-09	2.60E-09	2.60E-09
Cribs (non-rad)	Hg (kg)	8.50E-05	8.50E-05	8.50E-05
	NO3 (kg)	0.0091	0.0091	0.0091
	Pb (kg)	0.00015	0.00015	0.00015
	U (total) (kg)	3.70E-06	3.70E-06	3.70E-06
UPR (rad)	Am-241 (Ci)	1.3	1.3	1.3

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[(c)]	99% Retrieval Scenario[(c)]
	C-14 (Ci)	0.31	0.31	0.31
	Co-60 (Ci)	4.3	4.3	4.3
	Cs-137 (Ci)	20000	20000	20000
	Eu-152 (Ci)	0.083	0.083	0.083
	Eu-154 (Ci)	6.4	6.4	6.4
	H-3 (Ci)	24	24	24
	I-129 (Ci)	0.027	0.027	0.027
	Ni-59 (Ci)	1.1	1.1	1.1
	Ni-63 (Ci)	110	110	110
	Pu (total) (Ci)	3.1	3.1	3.1
	Sr-90 (Ci)	270	270	270
	Tc-99 (Ci)	6.4	6.4	6.4
	U (total) (Ci)	0.017	0.017	0.017
UPR (non-rad)	Cr (kg)	98	98	98
	Hg (kg)	0.025	0.025	0.025
	NO3 (kg)	7800	7800	7800
	Pb (kg)	25	25	25
	U (total) (kg)	6.6	6.6	6.6
Vadose Zone (from Vadose Zone Sources)				
VZ Remaining (rad)	Am-241 (Ci)	1.3	1.3	1.3
	C-14 (Ci)	0.46	0.46	0.46
	Co-60 (Ci)	4.3	4.3	4.3
	Cs-137 (Ci)	38000	38000	38000
	Eu-152 (Ci)	0.083	0.083	0.083
	Eu-154 (Ci)	6.4	6.4	6.4
	H-3 (Ci)	25	25	25
	I-129 (Ci)	0.03	0.03	0.03
	Ni-59 (Ci)	1.1	1.1	1.1
	Ni-63 (Ci)	110	110	110
	Pu (total) (Ci)	3.7	3.7	3.7
	Sr-90 (Ci)	530	530	530
	Tc-99 (Ci)	9.3	9.3	9.3

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[c]	99% Retrieval Scenario[c]
	U (total) (Ci)	0.022	0.022	0.022
VZ Remaining (non-rad)	Cr (kg)	140[d]	140[d]	140[d]
	Cr-VI (kg)	140[d]	140[d]	140[d]
	Hg (kg)	0.046	0.046	0.046
	Pb (kg)	31	31	31
	U (total) (kg)	9.5	9.5	9.5
VZ Treatment (rad)	Tc-99 (Ci)	0.002	0.002	0.002
VZ Treatment (non-rad)	NO3 (kg)	2.9	2.9	2.9
Saturated Zone (from Vadose Zone Sources)				
SZ Inventory (rad)	Tc-99 (Ci)	3.6	3.6	3.6
SZ Inventory (non-rad) (A and B)[e]	NO3 (kg)	43000	43000	43000

a. Tanks (SST and DST): Best Basis Inventory (BBI) March 2014; Ancillary Equipment (Anc Eq): Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix D; Unplanned Releases (UPRs): Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0); Ponds: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0); Cribs: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0); Trenches: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0) and Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix S; Leaks: Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix D; MUSTs: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0) and Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix S.

b. All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

c. 99% and 90% Retrieval Scenarios reflect assumptions described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 and apply only to tank volumes and inventories. They are calculated assuming retrieval of a fully mixed tank of homogeneous composition. For tanks that have been declared “Retrieval Completed” or “Retrieved to Limit of … Technologies” (Templeton, AM 2016, page 9, partially duplicated in Table E.1-7), no further retrieval for either the 99% or 90% retrieval scenario is assumed. This includes tank 241-S-112 and all C Tank Farm tanks except 241-C-105. For tanks that are currently undergoing retrieval (tanks 241-AY-102 and 241-C-105), a retrieval amount equivalent to the 99% and 90% retrieval volumes described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 are calculated.

d. Differences in inventories for Cr vs Cr-IV are due to differing Water Quality Standards (WQS) and thus plume extents: 100 mg/L for total chromium vs 48 mg/L for chromium (VI). The difference may not be distinguishable within the number of significant digits (2) displayed.

e. Nitrate assessment not updated for 2015 groundwater monitoring results (DOE/RL-2016-09, Rev. 0) because the Group A and B drive risk to groundwater.

Table E.8-3. Current Bulk Inventory and Steady State Flammability Results (by Tank) for the C Tank Farm (CP-TF-7)

Tank ID	Tank Type	Capacity (kGal)[a]	Sludge (kGal)[a]	Saltcake (kGal)[a]	Supernatant (kGal)[a]	HGR (ft^3/d)[b]	Days to 25% LFL Barometric[c]	Days to 25% LFL Zero Ventilation[d]
C-101	SST	530	6	0	0	0.31	NA	>1826
C-102	SST	530	16	0	0	0.33	NA	>1826
C-103	SST	530	2	0	0	0.8	NA	1341
C-104	SST	530	2	0	0	0.32	NA	>1826
C-105	SST	530	30	0	0	0.62	NA	1561
C-106	SST	530	3	0	0	1.3	NA	758
C-107	SST	530	10	0	0	0.8	NA	1330
C-108	SST	530	3	0	0	0.78	NA	1369
C-109	SST	530	2	0	0	0.31	NA	>1826
C-110	SST	530	2	0	0	0.32	NA	>1826
C-111	SST	530	5	0	0	0.79	NA	1356
C-112	SST	530	10	0	0	0.4	NA	>1826
C-201	SST	55	0	0	0	0.063	NA	1155
C-202	SST	55	0	0	0	0.064	NA	1136
C-203	SST	55	0	0	0	0.061	NA	1182
C-204	SST	55	0	0	0	0.061	NA	1195

a. Volumes from the Waste Tank Summary Report for Month Ending November 30, 2016 (Templeton, AM 2016).

b. Hydrogen generation rate (ft^3/d) (RPP-5926 Rev. 17). Note in 2001 all 24 tanks were removed from the flammable gas watch list (including T-110 in the T Tank and Waste Farms EU) (Johnson, et al. 2001, p. iii).

c. Time (in days) to 25% of the Lower Flammability Limit (LFL) under a barometric (barom) breathing scenario (RPP-5926, Rev. 17). “NA” indicates that the headspace will not reach specified flammability level.

d. Time (in days) to 25% of the LFL under a zero ventilation scenario (RPP-5926, Rev. 17).

Table E.8-4. Current Primary Contaminant Inventory (by Tank) for the C Tank Farm (CP-TF-7) [a]

Tank ID	Baseline Status[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)
C-101	2001	5.7	0.0035	NR[c]	0.00041	2200	0.00010	0.0051	0.040
C-102	2001	17	0.0082	NR	0.0010	640	0.00024	0.012	0.11
C-103	2001	4.9	0.0070	NR	0.089	800	0.000048	3.7	0.0078
C-104	2001	8.4	0.0030	NR	0.64	660	0.043	2.2	0.012
C-105	2001	360	0.28	NR	0.31	330000	0.00059	0.029	13
C-106	2001	65	0.0082	NR	11	1300	3.7	59	0.0082
C-107	2001	14	0.032	NR	0.0065	290	0.00037	0.022	0.028
C-108	2001	0.91	0.0038	NR	0.0013	90	0.00013	0.0062	0.024
C-109	2001	0.36	0.00073	NR	0.00086	45	0.000089	0.0043	0.0043
C-110	2001	0.053	0.0014	NR	0.00024	21	0.000025	0.0012	0.0022
C-111	2001	7.8	0.0039	NR	0.00053	160	0.000055	0.0027	0.0060
C-112	2001	20	0.018	NR	0.0020	630	0.00020	0.0097	0.072
C-201	2001	2.6	0.00076	NR	0.0043	7.8	0.0027	0.14	0.00020
C-202	2001	1.2	0.00020	NR	0.012	8.2	0.0040	0.25	0.00032
C-203	2001	0.032	0.00017	NR	0.010	12	0.0032	0.040	0.00026
C-204	2001	0.0032	0.00019	NR	0.0090	5.4	0.0030	0.15	0.00022

a. From Best Basis Inventory (BBI) Summary (February 2017). All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

b. This is the "Baseline Status" date as reported in the BBI (February 2017) as "Baselined 2001." It should not be necessarily be considered the decay date for isotope inventories.

c. NR = Not reported for this EU

Table E.8-5. Current Primary Contaminant Inventory[a] and Groundwater Threat Metric (by Tank) for the C Tank Farm (CP-TF-7)

Tank ID	I-129 (Ci)	Ni-59 (Ci)	Ni-63 (Ci)	Pu (total) (Ci)[b]	Sr-90 (Ci)	Tc-99 (Ci)	U (total) (Ci)[c]	GTM (Mm3)[d]
C-101	0.0027	0.00092	57	32	10000	0.79	3.5	1.1
C-102	0.0016	0.0026	580	96	550	0.43	0.72	0.65
C-103	0.0030	0.11	20	11	9100	0.045	0.037	1.2
C-104	0.00020	0.083	98	21	5200	0.29	3.0	0.32
C-105	0.058	1.1	89	310	370000	13	12	24
C-106	0.00063	11	71	56	60000	0.16	0.0043	0.26
C-107	0.0030	0.0017	330	20	11000	0.088	0.29	1.2
C-108	0.000036	0.00089	2.8	0.80	1300	0.046	0.072	0.052
C-109	0.000025	0.00061	0.86	1.0	2500	0.0083	0.018	0.01
C-110	0.00025	0.00017	0.39	1.7	2700	0.042	0.0050	0.1
C-111	0.000016	0.00038	3.5	3.2	45000	0.050	0.037	0.055
C-112	0.000057	0.0014	36	20	72000	0.28	0.62	0.31
C-201	0.00000046	0.0041	0.86	30	190	0.0026	0.075	0.0029
C-202	0.0000074	0.0042	0.22	31	440	0.0025	0.070	0.003
C-203	0.000015	0.0034	0.060	1.1	210	0.0023	0.23	0.006
C-204	0.00000036	0.0032	0.016	0.022	140	0.0032	0.17	0.0035

a. From Best Basis Inventory (BBI) Summary (February 2017). All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

b. Sum of plutonium isotopes 238, 239, 240, 241, and 242

c. Sum of uranium isotopes 232, 233, 234, 235, 236, and 238

d. The Groundwater Threat Metric (GTM) shown for tanks is equal to the maximum of the GTM for Tc-99 and I-129.

Table E.8-6. Current Primary Contaminant Inventory (by Tank) for the C Tank Farm (CP-TF-7) [a]

Tank ID	CCl4 (kg)	CN (kg)	Cr (kg)	Cr-VI (kg)	Hg (kg)	NO3 (kg)	Pb (kg)	TBP (kg)	TCE (kg)	U (total) (kg)
C-101	NR[b]	NR	5.0	NR	0.051	720	8.1	NR	NR	5200
C-102	NR	NR	11	NR	0.42	550	4.2	NR	NR	600
C-103	NR	NR	2.4	NR	1.1	0.87	8.5	NR	NR	49
C-104	NR	NR	2.9	NR	1.3	9.0	6.2	NR	NR	1300
C-105	NR	NR	230	NR	11	2300	220	NR	NR	18000
C-106	NR	NR	3.8	NR	1.9	35	26	NR	NR	2.7
C-107	NR	NR	6.7	NR	1.3	67	55	NR	NR	430
C-108	NR	NR	0.60	NR	0.019	8.7	16	NR	NR	120
C-109	NR	NR	0.17	NR	0.017	4.3	5.1	NR	NR	27
C-110	NR	NR	1.1	NR	0.10	6.3	5.3	NR	NR	7.3
C-111	NR	NR	1.5	NR	0.072	61	69	NR	NR	20
C-112	NR	NR	5.3	NR	0.14	180	120	NR	NR	1500
C-201	NR	NR	12	NR	0.11	1.4	6.3	NR	NR	110
C-202	NR	NR	9.1	NR	0.29	1.3	5.8	NR	NR	99
C-203	NR	NR	2.6	NR	0.0022	3.8	3.1	NR	NR	330
C-204	NR	NR	1.4	NR	0.15	0.022	1.0	NR	NR	240

a. From Best Basis Inventory (BBI) Summary (February 2017). All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

b. NR = Not reported for this EU

Table E.8-7. Summary of the Evaluation of Current Threats to Groundwater as a Protected Resource from Remaining Vadose Zone (VZ) Contamination associated with the C Tank and Waste Farms Evaluation Unit (CP-TF-7)

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} [d]	VZ GTM (Mm^3)	VZ Rating[e]
C-14	A	2000 pCi/L	0.25	0	1.82	4.61E-01 Ci	---	---	4.61E-01 Ci	2.30E-01	*Low*
I-129	A	1 pCi/L	0.25	0.2	1.82	2.99E-02 Ci	---	---	2.99E-02 Ci	1.22E+01	*Medium*
Sr-90	B	8 pCi/L	0.25	22	1.82	5.29E+02 Ci	---	---	5.29E+02 Ci	4.11E+02	*ND*[f]
Tc-99	A	900 pCi/L	0.25	0	1.82	1.30E+01 Ci	3.65E+00 Ci	1.97E-03 Ci	9.32E+00 Ci	1.04E+01	*Medium*
CCl4	A	5 µg/L	0.25	0	1.82	---	---	---	---	---	*ND*
Cr	B	100 µg/L	0.25	0	1.82	1.40E+02 kg	---	---	1.40E+02 kg	1.40E+00	*Low*
Cr-VI	A	48 µg/L[b]	0.25	0	1.82	1.40E+02 kg	---	---	1.40E+02 kg	2.91E+00	*Low*
TCE	B	5 µg/L	0.25	2	1.82	---	---	---	---	---	*ND*
U(tot)	B	30 µg/L	0.25	0.8	1.82	9.52E+00 kg	---	---	9.52E+00 kg	4.65E-02	*ND*[f]

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

b. "Model Toxics Control Act−Cleanup" (WAC 173-340) Method B groundwater cleanup level for hexavalent chromium. Other WQS values represent drinking water standards.

c. Treatment amounts from the 2015 Hanford Annual Groundwater Report (DOE/RL-2016-09, Rev. 0). The small amount of Tc-99 removed was as part of the treatability test for the B Complex perched aquifer where primarily uranium is removed. No other active remedial actions are being performed in the 200-BP GWIA.

d. The remaining vadose zone inventory is estimated by difference (CRESP 2015a; Appendix D.1) and thus has a high associated uncertainty.

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

f. As discussed in Section E.6.5, no appreciable total uranium or Sr-90 plume would be expected in the next 150 years due to transport and decay (Sr-90) considerations. Thus the *Low* rating would apply to the period *after* the Active Cleanup is complete to account for uncertainties.

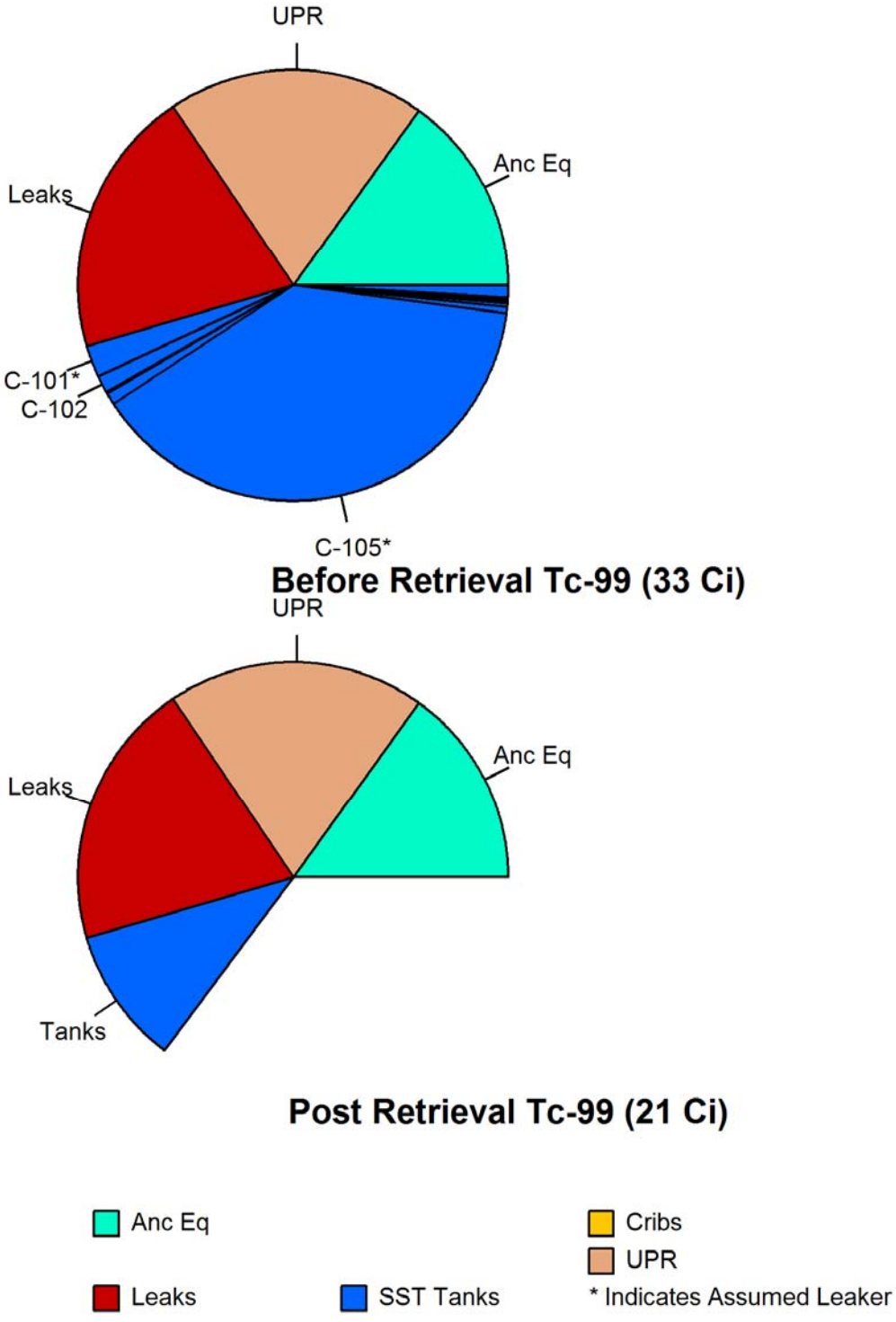


Figure E.8-3. C Tank and Waste Farms Evaluation Unit Inventory Estimates for Tc-99 Before and After 99% Retrieval

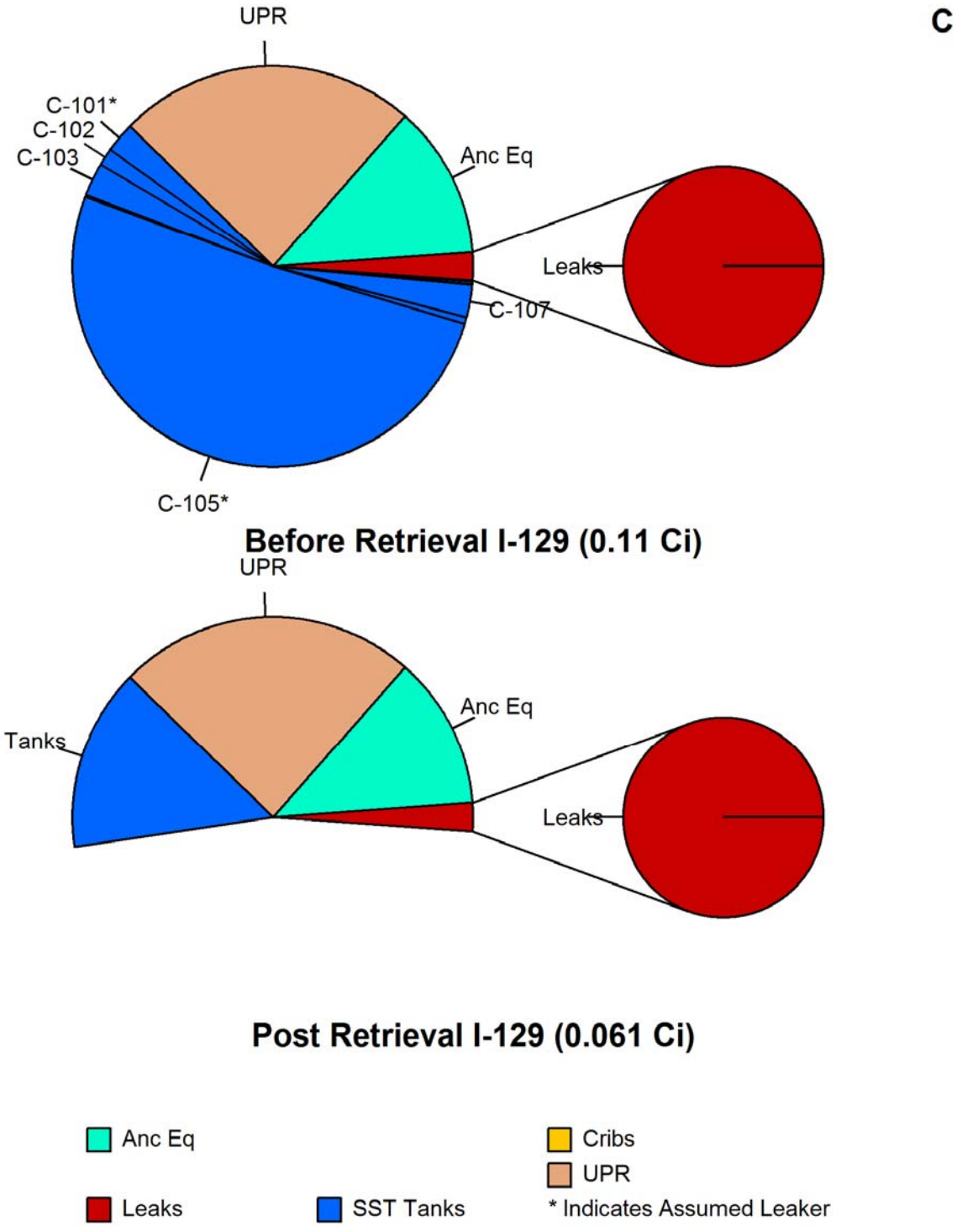


Figure E.8-4. C Tank and Waste Farms Evaluation Unit Inventory Estimates for I-129 Before and After 99% Retrieval

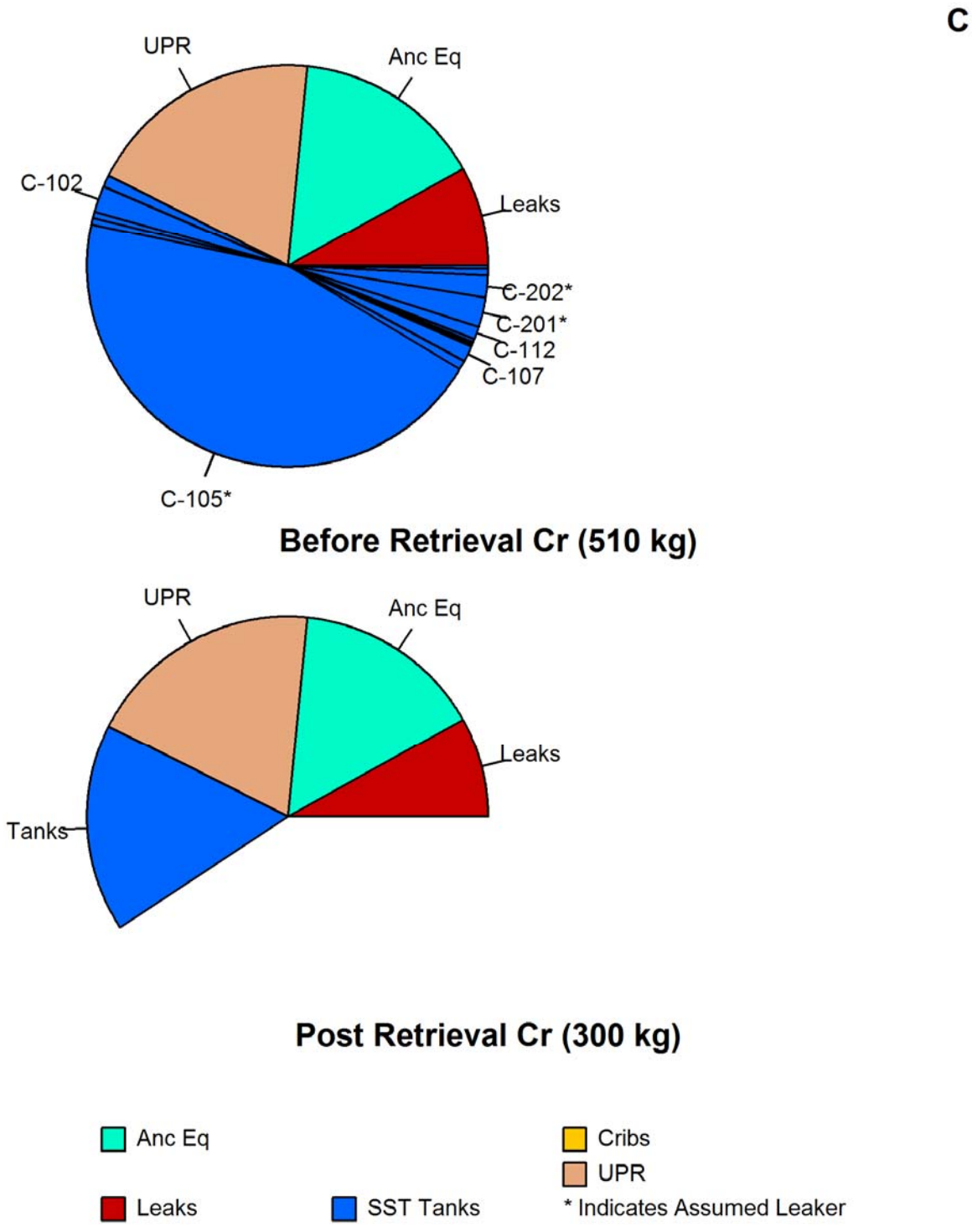


Figure E.8-5. C Tank and Waste Farms Evaluation Unit Inventory Estimates for Chromium Before and After 99% Retrieval

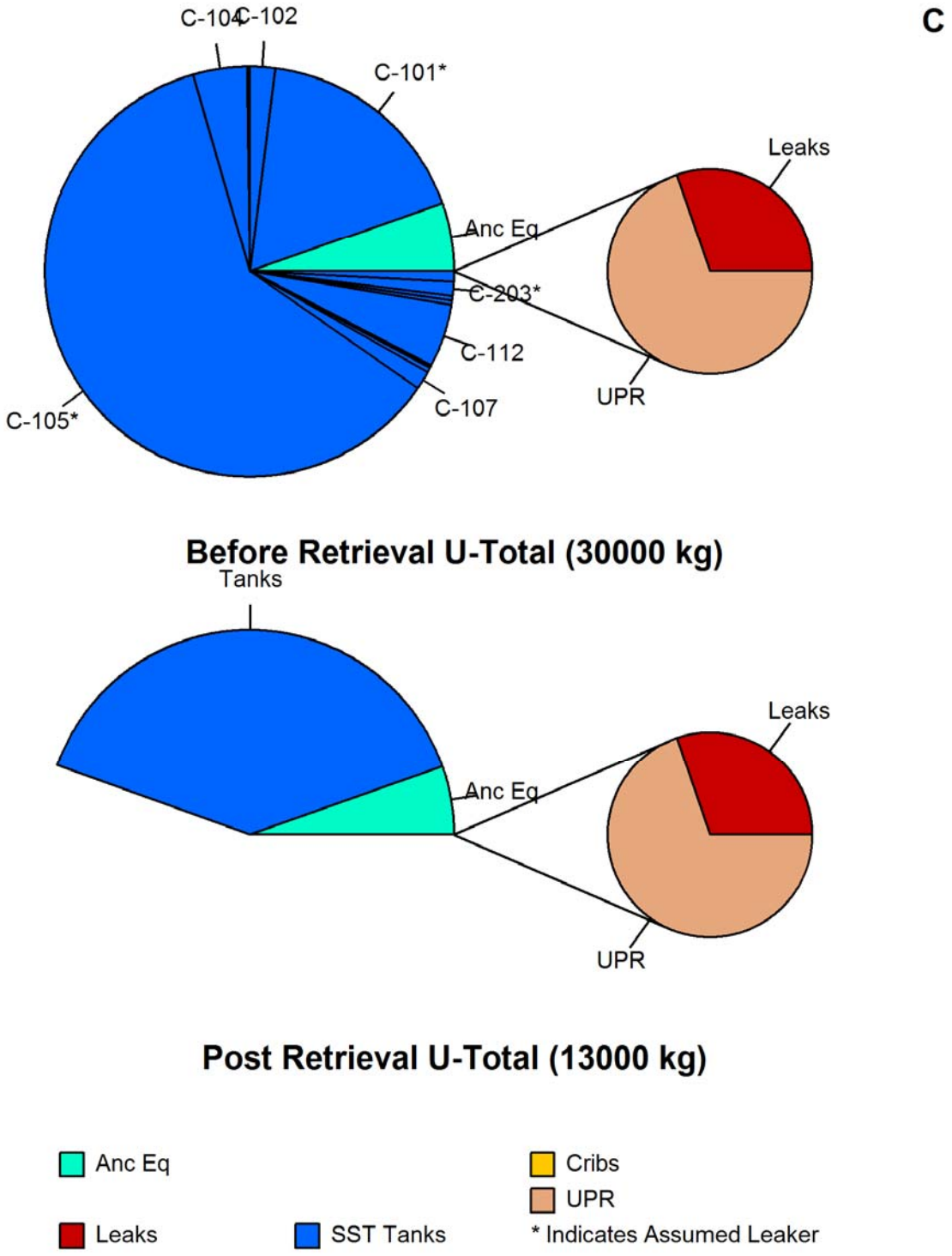


Figure E.8-6. C Tank and Waste Farms Evaluation Unit Inventory Estimates for U(tot) Before and After 99% Retrieval

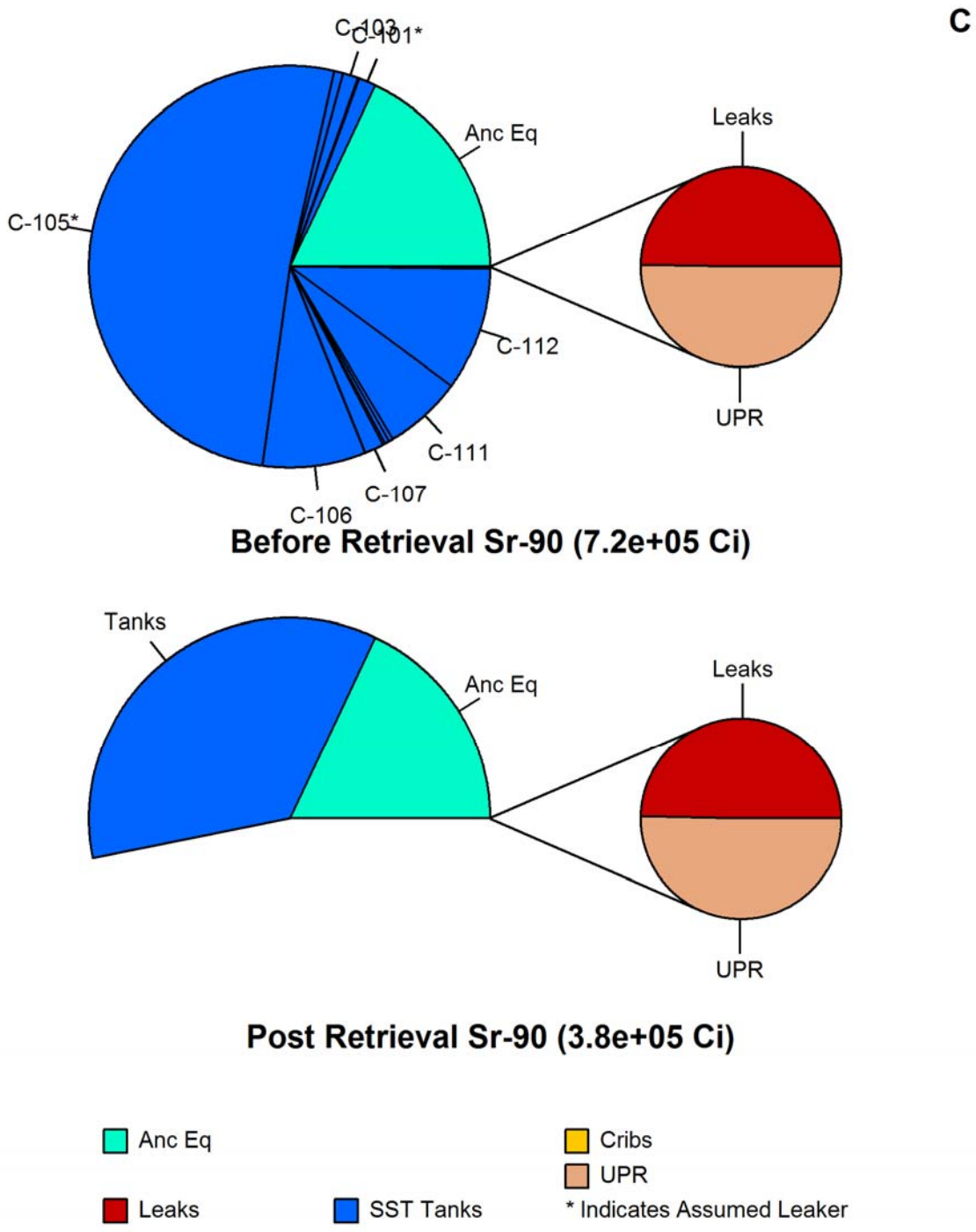


Figure E.8-7. C Tank and Waste Farms Evaluation Unit Inventory Estimates for Sr-90 Before and After 99% Retrieval

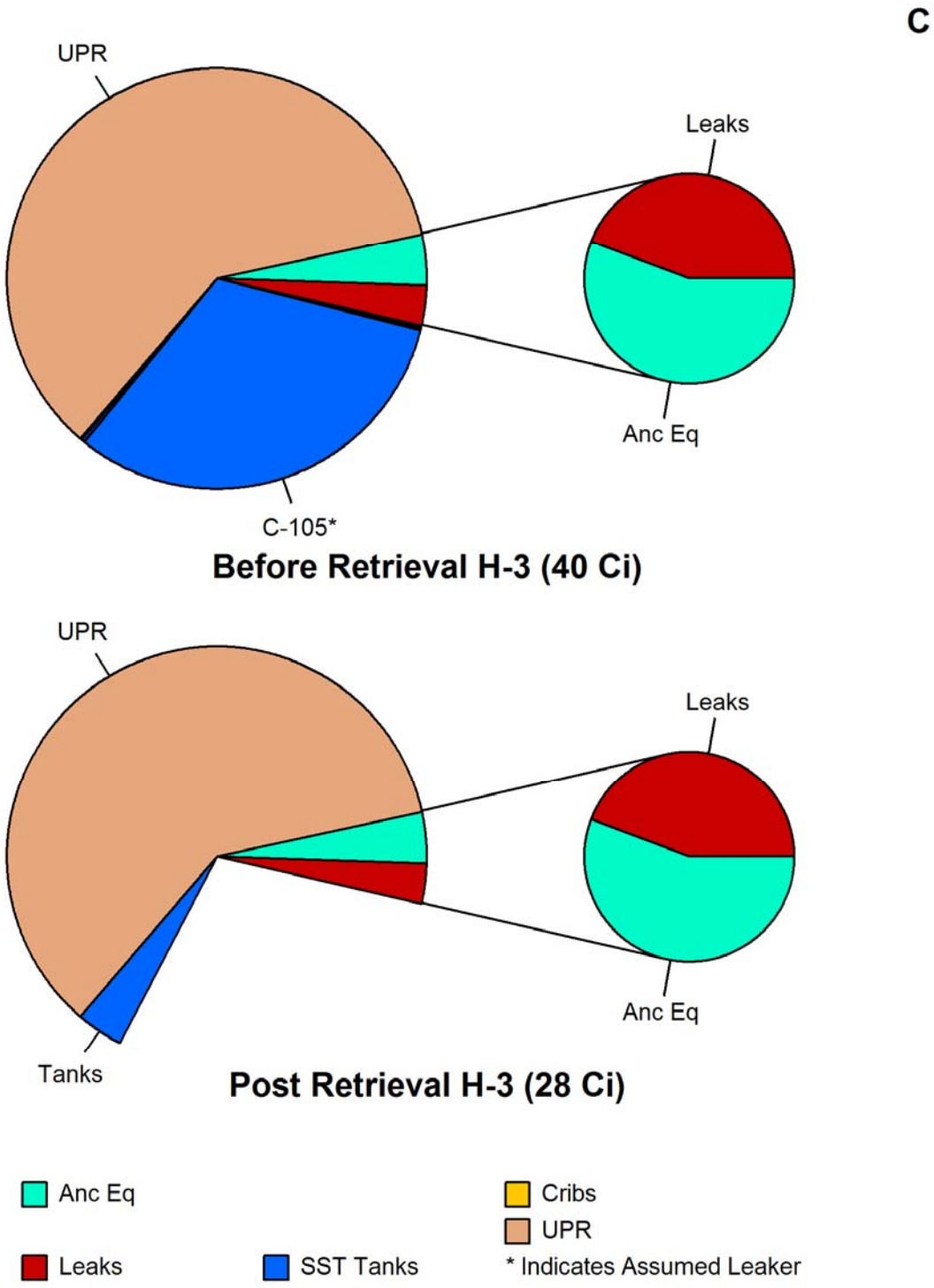


Figure E.8-8. C Tank and Waste Farms Evaluation Unit Inventory Estimates for Tritium (H-3) Before and After 99% Retrieval

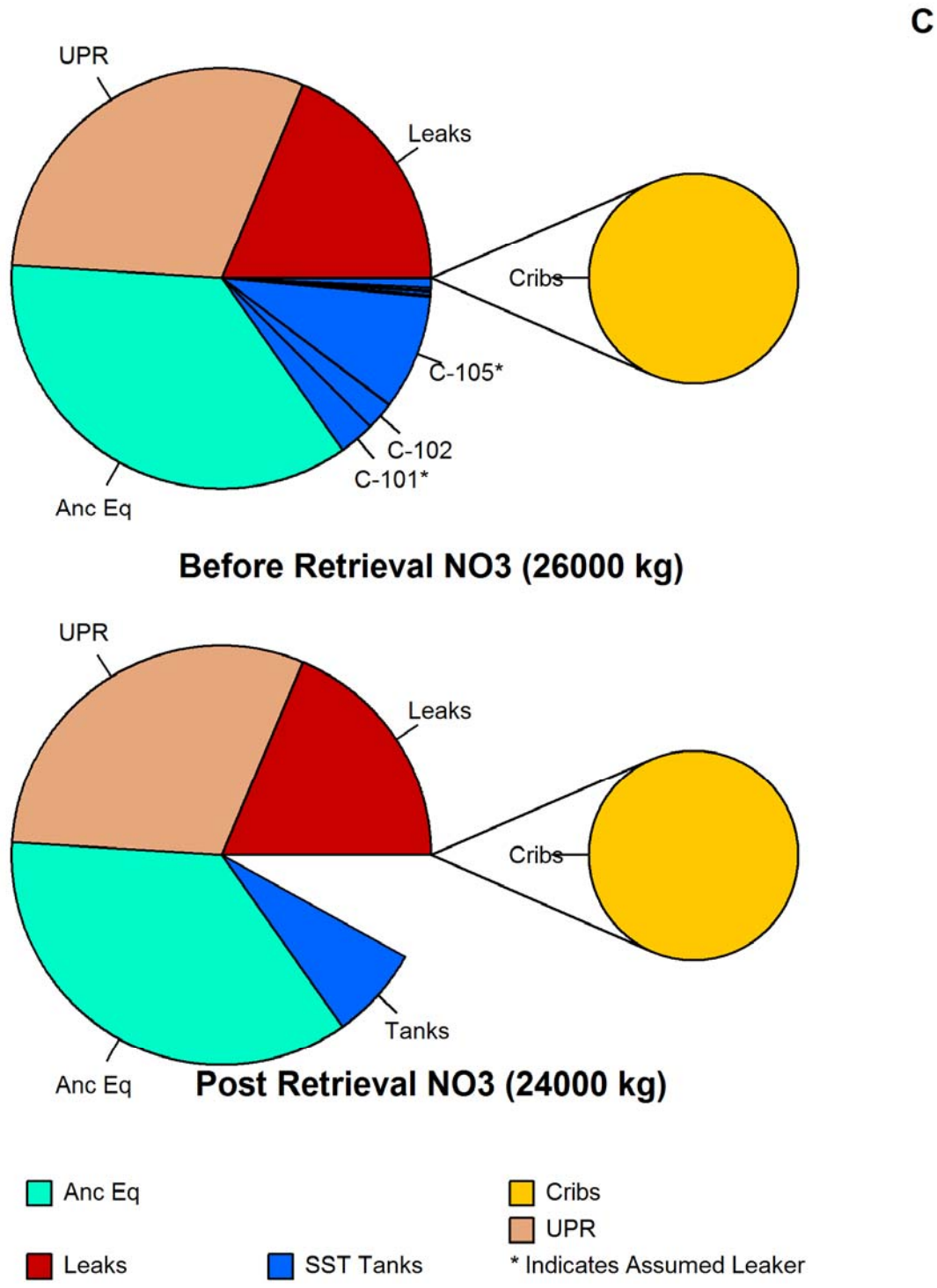


Figure E.8-9. C Tank and Waste Farms Evaluation Unit Inventory Estimates for Nitrate (NO3) Before and After 99% Retrieval

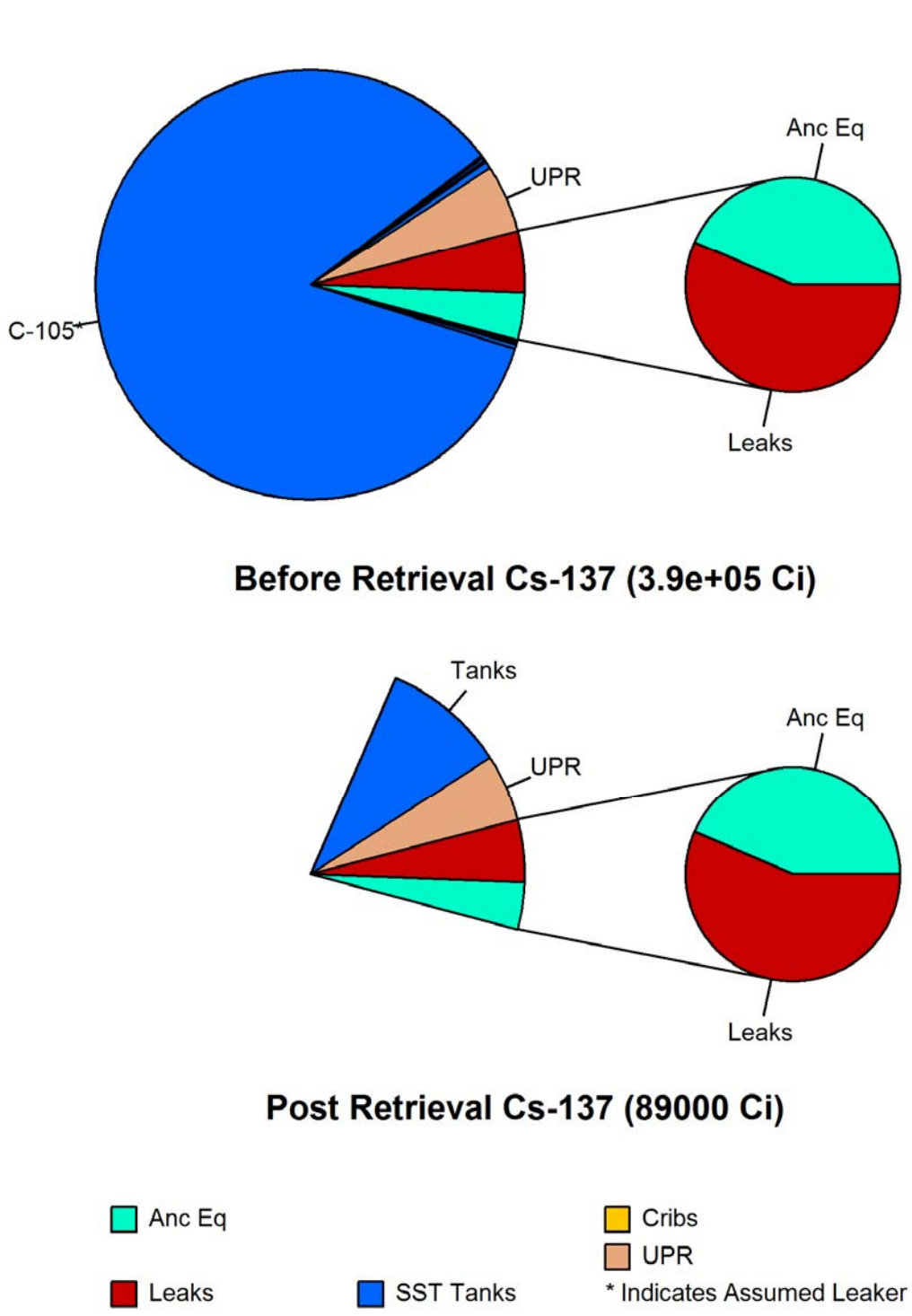


Figure E.8-10. C Tank and Waste Farms Evaluation Unit Inventory Estimates for Cs-137 Before and After 99% Retrieval

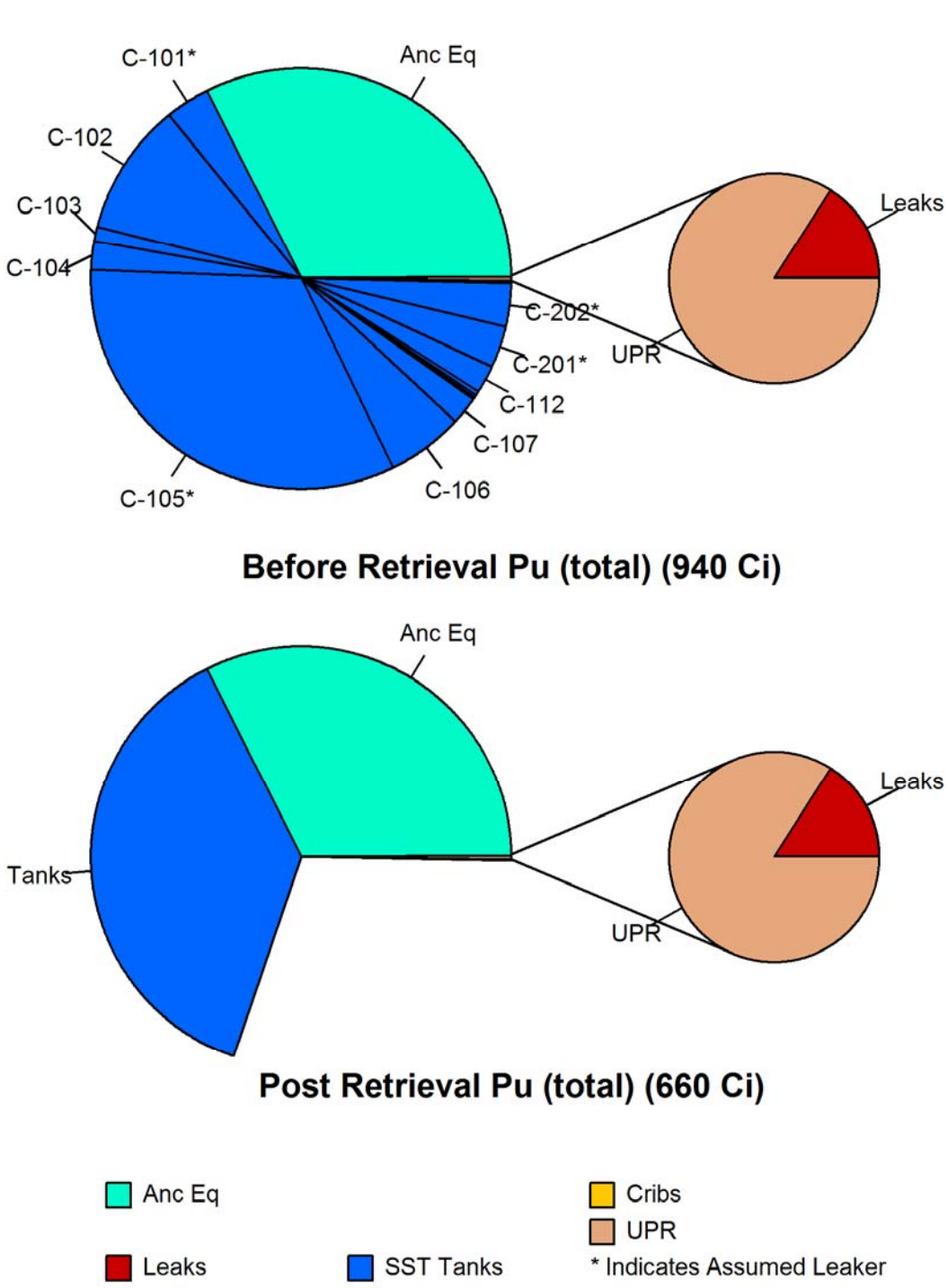


Figure E.8-11. C Tank and Waste Farms Evaluation Unit Inventory Estimates for Plutonium (total) Before and After 99% Retrieval

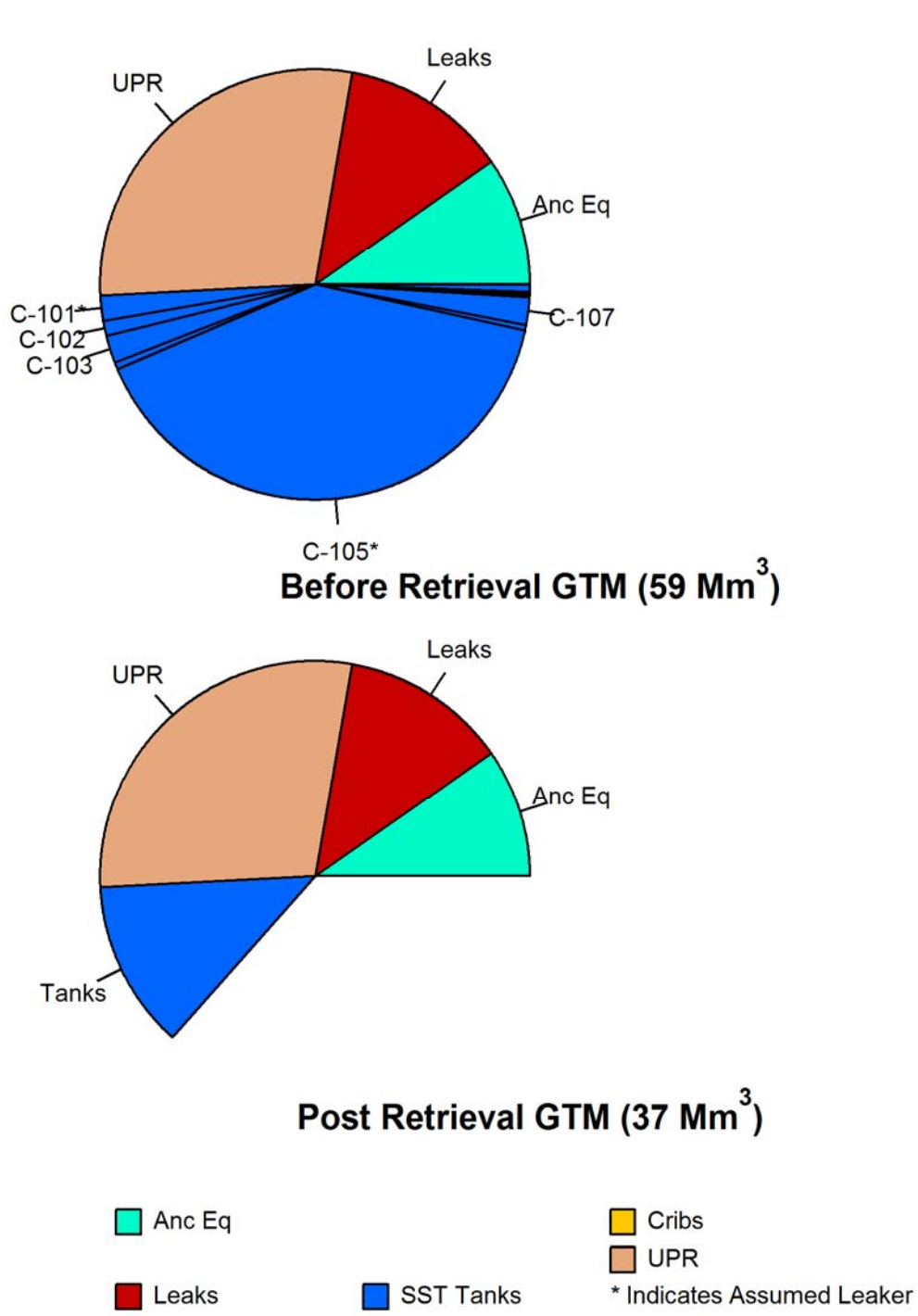


Figure E.8-12. C Tank and Waste Farms Evaluation Unit Maximum Groundwater Threat Metric (GTM) of I-129 and Tc-99 Estimates Before and After 99% Retrieval

E.8.6. POTENTIAL RISK/IMPACT PATHWAYS AND EVENTS

CURRENT CONCEPTUAL MODEL

A common safety analysis was performed for all the single- and double-shell tanks including pathways and barriers (safety scenarios that dominate risk, safety systems and controls, barriers to release, failure mechanisms, pathways and receptors, time frames for exposure). See Section E.1.6 in Appendix E.1 for details.

POPULATIONS AND RESOURCES CURRENTLY AT RISK OR POTENTIALLY IMPACTED

Facility Worker, Co-located Person, and Public

A common analysis was performed for the Facility Worker, Co-located Person, and Public. See Section E.1.6 (Appendix E.1) for details.

Groundwater

The current groundwater plumes (Tc-99 and nitrate) associated with the C Tank and Waste Farms EU and liquid waste disposal facilities are described in Section E.8.5 and further details including ratings are provided in the Appendix D.5 for the CP-GW-1 EU (200-BP-5 GW OU).

As shown in Table E.8-7 (Section E.8.5), the vadose zone (VZ) GTM values for the Group A and B primary contaminants range from *Not Discernible* (*ND*) for Sr-90 (which has an inventory that would translate to a *High* rating but appears relatively immobile in the area as described in Section E.8.5) and total uranium (with an inventory that would translate to a *Low* rating if mobile), *Low* for C-14 and chromium (total and hexavalent) to *Medium* for I-129 and Tc-99. The Sr-90 will decay significantly during the Active and Near-term, Post Cleanup periods that would result in a *Medium* rating during the Near-term, Post-Cleanup period. However, transport considerations indicate the Sr-90 is unlikely to impact groundwater in the future (i.e., next 10,000 years). Thus the overall current rating for groundwater impact from vadose zone sources is *Medium*.

Columbia River

As described in Section E.8.5, there are no plumes associated with the C Tank and Waste Farms EU that currently intersect the Columbia River, which corresponds to *Not Discernible* ratings for all evaluation periods.

As described in Section E.8.5, TC&WM EIS screening results indicate that peak concentrations in the nearshore region of the Columbia River were below benchmarks for wildlife receptors and benthic invertebrates and aquatic biota leading to a *Not Discernible* (*ND*) rating for radionuclides for both benthic and riparian receptors for all evaluation periods.

For chemicals, only nitrate and chromium (assumed hexavalent) are predicted in the TC&WM EIS to have concentrations (from sources including those other than the C Tank and Waste Farms EU) that could exceed thresholds in the near-shore ecology as described in Section E.8.5. Nitrate has a *Not Discernible* rating for current conditions (since the plume is not in contact with the Columbia River) and would have *Low* ratings for the benthic and riparian ecology for the Active Cleanup and Near-term, Post-Cleanup periods. Hexavalent chromium has a *Not Discernible* rating for current conditions (since the plume is not in contact with the Columbia River) and would have *Medium* and *High* ratings for benthic and riparian receptors for the Active Cleanup and Near-term, Post-Cleanup periods based on the TC&WM EIS screening results. However, well data indicate that chromium and nitrate are moving much

slower toward the Columbia River than predicted in the TC&WM EIS resulting in a *Not Discernible* (*ND*) rating for these evaluation periods.

The large dilution effect of the Columbia River results in a rating of *Not Discernible* (*ND*) for the free-flowing ecology for all evaluation periods.

Additional information concerning potential threats to the Columbia River from C Tank Farm and co-located liquid waste disposal facilities is provided in the Appendix D.5 for the CP-GW-1 EU (200-BP GWIA).

Ecological Resources

- The EU for C Tank Farm consists almost entirely of level 0 resources, and remediation actions will not have any negative effects on habitat resources within the EU.
- The EU is contiguous with the A-AX Tank Farm and 200-East Double Shell Tanks, but does adjoin small patches of level 2 and level 3 habitat to the west. However, disturbance to habitats within the EU would not have any effect on habitat connectivity.
- No wildlife were observed in the vicinity during the October survey.
- Individual occurrences of sensitive plant species are located within the landscape buffer area, but would be unlikely to be affected by any remediation action within the evaluation unit.

Cultural Resources

- The 271-CR Service and Office Building, contributing property within the Manhattan Project/Cold War Era Historic District with no documentation required is located within the C Tank and Waste Farms EU.
- There are no archaeological sites or TCPs known to be located or recorded within the C Tank and Waste Farms EU.

Archaeological sites and TCPs located within 500 meters of the EU

- An isolated find associated with the Native American Precontact and Ethnographic Landscape consisting has been located within close proximity to the C Tank and Waste Farms Evaluation Unit.
- The Hanford Site Plant Railroad and 2707AR Sludge Vault Change House are contributing properties within the Manhattan Project and Cold War Era Historic District with documentation required are located within close proximity to the C Tank and Waste Farms Evaluation Unit.

Recorded TCPs Visible from the EU

There are two recorded TCPs associated with the Native American Precontact and Ethnographic Landscape that are visible from the C Tank and Waste Farms EU.

CLEANUP APPROACHES AND END-STATE CONCEPTUAL MODEL

Selected or Potential Cleanup Approaches

A common analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

Contaminant Inventory Remaining at the Conclusion of Planned Active Cleanup Period

See Section E.8.5 including Table E.8-2 and Figure E.8-3 through Figure E.8-11 for the inventory information after planned 99% retrieval. Furthermore, a more general analysis was performed for all the single- and double-shell tanks. See Section E.1.6 for details.

Risks and Potential Impacts Associated with Cleanup

A common analysis was performed for all the single- and double-shell tanks for workers and the Public. See Section E.1.6 (Appendix E.1) for details.

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

Facility Worker, Co-located Person, and Public

A common analysis was performed for the Facility Worker, Co-located Person, and Public. See Section E.1.6 (Appendix E.1) for details.

Groundwater

As described in Section E.8.5, there will be a continuing impact during this period to groundwater (as a protected resource) from those mobile C Tank and Waste Farms EU primary contaminants currently with plumes that exceed thresholds. These impacts are described in Appendix D.5 for the CP-GW-1 EU (200-BP-5 GW OU).

Furthermore, there are primary (e.g., tank wastes) and secondary contaminant sources (legacy source sites) in the vadose zone that pose risk to groundwater. For the Active Cleanup and Near-Term, Post-Cleanup periods, the vadose zone (VZ) GTM values for the Group A and B primary contaminants for the C Tank and Waste Farms EU range from *Not Discernible* (*ND*) for total uranium and Sr-90 to *Low* for C-14, and chromium (total and hexavalent) to *Medium* for I-129 and Tc-99. As described in Section E.8.5, transport considerations based on the screening evaluations in the TC&WM EIS indicate that total uranium and Sr-90 are not likely to impact groundwater in the next 150 years[142]. Thus the overall rating for the Active Cleanup and Near-Term, Post-Cleanup periods is *Medium*.

The final action record of decision for the 200-BP-5 OU has not been scheduled; thus groundwater will likely be treated in the future to help address groundwater contamination.

It is considered unlikely that additional groundwater resources would be impacted as a result of either interim remedial actions (e.g., pump and treat) or final closure activities (that are not covered in the Ecological or Cultural Resources results).

Columbia River

As described in Section E.8.5, impacts from radiological contaminants to the Columbia River benthic and riparian ecology for the Active Cleanup and Near-term, Post Cleanup periods are rated as *Not Discernible* (*ND*). The nitrate has a rating of *Not Discernible* for the benthic and riparian ecology. For the Active Cleanup and Near-term, Post Cleanup periods, chromium (assumed hexavalent) would have had benthic and riparian zone ratings of *Medium* and *High*, respectively; however, well data suggest that chromium is moving much slower than predicted in the TC&WM EIS (Appendix O, DOE/EIS-0391 2012) resulting in *Not Discernible* ratings. The large dilution effect of the Columbia River on the contamination from the

[142] Note that no appreciable uranium or Sr-90 plume or, in this rare case, Tc-99 would be expected in the next 150 years due to transport considerations; however, these may impact groundwater after the 150-year period. Thus a *Low* rating would apply after the Active Cleanup period to account for uncertainties.

seeps and groundwater upwellings produces *ND* ratings for all contaminants for the Active Cleanup and Near-term, Post Cleanup periods.

It is considered unlikely that additional benthic or riparian resources would be impacted as a result of either interim remedial actions (e.g., pump and treat) or final closure activities (that are not covered in the Ecological or Cultural Resources results). Additional information on groundwater plumes and potential threats associated with the C Tank Farm and liquid waste disposal facilities are described in Section E.8.5 and Appendix D.5 for the CP-GW-1 EU (200-BP GWIA).

Ecological Resources

Personnel, car, and pick-up truck traffic through non-target and remediated areas will likely no longer cause an effect on the ecological resources, unless heavy traffic caused ruts. If alien/exotic species became established during remediation, their presence could continue to affect the ecological resources. Permanent effects remain in the area of site with barrier or cap. Permanent effects remain in area surrounding cap or containment, depending upon traffic and current activities. During remediation, radionuclides or other contaminants released or spilled on the surface could have long-term effects if the contamination remained, and plants did not recolonize or thrive. Such disruptions could affect the associated animal community.

Cultural Resources

Personnel, car and truck traffic on paved roads will likely have no direct effects on the cultural resources assuming the resources were not disturbed during remediation. If the remedial action included construction of buildings, cap or other type of containment then there are permanent effects in the area of the site. If archaeological resources or TCPs were directly or indirectly damaged or altered during construction of buildings or cap, cumulative effects include continued erosion and adverse effects to both archaeological site and TCP. If contamination is left behind and controlled by a barrier or other containment, then permanent effects to the cultural resources may occur in the area. If archaeological resources or TCPs were directly or indirectly damaged or altered during contamination, then cumulative effects include permanent adverse effects to both archaeological site and TCP.

Additional Risks and Potential Impacts if Cleanup is Delayed

A common analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

Near-Term, Post-Cleanup Status, Risks and Potential Impacts

A common analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

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

Table E.8-8. Summary of Populations and Resources at Risk or Potentially Impacted after Cleanup

Population or Resource		Impact Rating	Comments
Human	Facility Worker	Low	Workers will be low risk from exposure to direct radiation and waste contaminants after waste retrieval, grouting, and capping.
	Co-located Person	Low	These persons will be at low risk from exposure to direct radiation and waste contaminants after waste retrieval, grouting, and capping.
	Public	Not Discernible (ND)	The Tank Farms will be in secure and controlled areas that prevent intentional and inadvertent intruders. No complete groundwater pathway and no impact from air pathway.
Environmental	Groundwater (A&B) from vadose zone[(a)]	*Low* (Sr-90, U(tot), C-14, Tc-99, Cr(tot), and Cr-VI) *Medium* (I-129) **Overall**: *Medium*	Current GTM values for Group A and B primary contaminants (Table E.8-7): *ND* (Sr-90, U(tot),), *Low* (C-14, Cr(tot), Cr-VI), and *Medium* for Tc-99 and I-129. Sr-90 will decay significantly, and transport considerations described in Section E.8.5 indicate that the impact to groundwater from U(tot), Sr-90, and Tc-99 (in this rare case) would be *Low* to address uncertainty. Insufficient predicted impact from changes in recharge rates to modify ratings. There is currently no active treatment in the 200-BP GWIA.
	Columbia River from vadose zone[(a)]	Benthic: Not Discernible (radionuclides) Not Discernible (chemicals) Riparian: Not Discernible (radionuclides) Not Discernible (chemicals) Free-flowing: Not Discernible (all) **Overall**: Not Discernible	TC&WM EIS screening results used to evaluate benthic and riparian receptors (Section E.8.5). Only nitrate (*ND* for both benthic and riparian) and hexavalent chromium (*Medium* for benthic and *High* for riparian) are predicted to have concentrations (including sources other than the C Tank and Waste Farms EU) that could threaten the near-shore

Population or Resource		Impact Rating	Comments
			ecology. However, well data indicate slower movement of chromium toward the river resulting in an *ND* rating. Dilution factor of greater than 100 million between River and upwellings.
	Ecological Resources[(b)]	ND to Low	Likely monitoring of caps, with potential for disruption due to monitoring. Re-vegetation could result in higher quality habitat on EU.
Social	Cultural Resources[(b)]	**Native American:** Direct: Known Indirect: Known **Historic Pre-Hanford:** Direct: Known Indirect: Unknown **Manhattan/Cold War**: Direct: None Indirect: None	Permanent indirect effects to viewshed are possible from capping. Permanent effects may be possible due to presence of contamination if capping occurs. No other expected cultural resources impacts.

a. Groundwater threat for Group A and B contaminants remaining in the vadose zone or to the Columbia River for all primary contaminants. Threats from existing plumes associated with the C Tank and Waste Farms EU are described in Section E.8.5 and Appendix D.5 (CP-GW-1) for the 200-BP Groundwater Interest Area.

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

As described in Section E.8.5, the TC&WM ecological screening analysis indicate that that exposure to radioactive contaminants from peak groundwater discharge was below screening levels at the Columbia River near-shore region, indicating there should be no expected adverse effects from radionuclides. Furthermore, results of the corresponding TC&WM screening evaluation for chemicals indicated that predicted chromium and nitrate concentrations could exceed screening values (i.e., Hazard Quotient of unity) in the near-shore region. The predicted nitrate peak concentration was in the past and would be unlikely to exceed human or aquatic standards in the future. On the other hand, unless treated chromium (assumed hexavalent) could possibly impact benthic and riparian receptors (i.e., concentrations would exceed screening levels) after the Near-term, Post-Cleanup period.

For more information, see Section E.1.6 (Appendix E.1).

E.8.7. SUPPLEMENTAL INFORMATION AND CONSIDERATIONS

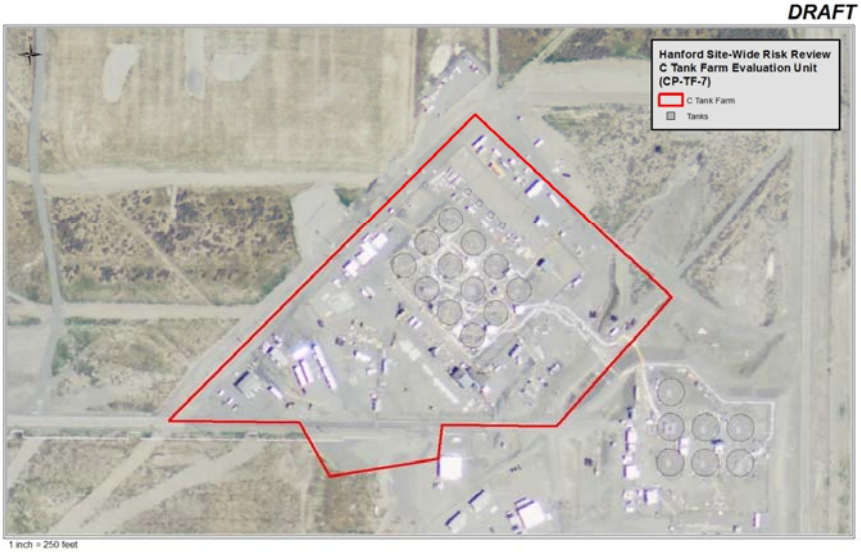
A common analysis was performed for all the single- and double-shell tanks. See Section E.1.7 (Appendix E.1) for details.

E.8.8. ATTACHMENT – C TANK AND WASTE FARMS EVALUATION UNIT WIDS REVIEW

Hanford Site-Wide Risk Review

Evaluation Unit:	C Tank Farm
ID:	CP-TF-7
Group:	Tank Farm
Operable Unit Cross-Walk:	WMA C
Related EU:	CP-LS-7
	CP-GW-1
Sites & Facilities:	C tank farm, ancillary structures, associated liquid waste sites, and soils contamination
Key Data Sources Docs:	RPP-13033
	RPP-23405
	RPP-40545
	RPP-PLAN-40145
	RPP-10435

Figure 1. Site Map with Evaluation Unit Boundaries and Tank Locations



Attached:

- Waste Site and Facility List
- Site Map with Evaluation Unit Boundaries and Associated Waste Sites
- Site Map with Evaluation Unit Boundaries and Associated Facilities

Prepared by: AMG, 08/29/2014
Reviewed by: GVL, 08/29/2014
Revisions: AMG, 09/10/2014

Hanford Site-Wide Risk Review
CP-TF-7 (C Tank Farm)
Waste Site and Facility List

Site Code	Name, Aliases, Description	Site Status	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation
200-E-111-PL	200-E-111-PL; 3-38 Encasement; Encased Pipeline from 241-ER-151 Diversion Box to 241-C Tank Farm and 244-AR Vault; Lines V108/V837/8618/8653/8901PAS, 809, 818, V836 and V834	Inactive	Encased Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-114-PL	200-E-114-PL; 216-BC-2805; 2805-E1, 2805-E2, 2805-E3 and 2805-E4; Pipeline from 216-BY-201 to 216-BC-201; Pipeline from 241-BY Tank Farm to 241-C Tank Farm and BC Cribs Trenches	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	200-BC-1	
200-E-116-PL	200-E-116-PL; Direct Buried Pipelines V111/V210/V130, 8902, and V122; Pipelines from 241-B-154 Diversion Box to 241-C-151 and 241-C-152 Diversion Boxes	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-133	200-E-133; Contaminated Soil at 241-C Tank Farm; Contamination Migration Beyond the fence at C Farm	Inactive	Contamination Migration	Unplanned Release - Surface/Near Surface	WMA C	
200-E-135	200-E-135; Contamination Area South of 241-C Tank Farm	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	TBD	
200-E-143-PL	200-E-143-PL; Encased Transfer Line from 241-AX-151 Diversion Box to 241-A Tank Farms and 244-CR Vault in 241-C Tank Farm; Tank Farm Transfer Lines 4101, 4102, 4103, 4104, 4105, 4106, 4107/V033, 4017, 4018 and 8656	Inactive	Encased Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-144-PL	200-E-144-PL; Encased Transfer Line from 241-CR-152 and 241-CR-153 to 241-AX-151; Lines 4006 and 4007 from 244-AR Vault to 241-AX-151; Tank Farm Transfer Line 4012; Transfer Line 4013 (A-4013)	Inactive	Encased Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-145-PL	200-E-145-PL; 241-ER-152 and 241-ER-151; Interplant Transfer Line; Tank Farm Transfer Line V228; Transfer Pipeline from 241-CR-153 to 241-ER-153	Inactive	Encased Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-147-PL	200-E-147-PL; Interplant Transfer Line; Tank Farm Transfer Line PAS-244; Transfer Line from 244-CR-TK-003 to 241-ER-153	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-148-PL	200-E-148-PL; Direct Buried Transfer Line from 241-C-151 to 241-A-01A; Tank Farm Transfer Line V109	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-149-PL	200-E-149-PL; Direct Buried Transfer Line from 241-C-252 to 201-C Hot Semi Works; Tank Farm Pipeline; Tank Farm Transfer Line V175	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-150-PL	200-E-150-PL; Direct Buried Transfer Line from 244-CR-TK-003 to 201-C Hot Semi Works Valve Box; Tank Farm Pipeline; Tank Farm Transfer Line 8900	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-151-PL	200-E-151-PL; Direct Buried Transfer Line from 241-C-104 to 241-A-152; Tank Farm Pipeline; Tank Farm Transfer Line V050	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	

Note that only those waste sites with a WIDS (Waste Information Data System) Classification of "Accepted" are shown, along with non-duplicate facilities, identified via the Hanford Geographic Information System (HGIS).

Hanford Site-Wide Risk Review
CP-TF-7 (C Tank Farm)
Waste Site and Facility List

Site Code	Name, Aliases, Description	Site Status	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation
200-E-152-PL	200-E-152-PL; Direct Buried Transfer Line from 241-C-104 to 241-A-152; Tank Farm Pipeline; Tank Farm Transfer Line V051	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-153-PL	200-E-153-PL; Direct Buried Transfer Line from 241-C-151 to 244-AR-TK-002; Tank Farm Pipeline; Tank Farm Transfer Line V108/812	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-154-PL	200-E-154-PL; Direct Buried Transfer Line from 241-C-151 to 241-AX-01A; Tank Farm Pipeline; Tank Farm Transfer Line V113	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-155-PL	200-E-155-PL; Pipeline from 241-C Fence to Radioactive Process Sewer Line 2904-CR-1	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-290-PL	200-E-290-PL; Pipeline from 271-CR to 216-C-8 French Drain	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-291-PL	200-E-291-PL; Pipeline from 241-C-106 to 241-AY-102, SN-200, SL-100, 241-C-106 Sluice line	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
216-C-8	216-C-8; 216-C-8 Crib; 216-C-8 French Drain; 271-CR Crib	Inactive	French Drain	Crib - Subsurface Liquid Disposal Site	WMA C	
241-C-101	241-C-101; 241-C-TK-101	Inactive	Single-Shell Tank	Underground Storage Tank	WMA C	
241-C-102	241-C-102; 241-C-TK-102	Inactive	Single-Shell Tank	Underground Storage Tank	WMA C	
241-C-103	241-C-103; 241-C-TK-103	Inactive	Single-Shell Tank	Underground Storage Tank	WMA C	
241-C-104	241-C-104; 241-C-TK-104	Inactive	Single-Shell Tank	Underground Storage Tank	WMA C	
241-C-105	241-C-105; 241-C-TK-105	Inactive	Single-Shell Tank	Underground Storage Tank	WMA C	
241-C-106	241-C-106; 241-C-TK-106	Inactive	Single-Shell Tank	Underground Storage Tank	WMA C	
241-C-107	241-C-107; 241-C-TK-107	Inactive	Single-Shell Tank	Underground Storage Tank	WMA C	
241-C-108	241-C-108; 241-C-TK-108	Inactive	Single-Shell Tank	Underground Storage Tank	WMA C	
241-C-109	241-C-109; 241-C-TK-109	Inactive	Single-Shell Tank	Underground Storage Tank	WMA C	
241-C-110	241-C-110; 241-C-TK-110	Inactive	Single-Shell Tank	Underground Storage Tank	WMA C	
241-C-111	241-C-111; 241-C-TK-111	Inactive	Single-Shell Tank	Underground Storage Tank	WMA C	
241-C-112	241-C-112; 241-C-TK-112	Inactive	Single-Shell Tank	Underground Storage Tank	WMA C	
241-C-151	241-C-151; 241-C-151 Diversion Box	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA C	
241-C-152	241-C-152; 241-C-152 Diversion Box	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA C	
241-C-153	241-C-153; 241-C-153 Diversion Box	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA C	
241-C-201	241-C-201; 241-C-TK-201	Inactive	Single-Shell Tank	Underground Storage Tank	WMA C	
241-C-202	241-C-202; 241-C-TK-202	Inactive	Single-Shell Tank	Underground Storage Tank	WMA C	
241-C-203	241-C-203; 241-C-TK-203	Inactive	Single-Shell Tank	Underground Storage Tank	WMA C	
241-C-204	241-C-204; 241-C-TK-204	Inactive	Single-Shell Tank	Underground Storage Tank	WMA C	
241-C-252	241-C-252; 241-C-252 Diversion Box	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA C	
241-C-301	241-C-301; 241-C-301C; 241-C-301-C Catch Tank; IMUST; Inactive Miscellaneous Underground Storage Tank; Lines V114 and V155	Inactive	Catch Tank	Underground Storage Tank	WMA C	
241-C-801	241-C-801; 241-C-801 Cesium Loadout Facility	Inactive	Process Unit/Plant	Process Building	WMA C	
241-CR-151	241-CR-151; 241-CR-151 Diversion Box	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA C	
241-CR-152	241-CR-152; 241-CR-152 Diversion Box; Line 8253	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA C	
241-CR-153	241-CR-153; 241-CR-153 Diversion Box; Line 8307	Inactive	Diversion Box	Pipeline and associated valves, etc.	WMA C	

Note that only those waste sites with a WIDS (Waste Information Data System) Classification of "Accepted" are shown, along with non-duplicate facilities, identified via the Hanford Geographic Information System (HGIS).

Hanford Site-Wide Risk Review
CP-TF-7 (C Tank Farm)
Waste Site and Facility List

Site Code	Name, Aliases, Description	Site Status	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation
244-CR VAULT	244-CR Vault; 244-CR VAULT; Line 8765	Inactive	Receiving Vault	Process Building	WMA C	
244-CR-WS-1	244-CR-WS-1; 244-CR French Drain	Inactive	French Drain	Crib - Subsurface Liquid Disposal Site	WMA C	
2607-EG	2607-EG	Inactive	Septic Tank	Septic System	WMA C	X
600-291-PL	600-291-PL; TEDF Line; 200 Area Treated Effluent Disposal Facility Pipeline	Active	Process Sewer	Pipeline and associated valves, etc.	Not Applic	
UPR-200-E-107	UPR-200-E-107; Contamination Spread in 241-C Tank Farm; UN-200-E-107	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-E-118	UPR-200-E-118; Airborne Release from 241-C-107; UN-200-E-118	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-E-136	UPR-200-E-136; 241-C-101 Tank Leak; UN-200-E-136	Inactive	Unplanned Release	Unplanned Release - Subsurface	Not Applic	
UPR-200-E-137	UPR-200-E-137; 241-C-203 Leak; UN-200-E-137	Inactive	Unplanned Release	Unplanned Release - Subsurface	Not Applic	
UPR-200-E-16	UPR-200-E-16; 241-C Overground Transfer Line Leak; UN-200-E-16	Inactive	Unplanned Release	Unplanned Release - Subsurface	Not Applic	
UPR-200-E-27	UPR-200-E-27; 241-CR Contamination Spread; UN-200-E-27	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-E-68	UPR-200-E-68; Radioactive Contamination Spread; UN-200-E-68; UN-216-E-68	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-E-72	UPR-200-E-72; Radioactive Contamination from Uncovered Buried Waste; UN-200-E-72	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	WMA C	
UPR-200-E-81	UPR-200-E-81; 241-CR-151 Line Break; UN-200-E-81; UN-216-E-9	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-E-82	UPR-200-E-82; V122; 241-C-152 Line Break; B Plant Ion Exchange Feed Line Leak; UN-200-E-82; UN-216-E-10	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
UPR-200-E-86	UPR-200-E-86; 241-C Tank Farm Line (V812) Break Southwest Corner; UN-200-E-86; UN-216-E-14	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
241C73	C FARM SERVICE BUILDING	ACTIVE	BUILDING	Infrastructure Building		
241C90	AIR COMPRESSOR FACILITY	ACTIVE	STRUCTURE	Process Building		
241C91	241C106 PROCESS BUILDING	ACTIVE	BUILDING	Process Building		
241CR271	WASTE DISPOSAL CONTROL HOUSE 241C TANK FARM	ACTIVE	BUILDING	Infrastructure Building		
271CR	SERVICE AND OFFICE BUILDING	ACTIVE	BUILDING	Infrastructure Building		X
2724CA	RAD MONITORING AND PROTECTIVE CLOTHING BLDG	INACTIVE	BUILDING	Infrastructure Building		X
291CR	244CR VAULT VENTILATION SYSTEM	INACTIVE	STRUCTURE	Process Building		
CT0001	CONTRACTOR TRL EAST SIDE OF C TANK FARM	ACTIVE	BUILDING	Infrastructure Building		X
HO6403534	CONTROL TRAILER NE OF 241-C TANK FARM	ACTIVE	BUILDING	Infrastructure Building		X
MO117	FACILITY EQUIPMENT/CONTROL TRAILER	ACTIVE	BUILDING	Infrastructure Building		X
MO211	MOBILE OFFICE NORTHEAST OF C FARM	ACTIVE	BUILDING	Infrastructure Building		X
MO512	HPT/CHANGE TRL ON NW SIDE OF 241C TANK FARM	ACTIVE	BUILDING	Infrastructure Building		X

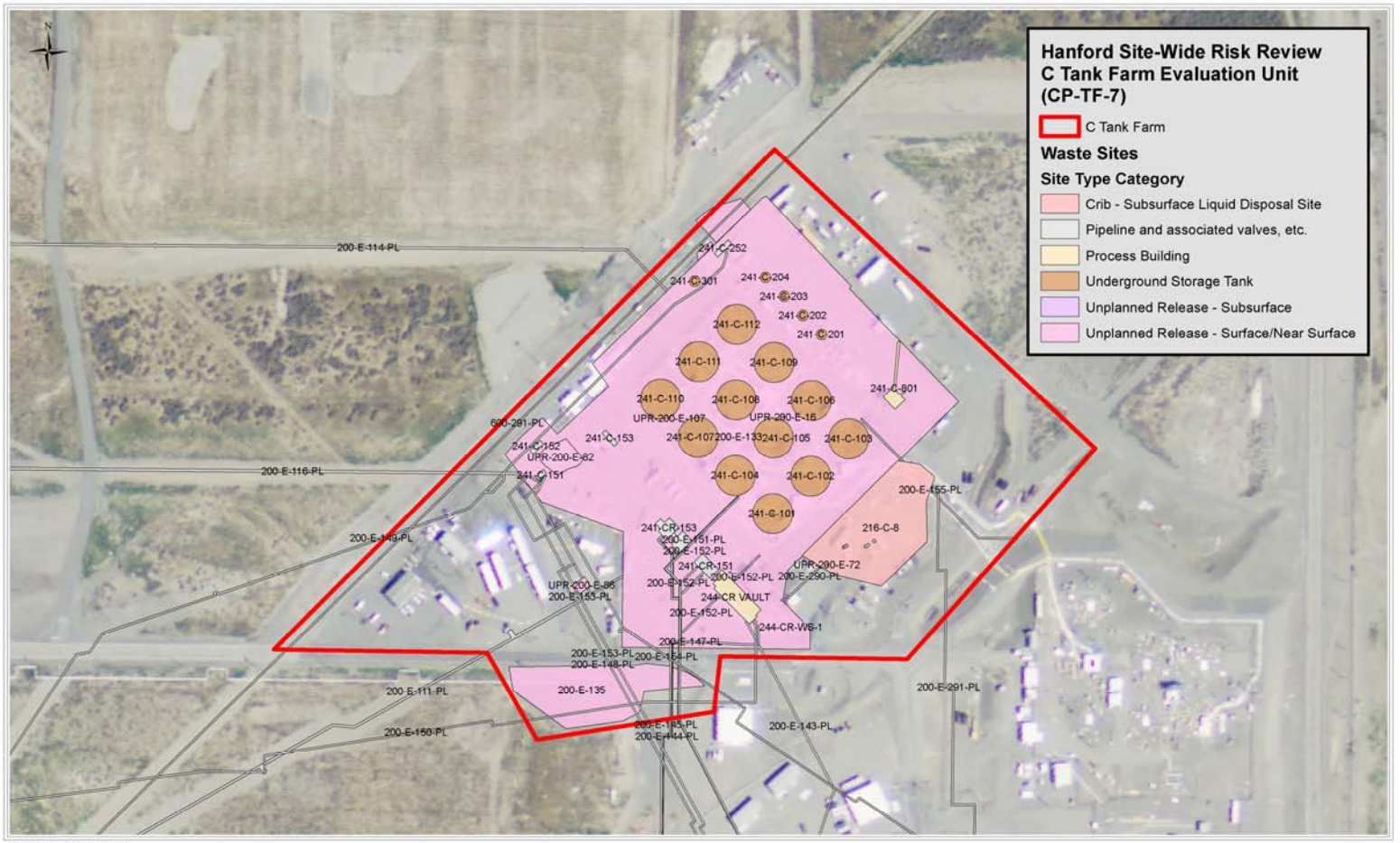
Note that only those waste sites with a WIDS (Waste Information Data System) Classification of "Accepted" are shown, along with non-duplicate facilities, identified via the Hanford Geographic Information System (HGIS).

Hanford Site-Wide Risk Review
CP-TF-7 (C Tank Farm)
Waste Site and Facility List

Site Code	Name, Aliases, Description	Site Status	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation
MO522	CHANGEROOM TRAILER SE OF C-FARM N OF 241CR	ACTIVE	BUILDING	Infrastructure Building		X
MO523	RESPIRATOR TRAILER - SOUTHWEST OF C-FARM	ACTIVE	BUILDING	Infrastructure Building		X
MO524	LUNCHROOM TRAILER - SOUTHWEST OF C-FARM	ACTIVE	BUILDING	Infrastructure Building		X
MO525	MOBILE OFFICE - SOUTHWEST OF C-FARM	ACTIVE	BUILDING	Infrastructure Building		X
MO529	C FARM SLUICING CONTROL MOBILE	ACTIVE	BUILDING	Infrastructure Building		X
MO531	MOBILE OFFICE - SOUTHWEST OF C-FARM	ACTIVE	BUILDING	Infrastructure Building		X
MO567	MOBILE OFFICE NE OF 241C TANK FARM	ACTIVE	BUILDING	Infrastructure Building		X
MO579	MARS CONTROL TRAILER AT C FARM	ACTIVE	BUILDING	Infrastructure Building		X
MO822	CHANGE TRAILER AT 241C TANK FARM	ACTIVE	BUILDING	Infrastructure Building		X
MO826	CHANGE TRAILER AT 241C TANK FARM	ACTIVE	BUILDING	Infrastructure Building		X

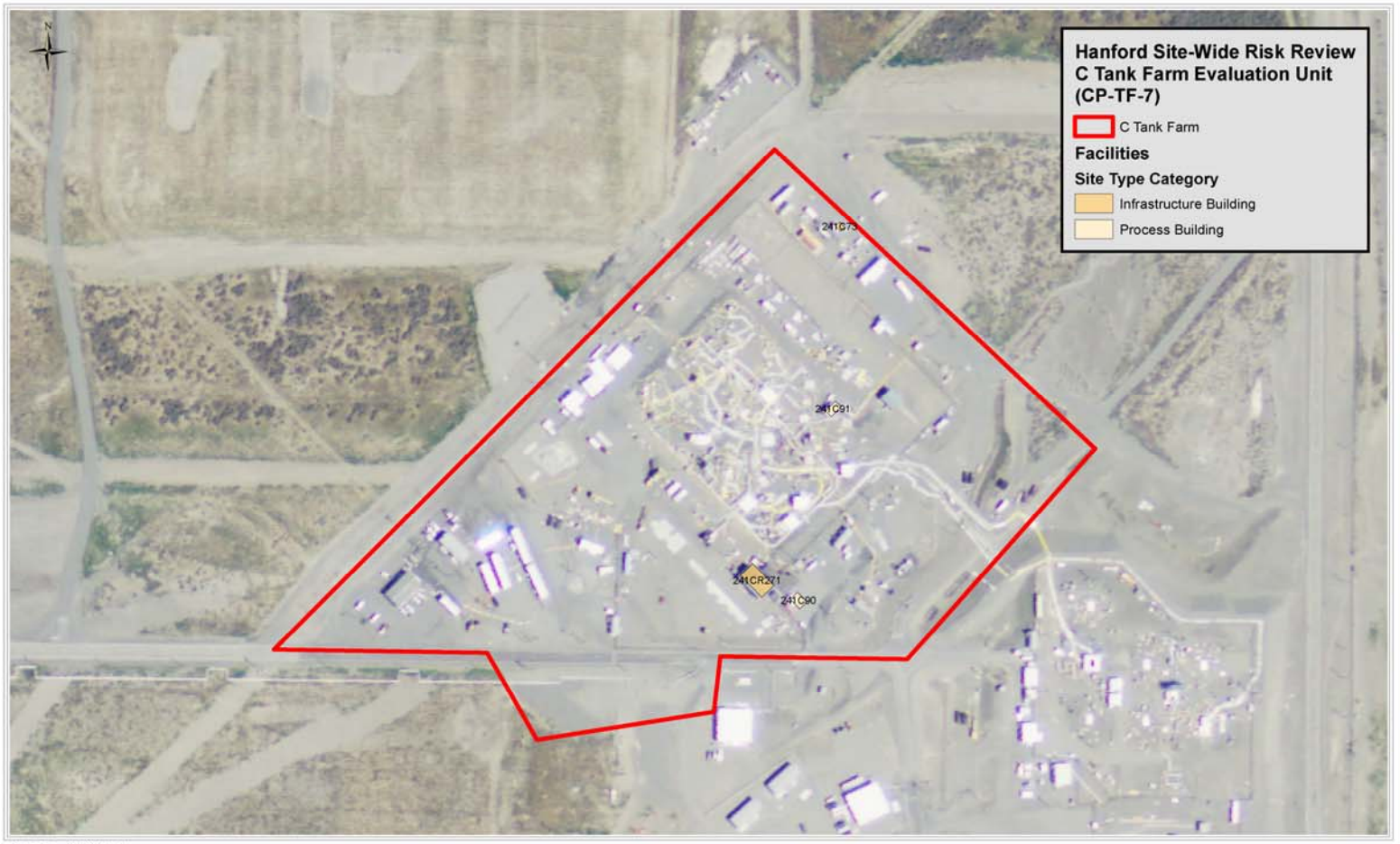
Note that only those waste sites with a WIDS (Waste Information Data System) Classification of "Accepted" are shown, along with non-duplicate facilities, identified via the Hanford Geographic Information System (HGIS).

DRAFT



1 inch = 250 feet

DRAFT


Hanford Site-Wide Risk Review
C Tank Farm Evaluation Unit
(CP-TF-7)
C Tank Farm
Facilities
Site Type Category
Infrastructure Building
Process Building
241C73
241C91
241CR271
241C90
1 inch = 250 feet

APPENDIX E.9

Tank Waste and Farms

CP-TF-8 (AN-AP-AW-AY-AZ Double-shell Tank Waste and Farms)

Evaluation Unit Summary Template

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PART E.9. CP-TF-8 AN-AP-AW-AY-AZ DOUBLE-SHELL TANK WASTE AND FARMS (200-E)

E.9.1. EXECUTIVE SUMMARY

EU LOCATION:

200 East Tank Farm

RELATED EUS:

S-SX Tank Waste and Farms (CP-TF-2), TX-TY Tank Waste and Farms (CP-TF-3), U Tank Waste and Farms (CP-TF-4), A-AX Tank Waste and Farms (CP-TF-5), B-BX-BY Tank Waste and Farms (CP-TF-6), C Tank Waste and Farms (CP-TF-7), 200-West DST Waste and Farms (CP-TF-9), 200-E Groundwater Plumes (CP-GW-1), and 200 Area Waste Transfer Pipeline (CP-LS-7)

PRIMARY CONTAMINANTS, CONTAMINATED MEDIA AND WASTES:

The TC&WM EIS describes tank wastes as including radioactive (tritium or H-3, C-14, Sr-90, Tc-99, I-129, Cs-137, U-233, U-234, U-235, U-238, Np-237, Pu-239, and Pu-240)[143] and non-radioactive contaminants (chromium, mercury, nitrate, lead, total uranium, and PCBs) of potential concern (DOE/EIS-0391 2012, Appendix D). The tank wastes contain saltcake, sludge, and supernatant phases. No current plumes in the 200-BP and 200-PO groundwater interest areas (GWIAs) that are straddled by the CP-TF-8 tanks are linked to sources in the CP-TF-8 EU.

BRIEF NARRATIVE DESCRIPTION

To provide additional storage capacity, 28 double-shell tanks were built in six tank farms between 1968 and 1986. Five of these tank farms are located in the 200 East Area, and one is located in the 200 West Area. The CP-TF-8 EU includes the five 200-East tank farms and pertinent waste sites. Historic liquid waste disposal practices, including unplanned releases in the vicinity (but not related to the tanks themselves) have resulted in small amounts of contamination near the CP-TF-8 tanks as summarized in Section E.9.3. One CP-TF-8 tank (AY-102) is declared an "assumed leaker," where waste has leaked into the annular tank space but not the environment (Templeton 2016). Tank AY-102 is undergoing retrieval.

SUMMARY TABLES OF RISKS AND POTENTIAL IMPACTS TO RECEPTORS

Table E.9-1 provides a summary of nuclear and industrial safety related consequences from the CP-TF-8 (200-East DST Farm EU) to humans and impacts to important physical Hanford Site resources. Receptors are described in Section E.1.6 (Appendix E.1).

[143] Other isotopes considered include U-232 and U-236 and Pu-238, Pu-241, and Pu-242 to be consistent with other EUs. These additional uranium and plutonium isotopes are included in the totals presented but are not used for rating because 1) uranium toxicity impacts (represented by total uranium drives corresponding risks and 2) plutonium has been found relatively immobile in the Hanford subsurface and has not been identified as a risk driver for groundwater impacts.

Table E.9-1. CP-TF-8 (200-East DST Farm) impact Rating Summary for Human Health (unmitigated basis with mitigated basis provided in parentheses (e.g., "High (Low)")

Population or Resource		Evaluation Time Period[a] Active Cleanup (to 2064) **Current Condition:** Maintenance & Monitoring (M&M)	 **From Cleanup Actions:** Retrieval & Closure
Human Health	Facility Worker[b]	***M&M***: Low-High[d] (Low-High)[d] ***Soil***: Not Discernible (ND)-High (ND-Low)	***Preferred method*****:** High (Low) ***Alternative***: High (Low)
	Co-located Person[b]	***M&M***: Low-Moderate (Low) ***Soil*****:** ND (ND)	***Preferred method*****:** Low-Moderate (Low) ***Alternative***: Low-Moderate (Low)
	Public[b]	***M&M***: Low (Low) ***Soil*****:** ND (ND)	***Preferred method*****:** Low (Low) ***Alternative***: Low (Low)
Environmental	Groundwater (A&B) from vadose zone[c]	*Low* – All PCs with reported inventories (e.g., Tc-99)[f] **Overall**: Low	*Low* – All PCs with reported inventories (e.g., Tc-99)[f] **Overall**: Low
	Columbia River from vadose zone[c]	Benthic: ND Riparian: ND Free-flowing: ND **Overall**: ND[f]	Benthic: ND Riparian: ND Free-flowing: ND **Overall**: ND[f]
	Ecological Resources[e]	ND	ND to Medium
Social	Cultural Resources[e]	**Native American:** Direct: Unknown Indirect: Known **Historic Pre-Hanford:** Direct: Unknown Indirect: Unknown **Manhattan/Cold War:** Direct: Known Indirect: Known	**Native American:** Direct: Unknown Indirect: Known **Historic Pre-Hanford:** Direct: Unknown Indirect: Unknown **Manhattan/Cold War:** Direct: Known Indirect: Known

a. A rating for cultural resources is 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.

b. Evaluated in Section E.1.6.

c. Groundwater threat for Group A and B contaminants remaining in the vadose zone or to the Columbia River for all primary contaminants. Threats from existing plumes associated with the 200 East DST Tank and Waste Farms EU are described in Section E.9.5 and Appendix D.5 (CP-GW-1) for the 200-PO-1 and 200-BP-5 Groundwater Operable Units.

d. Industrial safety consequences range from low to high (based on the evaluation scale used) for both mitigated (with controls) and unmitigated (without controls). Mitigated radiological and toxicological consequences to facility workers are high (unmitigated) and low (mitigated).

e. 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.

f. Small legacy site(s) are associated with the 200-East DSTs where the threat to groundwater is primarily from the inventory in the 216-A-39 crib. Note the ratings are not related to the waste in the DSTs (or the Tank AY-102 leak into the annulus). The small amount of vadose zone contamination would not be able to support a plume (if only from this EU) that could impact the Columbia River.

SUPPORT FOR RISK AND IMPACT RATINGS FOR EACH POPULATION OR RESOURCE

Human Health

The current and cleanup-related consequences related to work being conducted at the Tank Farms in the 200 Areas (Hanford Central Plateau) was evaluated in Section E.1.6 (Appendix E.1).

Groundwater, Vadose Zone, and Columbia River

Current

Contaminants from the Hanford double-shell Tank Farms are not currently impacting groundwater nor are the secondary sources; future impacts to groundwater or the Columbia River are not expected (e.g., the small amounts of vadose zone contaminants could not alone support plumes to the Columbia River). There are very small legacy sources (216-A-39 crib, unplanned releases, etc.) associated with this EU that posed little risk to groundwater or the Columbia River. The 216-A-39 Crib, for example, is not suspected of being able to contribute mobile contaminants to groundwater (DOE/RL-92-19, Rev. 0). The contaminants in the legacy source sites are considered unlikely to ever impact the Columbia River ecology (benthic, riparian, or free-flowing). Despite possible impacts in the area from radioactive decay (on Sr-90) or recharge rate, the ratings are not revised to address uncertainties in the evaluation.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

See Section E.1.1.

Ecological Resources

Current

No resources on site, but about 5% level 3 resources on buffer. If no trucks, ND effects currently.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

No resources on EU, but about 5% level 3 resources on buffer. Remediation could result in truck disturbance, increases in exotic species, changes in species composition in buffer, and contamination of sensitive species.

Cultural Resources

Current

Manhattan Project/Cold War significant resources have already been mitigated. Area is very disturbed and there are no known recorded archaeological resources within the EU. Traditional cultural places are visible from EU.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

Because area has not been investigated either on the surface or subsurface, archaeological investigations may need to occur within pockets of undisturbed land if any prior to remediation. Potential for intact archaeological material to be present is very low.

Considerations for Timing of the Cleanup Actions

There is potential for additional tank degradation and further leaks and contaminant transport through the vadose and saturated zones if Tank Farm closure activities are significantly delayed. For example, in 2012 DOE found that waste from one double-shell tank in the 200-East DST Farm EU (AY-102) had leaked from the primary shell into the annulus (but not the environment), and that 12 other DSTs "have construction flaws similar to those that contributed to the leak in AY-102" (GAO 2014). There is also potential risk from direct radiation and tank waste contaminants to workers (and ecological receptors) from routine Tank Farm operations. However, there would be no additional risk to facility workers, co-located persons, or the public if cleanup is delayed.

Near-Term, Post-Cleanup Risks and Potential Impacts

The assumed tank closure alternative includes 99 percent retrieval of waste from the double-shell tanks (DSTs) and treatment elsewhere onsite; operations and necessary maintenance, waste transfers and associated operations, and upgrades to existing tanks or construction of waste receipt facilities. DST closure operations is assumed to include filling the tanks and ancillary equipment with grout to immobilize residual waste contaminants. Disposal of contaminated equipment and soil would occur on site. Decisions on the extent of soil removal and/or treatment would be made on a tank farm or waste management area basis through the RCRA closure permitting process. The tanks would be stabilized with grout, and an engineered modified RCRA Subtitle C barrier put in place followed by post-closure care.

Thus workers and the public would be isolated from the residual contamination in the tanks by both grout and soil cover. Tank waste contamination already in the vadose and saturated zones would experience reduced infiltrating water (the primary driver for the release and transport of contaminants) because of the surface barrier.

Likely monitoring of caps, with potential for disruption due to monitoring. Re-vegetation could result in higher quality habitat on EU, but could be some residual contamination to sensitive resources.

Permanent indirect effects to viewshed are possible from capping. Permanent effects may be possible due to presence of contamination if capping occurs. No other expected cultural resources impacts.

E.9.2. ADMINISTRATIVE INFORMATION

OU AND/OR TSDF DESIGNATION(S):

The 200-East DST Tank and Waste Farms Evaluation Unit (EU), denoted *CP-TF-8*, consists of 25 waste tanks and ancillary structures.

COMMON NAME(S) FOR EU:

There is no common name for the 200-East DST EU because the EU is comprised of elements from a set of double-shell Tank Farms. Other components in the EU (including associated legacy waste sites) are listed below in the *Primary EU Source Components* section. The only legacy source site with a non-zero inventory is the 216-A-39 crib.

KEY WORDS:

Double-shell Tank Farm, 241-AN Tank Farm, 241-AP Tank Farm, 241-AW Tank Farm, 241-AY Tank Farm, 241-AZ Tank Farm, waste tanks, tank farm

REGULATORY STATUS

Regulatory Basis

The 200 Areas of the Hanford Site have been placed by EPA on the National Priorities List (NPL). The completion of remediation of the 200 Areas overall will eventually be finalized via CERCLA decisions made by the EPA, and permitting decisions made by Ecology.

DOE is the responsible agency for the closure of all Tank Farms through post closure, in close coordination with other closure and cleanup activities of the Hanford Central Plateau. Washington State has a program that is authorized under RCRA and implemented through the HWMA and its associated regulations. Please refer to Section E.1.2 (Appendix E.1) for more information.

Applicable Regulatory Documentation

Please refer to Section E.1.2 (Appendix E.1).

Applicable Consent Decree or TPA Milestones

Not applicable.

RISK REVIEW EVALUATION INFORMATION

Completed: Revised August 25, 2015

Evaluated by: K. Jones and K. G. Brown

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

E.9.3. SUMMARY DESCRIPTION

CURRENT LAND USE

DOE Hanford Site for industrial use. All current land-use activities in the 200-East Area are *industrial* in nature (EPA 2012).

DESIGNATED FUTURE LAND USE

Industrial-Exclusive. All four land-use scenarios listed in the Comprehensive Land Use Plan (CLUP) indicate that the 200-East Area is denoted *Industrial-Exclusive* (DOE/EIS-0222-F). An industrial-exclusive area is “suitable and desirable for treatment, storage, and disposal of hazardous, dangerous, radioactive, and nonradioactive wastes” (DOE/EIS-0222-F).

PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

The legacy source sites associated with the 200-East DST Farm EU are described in Attachment Section E.9.8. They are very small quantity sources including the 216-A-39 crib and various unplanned releases. Only the 216-A-39 cribs has a non-zero inventory; the other inventories are unknown and considered insignificant for this Review.

Waste Tanks and Ancillary Equipment

The 25 double-shell waste tanks in the 241-AN (-101 through -107 tanks), 241-AP (-101 through -108), 241-AW (-101 through -106), 241-AY (-101 and -102), and 241-AZ (-101 and -102). The ancillary equipment included in the200-East DST Farm EU is listed in Attachment Section E.9.8 and consists primarily of pipelines, diversion boxes, and catch tanks.

Groundwater Plumes

There are no groundwater plumes associated with the 200-East DSTs.

Operating Facilities

The DSTs will be used to process the wastes in the SSTs. Because of concerns with risks resulting from SSTs, the tank waste retrieval process currently planned at Hanford consists of two general phases: 1) retrieving wastes from SSTs to double-shell tanks (that are RCRA-compliant) for staging and subsequent tank closure and 2) mixing of the retrieved and staged SST waste for delivery to treatment facilities at the WTP. Thus the DSTs are considered an Operating Facility for this Review.

D&D of Inactive Facilities

Not Applicable.

LOCATION AND LAYOUT MAPS

A series of maps are used to illustrate the location of the components within the CP-TF-8 EU and the 200-East DST Farm EU relative to the Hanford Site. Figure E.2-1 shows the relationship between the 200-E (200 East) Area (where the 200-East DST Farm EU is located) and the Hanford Site. Figure E.9-1 illustrates the 200-East DST Farm EU boundary. Figure E.9-2 shows a detailed view of the waste tanks, ancillary equipment, and legacy source units in the 200-East DST Farm EU.

DRAFT

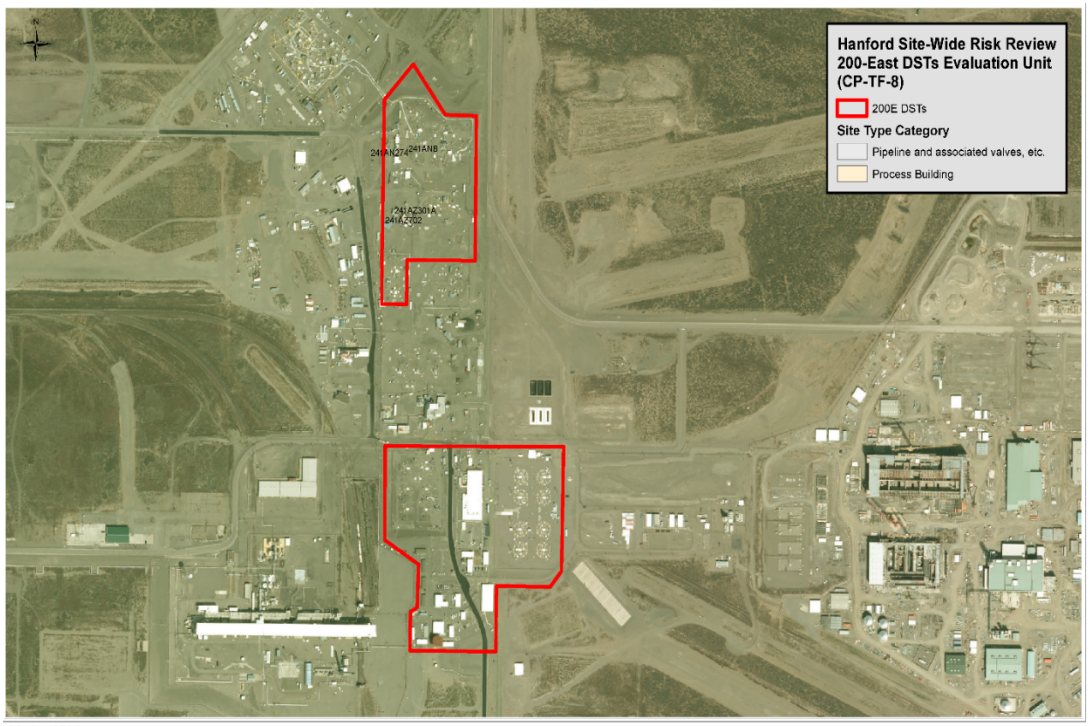


Figure E.9-1. Polygon representing the boundary of the 200-East DST Farm Evaluation Unit (Attachment Section E.9.8).

DRAFT

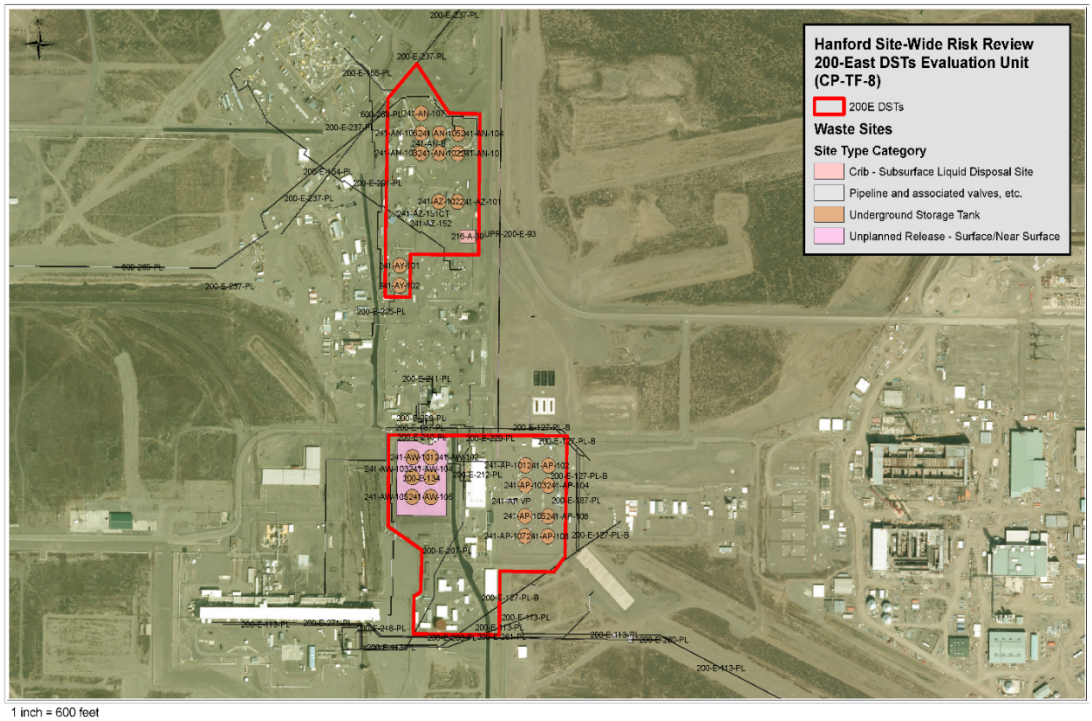


Figure E.9-2. Hanford 200-East DST Farm Evaluation Unit including tanks, legacy source units, and ancillary equipment (Attachment Section E.9.8).

E.9.4. UNIT DESCRIPTION AND HISTORY

EU FORMER / CURRENT USES

The Double-Shell Tank (DST) System began operations between April 1971 and October 1986. The DST System is used for receipt and the storage of liquid mixed waste generated on the Hanford Facility. Liquid mixed waste is transferred through buried double-encased transfer lines from SSTs to designated underground DSTs. Note that hose-in-hose temporary transfer lines are used for SST to DST transfers only. Transfers from tanker trucks use a single wall hose with plastic sleeving as the secondary containment and is under continuous surveillance (WA7890008967 Pt III).

LEGACY SOURCE SITES

There is a crib (216-A-39) with a reported inventory and three unplanned release sites (with unreported and likely unknown inventories) in the CP-TF-8 EU (Attachment Section E.9.8). The vadose zone contribution from these sites is small.

WASTE TANKS

See Section E.9.3 for details.

GROUNDWATER PLUMES – NOT APPLICABLE

D&D OF INACTIVE FACILITIES – NOT APPLICABLE

OPERATING FACILITIES – NOT APPLICABLE

The CP-TF-8 DSTs in the EU can be considered Operating Facilities for this Review since they will be used to process the single-shell tank waste.

ECOLOGICAL RESOURCES SETTING

Landscape Evaluation and Resource Classification

The amount and proximity of the biological resources to the EUs were examined within the adjacent landscape buffer areas radiating approximately 386 m (northern polygon) and 420 m (southern polygon) from the geometric centers of the EU (equivalent to 228.6 acres combined). The major portion—that is, nearly 90%—of the 200-East Double Shell Tanks EU and adjacent landscape buffer is comprised of level 0 and level 1 habitat resources (Appendix J, Table 2, p. J-57 and Figure 8, p. J-58). Small patches of level 2 habitat are located close to, but not contiguous with the northern and southern extents of the two EU polygons. A small patch (approximately 2 to 3 acres of level 3 habitat is located to the east of the two polygons (300 to 700 feet away from EU boundaries), and individual occurrences of level 3 plant species, Piper's daisy (*Erigeron piperianus*) are located to the south.

Field Survey

Field surveys conducted in October 2014 confirmed that the majority of the 200-East Double Shell Tanks EU consists of buildings, parking areas, graveled surfaces, and infrastructure related to the tanks. No vegetation measurements were taken and no field data sheets are included. The table in Appendix J

(Appendix J, Table 2, p. J-57) documents the surface conditions of the EU. No wildlife was observed within the EU during the October 2014 survey; however, PNNL ECAP surveys conducted in 2009 noted the following wildlife on/near the buildings: house finch (*Carpodacus mexicanus*), Brewer's blackbird (*Euphagus byanocephalus*), black-billed magpie (*Pica pica*), and western kingbird (*Tyrannus verticalis*).

CULTURAL RESOURCES SETTING

Underground Liquid Waste Tanks Farm, a contributing property within the Manhattan Project/Cold War Era Landscape with no documentation required. All documentation has been addressed as described in the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan* (DOE/RL-97-56). There are no known archaeological sites, or TCPs known to be recorded within the 200-East DSTs EU. None of the 200-East DSTs EU has been inventoried for archaeological resources with the exception of a very small portion. No archeological resources were located by this inventory in the 200-East DSTs EU. There is a possibility, but unlikely given the extensive disturbance in the 200-East DSTs EU, 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), particularly if undisturbed soil deposits exist within the 200-East DSTs EU. Closure and remediation of the tank farms located within the 200-East DSTs EU has been addressed in an NHPA Section 106 review completed.

Several National Register-eligible properties associated with the Manhattan Project/Cold War Era Landscape both with documentation required (Hanford Site Plant Railroad and the 2707AR Sludge Vault Change House) and no documentation required (244 AR Vault Facility and Canyon and 242BA 242-A Boiler Annex)are located within 500 meters of the 200-East DSTs EU. Also see the list of Manhattan Project/Cold War Era buildings located within the PUREX Evaluation Unit which is located in adjacent to the 200-East DSTs EU. All have been documented as described in the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan* (DOE/RL-97-56).

Historic maps indicate that there is no evidence of historic settlement in or near the 200-East DSTs EU. Geomorphology throughout most of the 200-East DSTs EU (with the exception of the eastern portion of the southern-most area of the 200-East DSTs EU) and extensive ground disturbance further suggest a low potential for intact archaeological resources associated with all three landscapes to be present subsurface within the 200-East DSTs EU. Pockets of undisturbed soil may exist, it may be appropriate to conduct 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 associated with these landscapes (e.g. East Benton Historical Society, the Franklin County Historical Society, Prosser Cemetery Association, the Reach, and B-Reactor Museum Association) may need to occur. Indirect effects are always possible when TCPs are known to be located in the general vicinity. 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.

E.9.5. WASTE AND CONTAMINATION INVENTORY

Table E.9-2 provides inventory estimates of the various source components associated with the 200-East DST Farm EU (CP-TF-8); these are primarily tank wastes and ancillary equipment. The legacy sources (primarily discharges to cribs) are very small relative to the DST and other SST legacy inventory in the vadose zone as shown in Figure E.9-3 through Figure E.9-11. Thus the primary focus should be on the tank waste and ancillary equipment for the EU.

The major sources for before assumed retrieval are the 200-East DSTs. A 99% retrieval as used for the Hanford SSTs (CP-TF-1 through CP-TF-7) is also assumed for the 200-East DST Farm EUs. The tank residuals represent the largest source after assumed 99% retrieval for the contaminants with the remaining contribution from ancillary equipment. The current maximum groundwater threat metric (GTM) (Figure E.9-12)[144] is dominated by the Tc-99 and I-129 in the 200-East DST Farms wastes before retrieval and by residual waste after assumed 99% retrieval[145].

CONTAMINATION WITHIN PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

The estimated 200-East DST Farm inventory for the Legacy / Vadose Zone Source Sites (in this case, a small inventory in the 216-A-39 Crib) is summarized in Table E.9-2 and further described in Figure E.9-3 through Figure E.9-11 before and after planned 99% retrieval (which will have no impact on the legacy source site inventories). These legacy source inventories are very small.

Waste Tanks and Ancillary Equipment

The estimated total inventory for the 200-East DST Farm waste tanks and Ancillary Equipment is provided in Table E.9-2 for both assumed 90% and 99% retrieval scenarios. The tank-by-tank inventories are provided in Table E.9-3 through Table E.9-6. Safety-related information (i.e., hydrogen generation rates and times to the lower flammability limit are also provided. The inventories for the various contaminant in the 200-East DST Farm tanks vary over several orders of magnitude as does the GTM. This information is further summarized in Figure E.9-3 through Figure E.9-11 before and after assumed 99% retrieval and for the maximum GTM (I-129 and Tc-99) in Figure E.9-12.

Vadose Zone Contamination

The estimated inventories for the vadose zone are found in Table E.9-2. These inventories represent the vadose zone contamination *outside* the tanks and ancillary equipment (i.e., that are generally available for transport through the environment); however, as shown in Figure E.9-3 through Figure E.9-11, these values are very small. These values are used to estimate the inventory remaining in the vadose zone using the process described in Chapter 6 of the Methodology Report (CRESP 2015a) as modified for the 2015 groundwater results (Appendix D.1). The focus in this section will be on the Group A and B contaminants in the vadose zone due to their mobility and persistence and potential threats to groundwater. Using the process outlined in Chapter 6 of the Methodology Report (CRESP 2015a) as revised as mentioned above, the vadose zone inventories in Table E.9-2 are estimated and used to calculate Groundwater Threat Metric (GTM) values for the Group A and B contaminants remaining in the vadose zone as illustrated in Table E.9-7. The ratings associated with potential vadose zone threats

[144] Maximum of the GTMs for Tc-99 and I-129 only.

[145] According to the Tri-Party Agreement (Ecology, EPA, and DOE, 1998), retrieval limits for residual wastes are 360 ft^3 and 30 ft^3 for 100-Series and 200-Series tanks, respectively, corresponding to the 99% waste retrieval goal as defined in TPA Milestone M-45-00. For purposes of this Review the 99% and 90% Retrieval Scenarios reflect assumptions described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 and apply only to tank volumes and inventories. They are calculated assuming retrieval of a fully mixed tank of homogeneous composition. For tanks that have been declared "Retrieval Completed" or "Retrieved to Limit of … Technologies" (Templeton, AM 2016, page 9, partially duplicated in Table E.1-7), no further retrieval for either the 99% or 90% retrieval scenario is assumed. This includes tank 241-S-112 and all C Tank Farm tanks except 241-C-105. For tanks that are currently undergoing retrieval (tanks 241-AY-102 and 241-C-105), a retrieval amount equivalent to the 99% and 90% retrieval volumes described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 are calculated.

related to the 200-East DST Farm EU are *Low* for all primary contaminants (with non-zero reported inventories) except for Sr-90 and total uranium for all evaluation periods[146].

Groundwater Plumes

There are no plumes associated with 200-East DST Farm EU sources (Table E.9-2) nor are any expected in the foreseeable future.

Columbia River – Benthic, Riparian, and Free-flowing Ecology – All Evaluation Periods

The process illustrated in Chapter 6 of the Methodology Report (CRESP 2015a) (as revised in Appendix D.1) is used to evaluate potential impacts to the Columbia River. Since there are no plumes associated with the 200-East DST Farm EU (Table E.9-2) nor are any expected in the foreseeable future (i.e., not sufficient source from this one EU to support plumes to the Columbia River), the potential for impacts to the Columbia River benthic, riparian, or free-flowing ecology is not credible based on current information. Thus the ratings associated with potential threats from 200-East DST Farm EU to Columbia River benthic, riparian, or free-flowing receptors are defined to be *Not Discernible* (*ND*) for all contaminants and all evaluation periods.

Facilities for D&D – Not Applicable

Operating Facilities

The CP-TF-8 DSTs in the EU can be considered Operating Facilities for this Review since they will be used to process the single-shell tank waste. The inventory associated with these facilities is thus that shown for the Waste Tanks and Ancillary Equipment above.

[146] As indicated in Section E.6.5 (A-AX TF EU) and Section E.7.5 (B-BX-BY TF EU), Sr-90 and total uranium are likely relatively immobile in the Active Cleanup and Near-term, Post-Cleanup periods, which leads to *Not Discernible* (*ND*) ratings. The ratings after the Active Cleanup period are *Low* to address uncertainties.

Table E.9-2. Summary Table of Infrastructure and Subsurface Contamination Inventory for the AN/AP/AW/AY/AZ Tank and Waste Farms EU (CP-TF-8) [a,b]

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[c]	99% Retrieval Scenario[c]
Infrastructure (Tanks and Ancillary Equipment)				
Tank Waste	Waste (kGal)	23192	2319.2	231.92
	Sludge (kGal)	2210	221	22.1
	Saltcake (kGal)	3269	326.9	32.69
	Supernatant (kGal)	17713	1771.3	177.13
Tank Waste (rad)	Am-241 (Ci)	93000	9900	990
	C-14 (Ci)	170	17	1.7
	Co-60 (Ci)	880	90	9
	Cs-137 (Ci)	23000000	2300000	230000
	Eu-152 (Ci)	270	32	3.2
	Eu-154 (Ci)	17000	2100	210
	H-3 (Ci)	540	55	5.5
	I-129 (Ci)	17	1.7	0.17
	Ni-59 (Ci)	320	36	3.6
	Ni-63 (Ci)	26000	2800	280
	Pu (total) (Ci)	60000	6500	650
	Sr-90 (Ci)	18000000	2300000	230000
	Tc-99 (Ci)	13000	1300	130
	U (total) (Ci)	610	61	6.1
Tank Waste (non-rad)	Cr (kg)	71000	7100	710
	Hg (kg)	460	46	4.6
	NO3 (kg)	13000000	1300000	130000
	Pb (kg)	33000	3300	330
	U (total) (kg)	160000	16000	1600
Ancillary Equipment (rad)	C-14 (Ci)	1.7	1.7	1.7
	Cs-137 (Ci)	89000	89000	89000
	H-3 (Ci)	6.5	6.5	6.5
	I-129 (Ci)	0.052	0.052	0.052

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[(c)]	99% Retrieval Scenario[(c)]
	Pu (total) (Ci)	41	41	41
	Sr-90 (Ci)	71000	71000	71000
	Tc-99 (Ci)	39	39	39
	U (total) (Ci)	0.23	0.23	0.23
Ancillary Equipment (non-rad)	Cr (kg)	210	210	210
	Hg (kg)	0.86	0.86	0.86
	NO3 (kg)	57000	57000	57000
	Pb (kg)	52	52	52
	U (total) (kg)	210	210	210
Vadose Zone Source (Leaks and Intentional Discharges into Cribs and Trenches)				
Cribs (rad)	Am-241 (Ci)	0.00013	0.00013	0.00013
	C-14 (Ci)	6.00E-05	6.00E-05	6.00E-05
	Co-60 (Ci)	0.00048	0.00048	0.00048
	Cs-137 (Ci)	15	15	15
	Eu-152 (Ci)	2.00E-05	2.00E-05	2.00E-05
	Eu-154 (Ci)	0.0016	0.0016	0.0016
	H-3 (Ci)	0.00024	0.00024	0.00024
	I-129 (Ci)	2.00E-07	2.00E-07	2.00E-07
	Ni-59 (Ci)	2.70E-05	2.70E-05	2.70E-05
	Ni-63 (Ci)	0.0026	0.0026	0.0026
	Pu (total) (Ci)	0.00035	0.00035	0.00035
	Sr-90 (Ci)	0.05	0.05	0.05
	Tc-99 (Ci)	0.0034	0.0034	0.0034
	U (total) (Ci)	4.30E-07	4.30E-07	4.30E-07
Cribs (non-rad)	Cr (kg)	0.0085	0.0085	0.0085
	Hg (kg)	6.50E-06	6.50E-06	6.50E-06
	NO3 (kg)	0.15	0.15	0.15
	Pb (kg)	0.003	0.003	0.003
	U (total) (kg)	0.00062	0.00062	0.00062
Vadose Zone (from Vadose Zone Sources)				
VZ Remaining (rad)	Am-241 (Ci)	0.00013	0.00013	0.00013
	C-14 (Ci)	6.00E-05	6.00E-05	6.00E-05

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario[(c)]	99% Retrieval Scenario[(c)]
	Co-60 (Ci)	0.00048	0.00048	0.00048
	Cs-137 (Ci)	15	15	15
	Eu-152 (Ci)	2.00E-05	2.00E-05	2.00E-05
	Eu-154 (Ci)	0.0016	0.0016	0.0016
	H-3 (Ci)	0.00024	0.00024	0.00024
	I-129 (Ci)	2.00E-07	2.00E-07	2.00E-07
	Ni-59 (Ci)	2.70E-05	2.70E-05	2.70E-05
	Ni-63 (Ci)	0.0026	0.0026	0.0026
	Pu (total) (Ci)	0.00035	0.00035	0.00035
	Sr-90 (Ci)	0.05	0.05	0.05
	Tc-99 (Ci)	0.0034	0.0034	0.0034
	U (total) (Ci)	4.30E-07	4.30E-07	4.30E-07
VZ Remaining (non-rad)	Cr (kg)	0.0085[(d)]	0.0085[(d)]	0.0085[(d)]
	Cr-VI (kg)	0.0085[(d)]	0.0085[(d)]	0.0085[(d)]
	Hg (kg)	6.50E-06	6.50E-06	6.50E-06
	NO3 (kg)	0.15	0.15	0.15
	Pb (kg)	0.003	0.003	0.003
	U (total) (kg)	0.00062	0.00062	0.00062
Saturated Zone (from Vadose Zone Sources)				

a. Tanks (SST and DST): Best Basis Inventory (BBI) February 2017; Ancillary Equipment (Anc Eq): Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix D; Unplanned Releases (UPRs): Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0); Ponds: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0); Cribs: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0); Trenches: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0) and Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix S; Leaks: Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix D; MUSTs: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0) and Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix S.

b. All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

c. 99% and 90% Retrieval Scenarios reflect assumptions described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 and apply only to tank volumes and inventories. They are calculated assuming retrieval of a fully mixed tank of homogeneous composition. For tanks that have

been declared “Retrieval Completed” or “Retrieved to Limit of … Technologies” (Templeton, AM 2016, page 9, partially duplicated in Table E.1-7), no further retrieval for either the 99% or 90% retrieval scenario is assumed. This includes tank 241-S-112 and all C Tank Farm tanks except 241-C-105. For tanks that are currently undergoing retrieval (tanks 241-AY-102 and 241-C-105), a retrieval amount equivalent to the 99% and 90% retrieval volumes described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 are calculated.

d. Differences in inventories for Cr vs Cr-IV are due to differing Water Quality Standards (WQS) and thus plume extents: 100 mg/L for total chromium vs 48 mg/L for chromium (VI). Some differences may not be apparent due to the number of significant figures (2) used.

Table E.9-3. Current Bulk Inventory and Steady State Flammability Results (by Tank) for the AN-AP-AW-AY-AZ Double-Shell Tank Farms (CP-TF-8)

Tank ID	Tank Type	Capacity (kGal)[a]	Sludge (kGal)[a]	Saltcake (kGal)[a]	Supernatant (kGal)[a]	HGR (ft^3/d)[b]	Days to 25% LFL Barometric[c]	Days to 25% LFL Zero Ventilation[d]
AN-101	DST	1160	636	30	400	29	13	13
AN-102	DST	1160	0	154	900	32	12	12
AN-103	DST	1160	0	510	453	24	21	20
AN-104	DST	1160	0	491	559	29	13	13
AN-105	DST	1160	0	536	587	28	11	11
AN-106	DST	1160	458	17	73	37	21	20
AN-107	DST	1160	0	240	830	31	12	12
AP-101	DST	1257	0	33	1202	15	13	12
AP-102	DST	1160	140	0	409	57	5.2	5.1
AP-103	DST	1257	0	16	1107	35	17	17
AP-104	DST	1160	0	99	199	25	7	6.9
AP-105	DST	1257	0	102	1140	15	11	11
AP-106	DST	1160	0	0	1125	12	26	25
AP-107	DST	1160	0	63	1173	26	16	15
AP-108	DST	1257	0	112	1130	16	11	11
AW-101	DST	1160	0	405	731	26	12	12
AW-102	DST	1160	52	0	567	11	219	139

Tank ID	Tank Type	Capacity (kGal)[a]	Sludge (kGal)[a]	Saltcake (kGal)[a]	Supernatant (kGal)[a]	HGR (ft^3/d)[b]	Days to 25% LFL Barometric[c]	Days to 25% LFL Zero Ventilation[d]
AW-103	DST	1160	280	40	756	12	32	30
AW-104	DST	1160	97	157	794	14	30	28
AW-105	DST	1160	248	0	690	11	145	106
AW-106	DST	1160	0	264	860	22	14	14
AY-101	DST	1018	105	0	418	15	74	63
AY-102	DST	1018	38	0	6	91	8.1	7.9
AZ-101	DST	1018	52	0	705	54	13	13
AZ-102	DST	1018	104	0	899	28	55	49

a. Volumes from the Waste Tank Summary Report for Month Ending November 30, 2016 (Templeton, AM 2016).

b. Hydrogen generation rate (ft^3/d) (RPP-5926 Rev. 17). Note in 2001 all 24 tanks were removed from the flammable gas watch list (including T-110 in the T Tank and Waste Farms EU) (Johnson, et al. 2001, p. iii).

c. Time (in days) to 25% of the Lower Flammability Limit (LFL) under a barometric (barom) breathing scenario (RPP-5926, Rev. 17). "NA" indicates that the headspace will not reach specified flammability level.

d. Time (in days) to 25% of the LFL under a zero ventilation scenario (RPP-5926, Rev. 17).

Table E.9-4. Current Primary Contaminant Inventory (by Tank) for the AN-AP-AW-AY-AZ Double-Shell Tank Farms (CP-TF-8) [(a)]

Tank ID	Baseline Status[(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)
AN-101	2001	6100	8.5	NR[(c)]	68	370000	8	410	71
AN-102	2001	840	2.9	NR	41	1300000	1.6	320	1.7
AN-103	2001	21	15	NR	5.4	1300000	1.8	68	3.9
AN-104	2001	53	13	NR	4.8	1400000	1.5	54	11
AN-105	2001	52	14	NR	6.5	1100000	1.7	78	2.2
AN-106	2001	9000	2.3	NR	93	340000	16	1400	44
AN-107	2001	3100	7.2	NR	61	1000000	1.1	1200	5
AP-101	2001	5.3	9.8	NR	7.5	1300000	4.6	38	6.4
AP-102	2001	3700	2.2	NR	13	300000	27	1900	5.4
AP-103	2001	7.2	6.8	NR	9.4	1400000	4.7	39	13
AP-104	2001	2.2	3.5	NR	2.6	320000	1.1	8.9	2.5
AP-105	2001	6	7	NR	7.5	1000000	3.6	74	5.2
AP-106	2001	0.057	4.2	NR	7.6	730000	4.7	450	54
AP-107	2001	15	11	NR	8.8	1200000	4.9	47	28
AP-108	2001	8.3	11	NR	11	890000	8.5	52	45
AW-101	2001	110	11	NR	7	1200000	1.6	70	15
AW-102	2001	570	2.3	NR	4.2	330000	1.4	9.9	27
AW-103	2001	180	2.4	NR	25	350000	2	42	5.2
AW-104	2001	100	4.8	NR	12	880000	3	76	4.7
AW-105	2001	730	3.9	NR	8.1	330000	0.48	5.8	130
AW-106	2001	49	13	NR	17	810000	1.9	96	13
AY-101	2001	15000	2.5	NR	130	260000	57	2700	4.6
AY-102	2001	1300	0.056	NR	4.2	50000	9.2	670	0.48
AZ-101	2001	24000	6	NR	170	4100000	58	4100	25
AZ-102	2001	28000	8.7	NR	170	880000	50	3400	26

a. From Best Basis Inventory (BBI) Summary (February 2017). All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

b. This is the “Baseline Status” date as reported in the BBI (February 2017) as “Baselined 2001.” It should not be necessarily be considered the decay date for isotope inventories.

c. NR = Not reported for this EU

Table E.9-5. Current Primary Contaminant Inventory[a] and Groundwater Threat Metric (by Tank) for the AN-AP-AW-AY-AZ Double-Shell Tank Farms (CP-TF-8)

Tank ID	I-129 (Ci)	Ni-59 (Ci)	Ni-63 (Ci)	Pu (total) (Ci)[b]	Sr-90 (Ci)	Tc-99 (Ci)	U (total) (Ci)[c]	GTM (Mm3)[d]
AN-101	1.1	26	2200	18000	1100000	170	510	460
AN-102	0.58	4.7	420	270	310000	580	1.4	640
AN-103	1.2	14	1200	18	4900	690	0.19	760
AN-104	0.67	11	930	32	61000	800	0.71	880
AN-105	0.85	13	1100	27	22000	1100	0.38	1200
AN-106	0.87	31	2400	6600	3400000	190	24	360
AN-107	0.6	75	5000	2400	370000	430	0.97	480
AP-101	1.5	4.5	380	7.5	3700	770	0.24	850
AP-102	0.33	18	1500	2500	2600000	140	0.96	160
AP-103	0.8	3.3	230	32	4900	710	0.21	790
AP-104	0.21	2.5	200	9.3	1600	210	0.09	230
AP-105	1.3	4.3	370	12	21000	880	0.24	970
AP-106	0.33	4.3	380	0.45	150	370	0.2	410
AP-107	0.93	4.6	400	29	11000	780	0.53	870
AP-108	1.1	5.5	440	6.1	4300	720	0.23	800
AW-101	0.67	9.7	840	400	63000	820	3.8	910
AW-102	0.31	3.3	210	250	130000	160	4.5	180
AW-103	0.27	3.3	130	2900	12000	400	15	440
AW-104	0.86	4	370	5000	5300	760	8.9	840
AW-105	0.45	0.55	47	4000	46000	160	18	180
AW-106	0.78	10	940	890	40000	590	3.7	650
AY-101	0.22	31	2700	3200	1800000	110	3	130
AY-102	0.0082	6.3	530	1000	920000	6.4	0.35	7.1
AZ-101	0.39	21	1900	6100	4000000	1200	1.6	1400
AZ-102	0.97	11	970	5900	2900000	610	6.3	680

a. From Best Basis Inventory (BBI) Summary (February 2017). All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

b. Sum of plutonium isotopes 238, 239, 240, 241, and 242

c. Sum of uranium isotopes 232, 233, 234, 235, 236, and 238

d. The Groundwater Threat Metric (GTM) shown for tanks is equal to the maximum of the GTM for Tc-99 and I-129.

Table E.9-6. Current Primary Contaminant Inventory (by Tank) for the AN-AP-AW-AY-AZ Double-Shell Tank Farms (CP-TF-8) [(a)]

Tank ID	CCl4 (kg)	CN (kg)	Cr (kg)	Cr-VI (kg)	Hg (kg)	NO3 (kg)	Pb (kg)	TBP (kg)	TCE (kg)	U (total) (kg)
AN-101	NR[(b)]	NR	3000	NR	130	210000	3300	NR	NR	54000
AN-102	NR	NR	2100	NR	0.45	880000	740	NR	NR	960
AN-103	NR	NR	2600	NR	1.6	660000	430	NR	NR	130
AN-104	NR	NR	5000	NR	1.3	730000	170	NR	NR	460
AN-105	NR	NR	7300	NR	1.9	690000	260	NR	NR	270
AN-106	NR	NR	3100	NR	130	210000	13000	NR	NR	24000
AN-107	NR	NR	1400	NR	0.65	780000	1700	NR	NR	680
AP-101	NR	NR	4500	NR	0.005	1000000	130	NR	NR	130
AP-102	NR	NR	1800	NR	120	730000	280	NR	NR	60
AP-103	NR	NR	4000	NR	0.14	850000	180	NR	NR	210
AP-104	NR	NR	710	NR	0.071	240000	60	NR	NR	280
AP-105	NR	NR	2100	NR	0.29	860000	140	NR	NR	160
AP-106	NR	NR	2900	NR	0	300000	17	NR	NR	23
AP-107	NR	NR	4000	NR	0.32	190000	22	NR	NR	12
AP-108	NR	NR	3600	NR	0.003	910000	150	NR	NR	140
AW-101	NR	NR	1200	NR	1.7	820000	690	NR	NR	2700
AW-102	NR	NR	1200	NR	7.6	360000	1300	NR	NR	6500
AW-103	NR	NR	5000	NR	0.22	370000	44	NR	NR	14000
AW-104	NR	NR	3500	NR	0.4	450000	240	NR	NR	9800
AW-105	NR	NR	1600	NR	0.077	49000	120	NR	NR	20000
AW-106	NR	NR	2300	NR	1.6	650000	210	NR	NR	2700
AY-101	NR	NR	2300	NR	19	110000	730	NR	NR	490
AY-102	NR	NR	400	NR	41	350000	4300	NR	NR	2000
AZ-101	NR	NR	2700	NR	1.1	190000	150	NR	NR	1700
AZ-102	NR	NR	2600	NR	5	250000	800	NR	NR	7100

a. From Best Basis Inventory (BBI) Summary (February 2017). All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

b. NR = Not reported for this EU

Table E.9-7. Summary of the Evaluation of Current Threats to Groundwater as a Protected Resource from Remaining Vadose Zone (VZ) Contamination associated with the AN-AP-AW-AY-AZ Double-Shell Tank Farms (CP-TF-8)

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	0.25	0	1.82	5.96E-05 Ci	---	---	5.96E-05 Ci	2.98E-05	*Low*
I-129	A	1 pCi/L	0.25	0.2	1.82	2.04E-07 Ci	---	---	2.04E-07 Ci	8.30E-05	*Low*
Sr-90	B	8 pCi/L	0.25	22	1.82	4.96E-02 Ci	---	---	4.96E-02 Ci	3.85E-02	*ND*[e]
Tc-99	A	900 pCi/L	0.25	0	1.82	3.39E-03 Ci	---	---	3.39E-03 Ci	3.77E-03	*Low*
CCl_4	A	5 µg/L	0.25	0	1.82	---	---	---	---	---	*ND*
Cr	B	100 µg/L	0.25	0	1.82	8.47E-03 kg	---	---	8.47E-03 kg	8.47E-05	*Low*
Cr-VI	A	48 µg/L[b]	0.25	0	1.82	8.47E-03 kg	---	---	8.47E-03 kg	1.76E-04	*Low*
TCE	B	5 µg/L	0.25	2	1.82	---	---	---	---	---	*ND*
U(tot)	B	30 µg/L	0.25	0.8	1.82	6.21E-04 kg	---	---	6.21E-04 kg	3.03E-06	*ND*[e]

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

b. "Model Toxics Control Act−Cleanup" (WAC 173-340) Method B groundwater cleanup level for hexavalent chromium. Other WQS values are corresponding drinking water standards.

c. Treatment amounts from the 2015 Hanford Annual Groundwater Report (DOE/RL-2016-09, Rev. 0). No contaminants are being actively treated in the 200-PO and 200-BP GWIAs that are straddled by the CP-TF-8 waste tanks.

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

e. Sr-90 will decay significantly during the Active Cleanup and Near-term, Post-Cleanup periods and transport considerations (Section 9.5) indicate that Sr-90 and uranium will likely be relatively immobile in the subsurface leading to *Not Discernible* (*ND*) ratings through the Active Cleanup period. A *Low* rating will be ascribed after this period to address uncertainty.

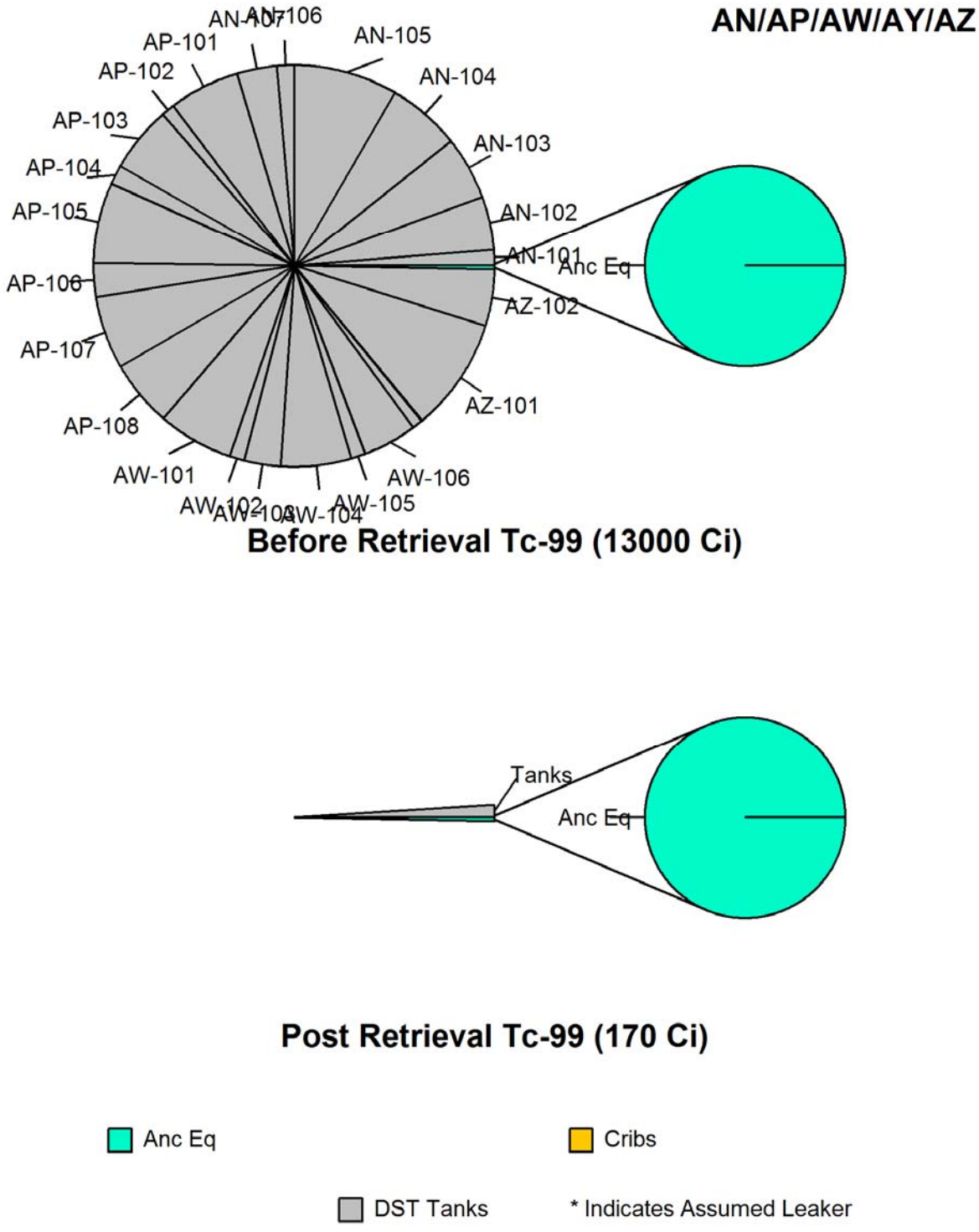


Figure E.9-3. AN-AP-AW-AY-AZ Tank and Waste Farms Evaluation Unit Inventory Estimates for Tc-99 Before and After 99% Retrieval

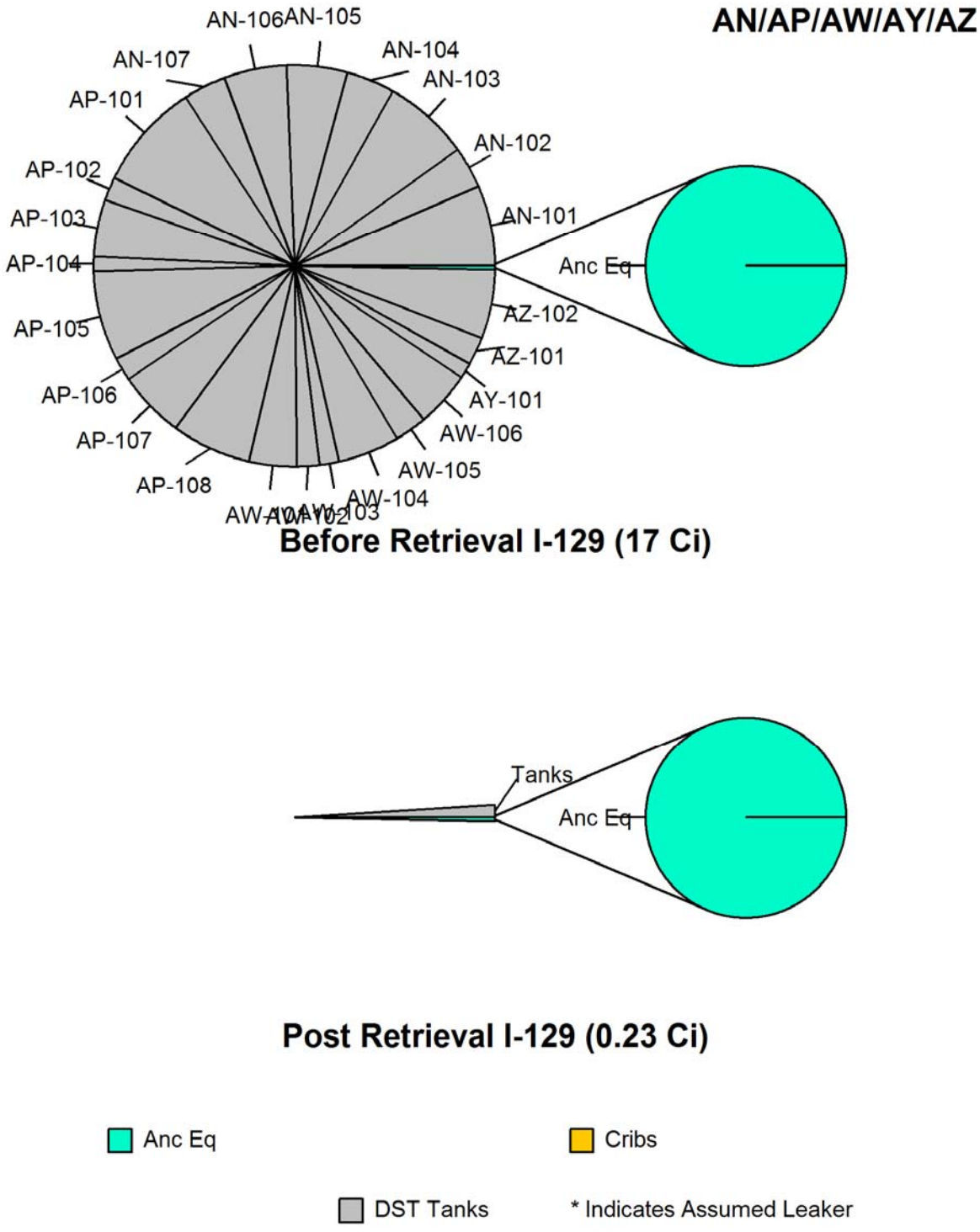


Figure E.9-4. AN-AP-AW-AY-AZ Tank and Waste Farms Evaluation Unit Inventory Estimates for I-129 Before and After 99% Retrieval

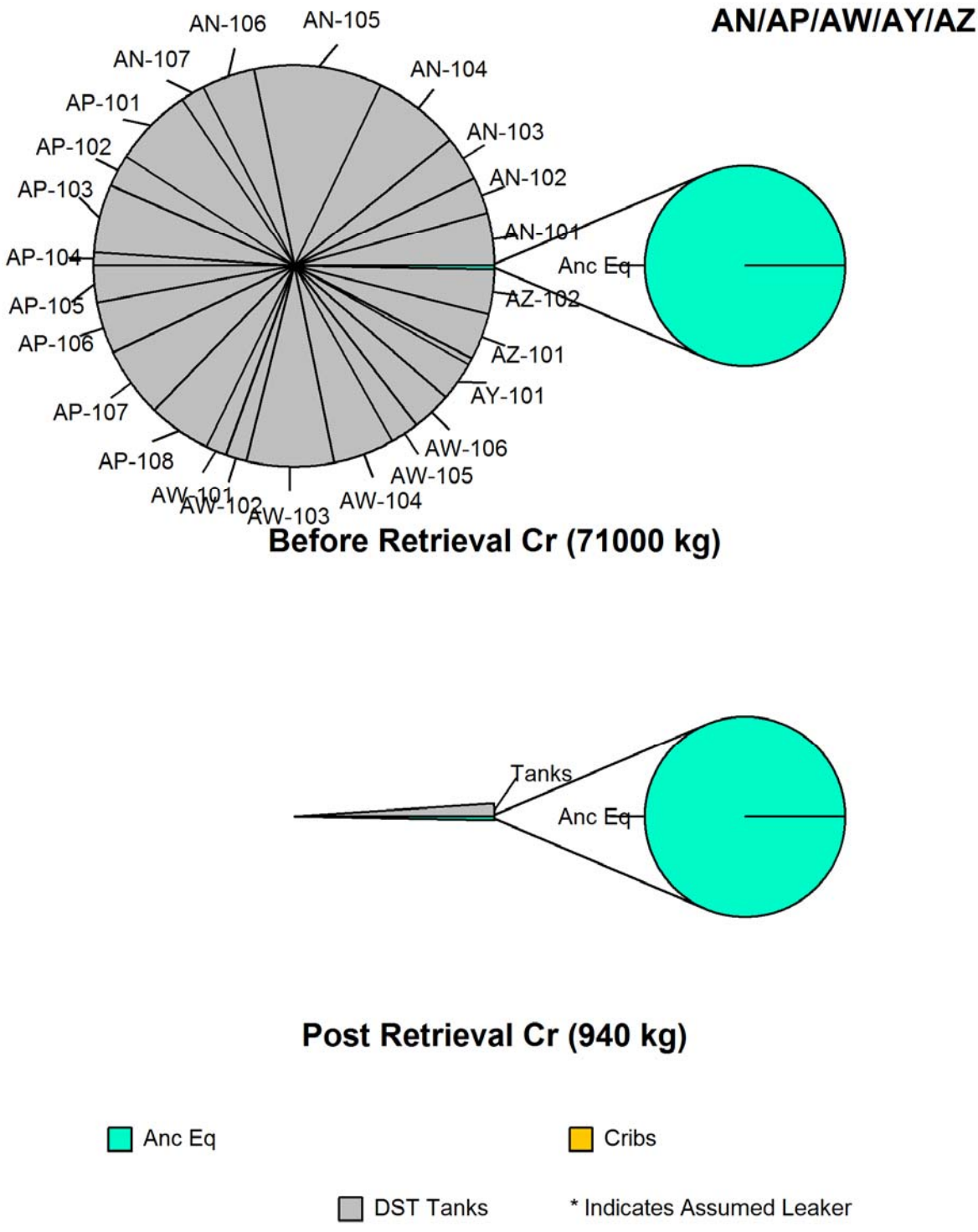


Figure E.9-5. AN-AP-AW-AY-AZ Tank and Waste Farms Evaluation Unit Inventory Estimates for Chromium Before and After 99% Retrieval

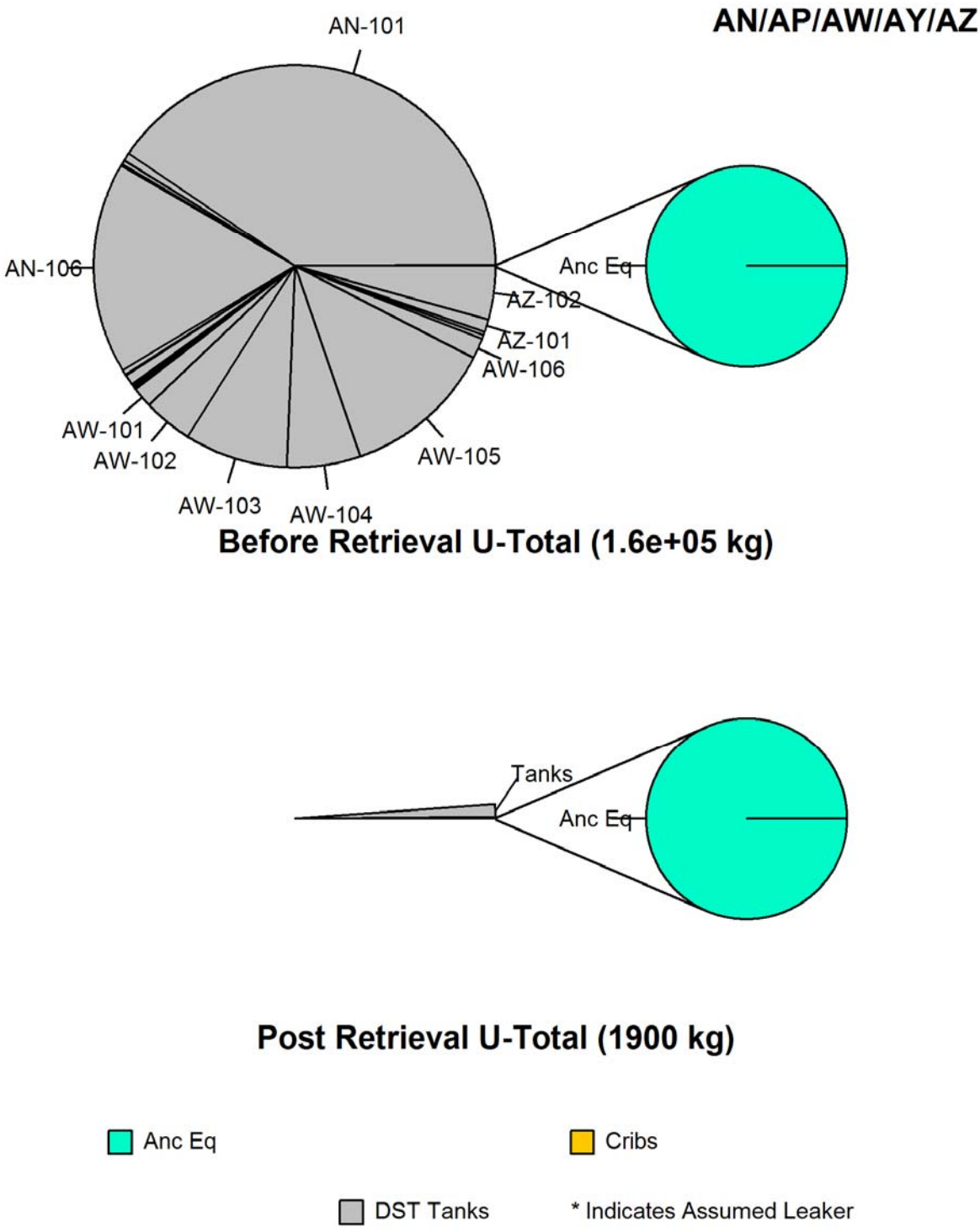


Figure E.9-6. AN-AP-AW-AY-AZ Tank and Waste Farms Evaluation Unit Inventory Estimates for U(tot) Before and After 99% Retrieval

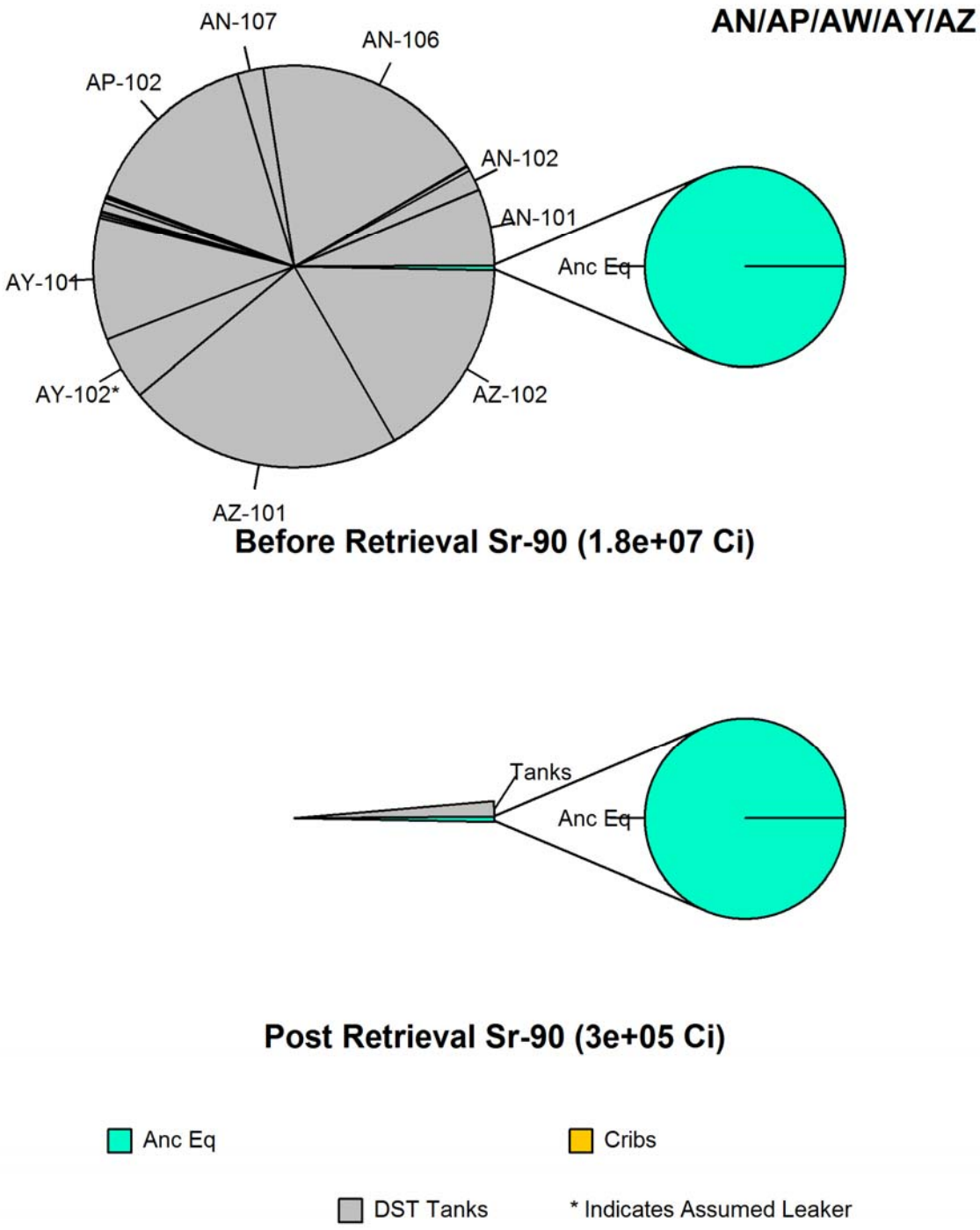


Figure E.9-7. AN-AP-AW-AY-AZ Tank and Waste Farms Evaluation Unit Inventory Estimates for Sr-90 Before and After 99% Retrieval

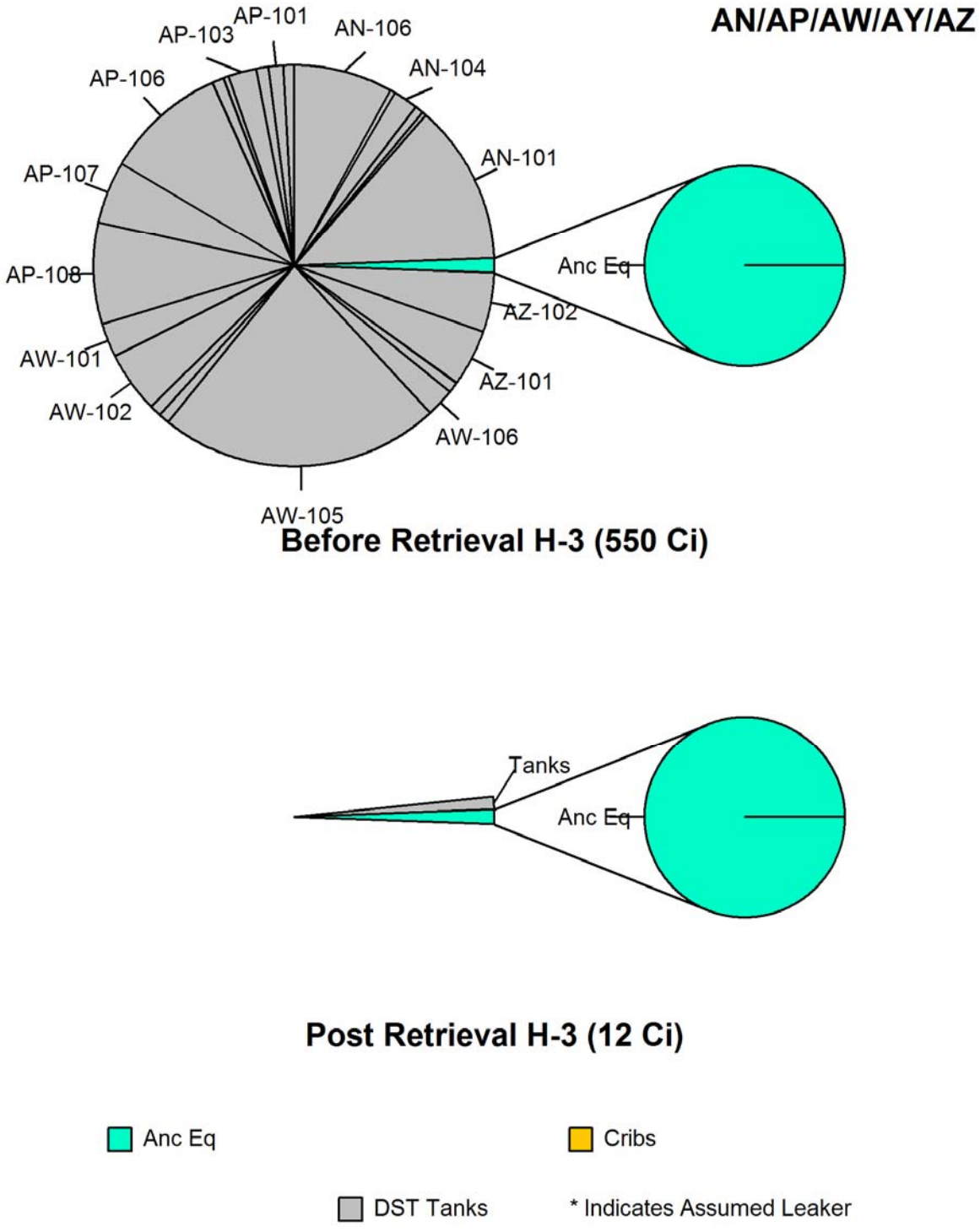


Figure E.9-8. AN-AP-AW-AY-AZ Tank and Waste Farms Evaluation Unit Inventory Estimates for Tritium (H-3) Before and After 99% Retrieval

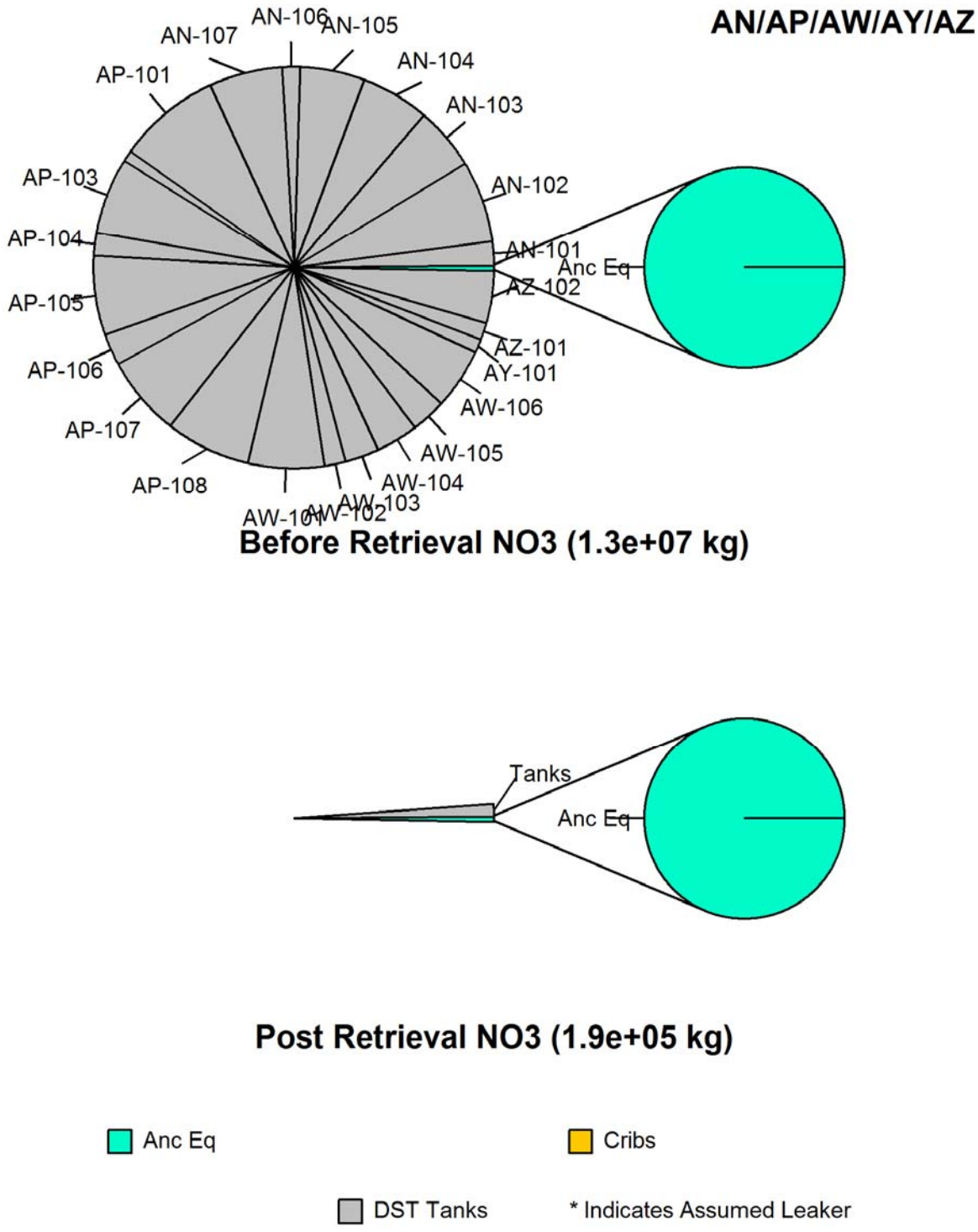


Figure E.9-9. AN-AP-AW-AY-AZ Tank and Waste Farms Evaluation Unit Inventory Estimates for Nitrate (NO3) Before and After 99% Retrieval

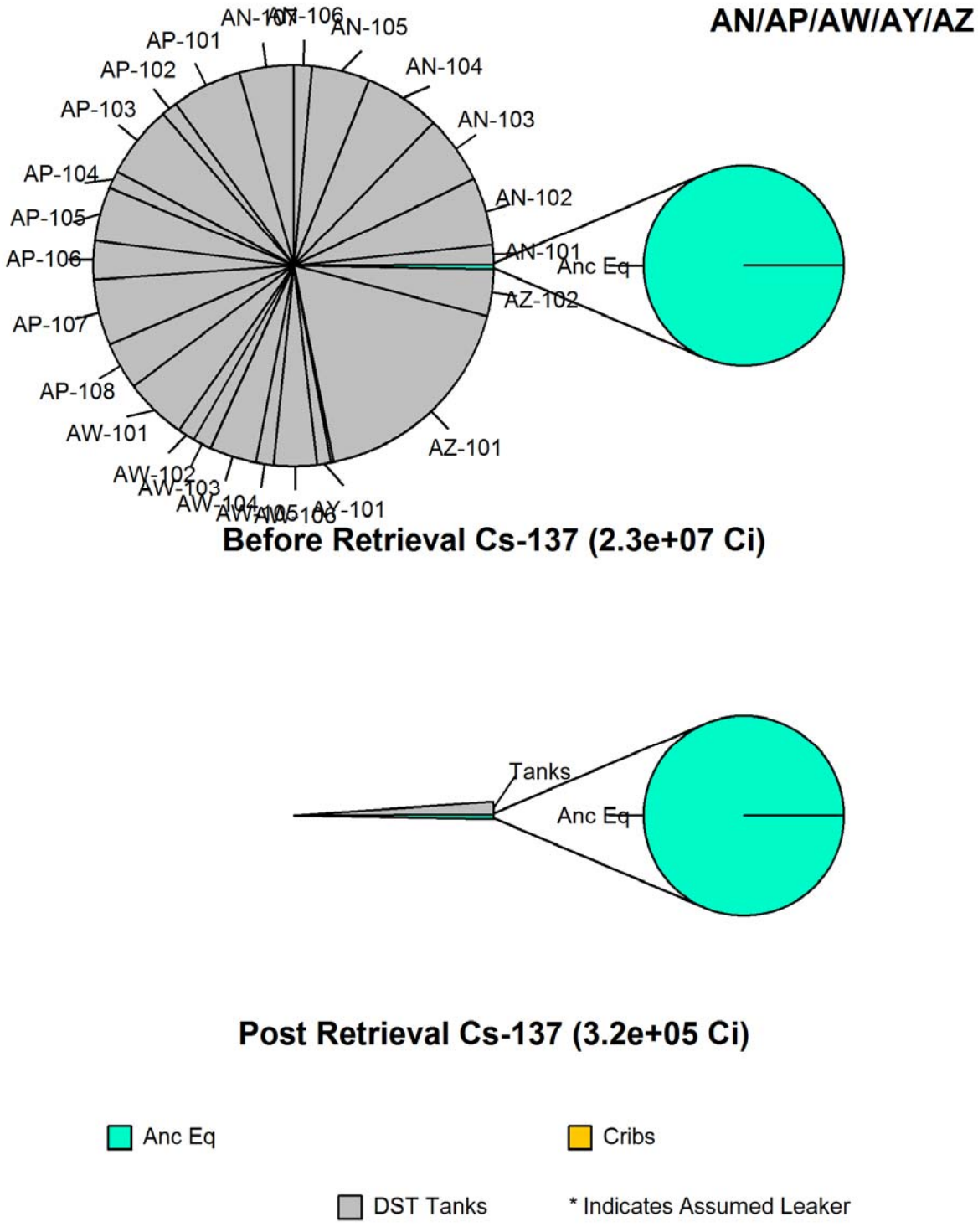


Figure E.9-10. AN-AP-AW-AY-AZ Tank and Waste Farms Evaluation Unit Inventory Estimates for Cs-137 Before and After 99% Retrieval

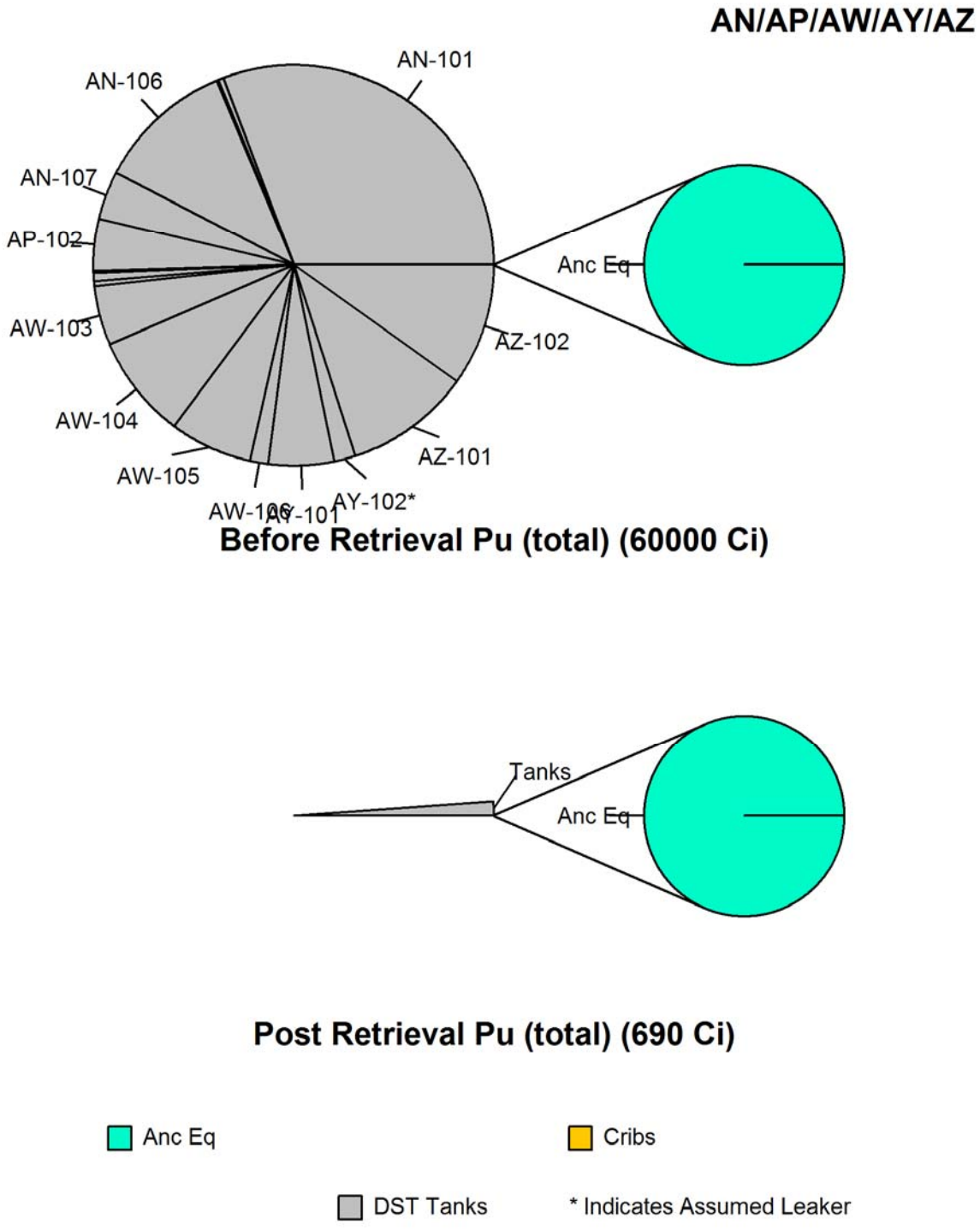


Figure E.9-11. AN-AP-AW-AY-AZ Tank and Waste Farms Evaluation Unit Inventory Estimates for Plutonium (total) Before and After 99% Retrieval

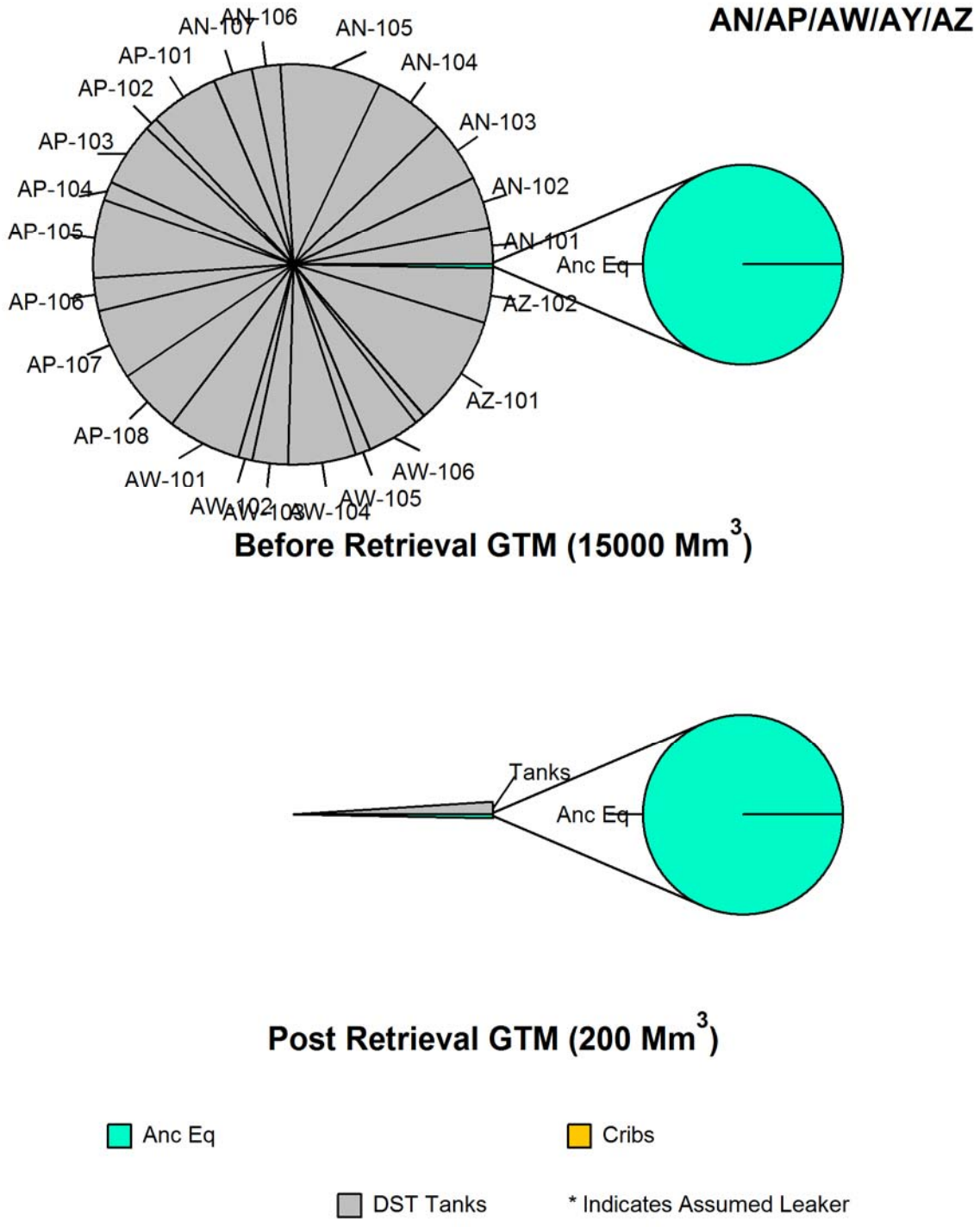


Figure E.9-12. AN-AP-AW-AY-AZ Tank and Waste Farms Evaluation Unit Maximum Groundwater Threat Metric (GTM) of I-129 and Tc-99 Estimates Before and After 99% Retrieval

E.9.6. POTENTIAL RISK/IMPACT PATHWAYS AND EVENTS

CURRENT CONCEPTUAL MODEL

A common safety analysis was performed for all the single- and double-shell tanks including pathways and barriers (safety scenarios that dominate risk, safety systems and controls, barriers to release, failure mechanisms, pathways and receptors, time frames for exposure). See Section E.1.6 in Appendix E.1 for details.

POPULATIONS AND RESOURCES CURRENTLY AT RISK OR POTENTIALLY IMPACTED

Facility Worker, Co-located Person, and Public

A common analysis was performed for the Facility Worker, Co-located Person, and Public. See Section E.1.6 (Appendix E.1) for details.

Groundwater

There are no plumes associated with the 200-East DST Farm EU (DOE/RL-2016-09, Rev. 0) nor are any expected in the foreseeable future (Section E.9.5).

As shown in Table E.9-2 (Section E.9.5), the vadose zone (VZ) GTM values for the Group A and B primary contaminants range are *Low* for all primary contaminants with reported inventories except for Sr-90 and Tc-99 (that have *ND* ratings). The Sr-90 will decay significantly during the Active and Near-term, Post Cleanup period, and transport considerations suggest that Sr-90 or total uranium plumes would not be expected. The overall current rating for groundwater impact from vadose zone sources is *Low*.

Columbia River

Since there are no plumes associated with the 200-East DST Farm EU Table E.9-2) nor are any expected in the foreseeable future, the potential for impacts to the Columbia River benthic, riparian, or free-flowing ecology is not credible based on current information. Thus the ratings associated with potential threats from 200-East DST Farm EU to Columbia River benthic, riparian, or free-flowing receptors are defined to be *Not Discernible* (*ND*) for all contaminants and all evaluation periods.

Ecological Resources

- The EU is level 0 habitat, and no level 3 or greater resources exist within the 200-East Double Shell Tank EU boundaries.
- No wildlife were observed using the disturbed habitats within the EU boundaries.
- Because the area is an industrial site, and is contiguous with adjacent tank farms and other industrial areas—no significant change in habitat connectivity would be expected to result from remediation actions taken within the EU.

Cultural Resources

- The 241 AW Underground Liquid Waste Tanks Farm, a contributing property within the Manhattan Project and Cold War Era Historic District, with documentation required, is located within the 200-East DSTs EU.
- There are no archaeological sites or TCPs known to be located within the 200-East DSTs EU.

Archaeological sites and TCPs located within 500 meters of the EU

- An isolated find associated with the Native American Precontact and Ethnographic Landscape has been located within close proximity to the 200-East DSTs EU.
- The Hanford Site Plant Railroad and the 2707AR Sludge Vault Change House a contributing property within the Manhattan Project and Cold War Era Historic District with documentation required is located within close proximity to the 200-East DSTs EU.
- The 244 AR Vault Facility and Canyon and 242BA 242-A Boiler Annex are contributing properties within the Manhattan Project and Cold War Era Historic District with no documentation required are located within close proximity to the 200-East DSTs EU.
- All of the Manhattan Project/Cold War Era buildings located within the PUREX Evaluation Unit are also located in close proximity to the 200-East DSTs EU.

Closest Recorded TCP

- There are two recorded TCPs associated with the Native American Precontact and Ethnographic Landscape that are visible from 200-East DSTs EU.

CLEANUP APPROACHES AND END-STATE CONCEPTUAL MODEL

Selected or Potential Cleanup Approaches

A common analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

Contaminant Inventory Remaining at the Conclusion of Planned Active Cleanup Period

See Section E.9.5 including Table E.9-2 and Figure E.9-3 through Figure E.9-11 for the inventory information after planned 99% retrieval. Furthermore, a more general analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

Risks and Potential Impacts Associated with Cleanup

A general analysis was performed for all the single- and double-shell tanks for workers and the Public. See Section E.1.6 (Appendix E.1) for details.

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

Facility Worker, Co-located Person, and Public

A common analysis was performed for the Facility Worker, Co-located Person, and Public. See Section E.1.6 (Appendix E.1) for details.

Groundwater

There are no current or anticipated plumes or impacts to groundwater from sources associated with the 200-East DST Farm EU.

However, there are primary (e.g., tank wastes) and secondary contaminant sources (legacy source sites) in the vadose zone that may pose a very small risk to groundwater. For the Active Cleanup and Near-Term, Post-Cleanup periods, the vadose zone (VZ) GTM values for the Group A and B primary contaminants for the 200-East DST Farm EU would be *Low* (except for Sr-90 and total uranium during

the Active Cleanup period[147]) since neither decay nor transport considerations would change the overall rating. Thus the overall rating for the Active Cleanup and Near-Term, Post-Cleanup periods is *Low*.

It is considered unlikely that additional groundwater resources would be impacted as a result of assumed final closure activities (that are not covered in the Ecological or Cultural Resources results).

Columbia River

There are no current or anticipated plumes or impacts to the Columbia River from the 200-East DST Farm EU.

It is considered unlikely that additional benthic or riparian resources would be impacted as a result of assumed final closure activities (that are not covered in the Ecological or Cultural Resources results).

Ecological Resources

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

Cultural Resources

See Section E.1.6 (Appendix E.1) for details.

ADDITIONAL RISKS AND POTENTIAL IMPACTS IF CLEANUP IS DELAYED

A common analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

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

A common analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

[147] Note that no appreciable uranium or Sr-90 plume would be expected in the next 150 years due to transport considerations; however, these may impact groundwater after the 150-year period. Thus a *Low* rating would apply after the Active Cleanup period to account for uncertainties.

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

Table E.9-8. Summary of Populations and Resources at Risk or Potentially Impacted after Cleanup

Population or Resource		Impact Rating	Comments
Human	Facility Worker	Low	Workers will be low risk from exposure to direct radiation and waste contaminants after waste retrieval, grouting, and capping.
	Co-located Person	Low	These persons will be at low risk from exposure to direct radiation and waste contaminants after waste retrieval, grouting, and capping.
	Public	Not Discernible (ND)	The Tank Farms will be in secure and controlled areas that prevent intentional and inadvertent intruders. No complete groundwater pathway and no impact from air pathway.
Environmental	Groundwater (A&B) from vadose zone[(a)]	*Low* (all PCs with reported inventories) **Overall**: *Low*	Current GTM values for Group A and B PCs (Table E.9-2): ND (Sr-90 and U(tot)) and *Low* for other PCs. Sr-90 and U(tot) ratings changed to *Low* to address uncertainty. No current plumes or expected significant transport from vadose zone to groundwater.
	Columbia River from vadose zone[(a)]	Benthic: Not Discernible (all) Riparian: Not Discernible (all) Free-flowing: Not Discernible (all) **Overall**: Not Discernible	No current plumes or expected significant transport from vadose zone to groundwater and thus no credible impact to the Columbia River ecology over the foreseeable future.
	Ecological Resources[(b)]	ND to Low	Likely monitoring of caps, with potential for disruption due to monitoring. Re-vegetation could result in higher quality habitat on EU, but could be some residual contamination to sensitive resources.
Social	Cultural Resources[(b)]	**Native American:** Direct: Unknown Indirect: Known **Historic Pre-Hanford:** Direct: Unknown	Permanent indirect effects to viewshed are possible from capping. Permanent effects may be possible due to presence of contamination if capping occurs.

Population or Resource		Impact Rating	Comments
		Indirect: Unknown **Manhattan/Cold War**: Direct: None Indirect: None	No other expected cultural resources impacts.

a. Groundwater threat for Group A and B contaminants remaining in the vadose zone or to the Columbia River for all primary contaminants.

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

There are no current plumes or expected significant transport from vadose zone to groundwater and thus no credible impact to groundwater or the Columbia River ecology over the foreseeable future.

E.9.7. SUPPLEMENTAL INFORMATION AND CONSIDERATIONS

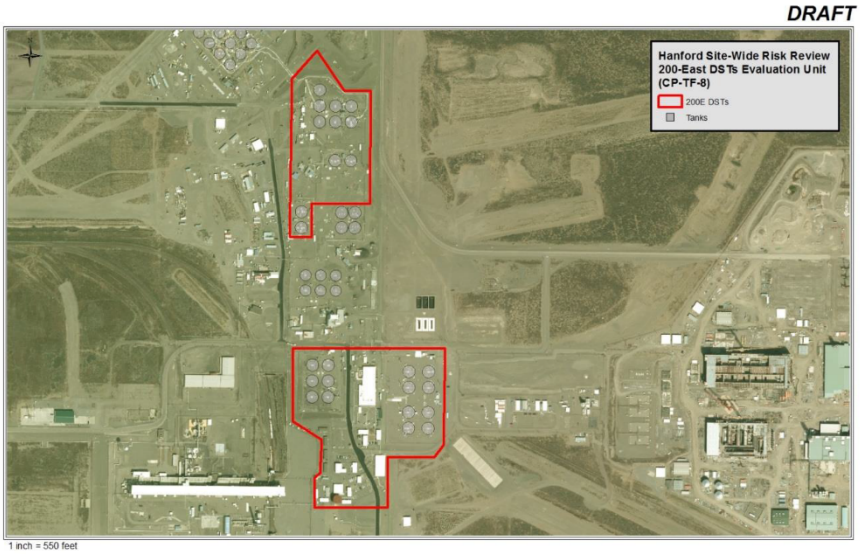
A common analysis was performed for all the single- and double-shell tanks. See Section E.1.7 (Appendix E.1) for details.

E.9.8. ATTACHMENT – AN-AP-AW-AY-AZ TANK FARMS EVALUATION UNIT WIDS REVIEW

Hanford Site-Wide Risk Review

Evaluation Unit:	200-East DSTs
ID:	CP-TF-8
Group:	Tank Farm
Operable Unit Cross-Walk:	NA
Related EU:	CP-LS-7 CP-TF-5
Sites & Facilities:	AN, AP, AW, AY, AZ tank farms, ancillary structures, associated liquid waste sites, and soils contamination
Key Data Sources Docs:	NA

Figure 1. Site Map with Evaluation Unit Boundaries and Tank Locations



Attached:

- Waste Site and Facility List
- Site Map with Evaluation Unit Boundaries and Associated Waste Sites
- Site Map with Evaluation Unit Boundaries and Associated Facilities

Hanford Site-Wide Risk Review
CP-TF-8 (200-East DSTs)
Waste Site and Facility List

Site Code	Name	Site Status	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation
200-E-113-PL	200-E-113-PL; 216-A-42C Valve Box; Line 8824; Pipeline from PUREX to 216-A-6 and 216-A-30 Crib	Inactive	Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-127-PL-B	200-E-127-PL-B; Segments of Gable Mountain Pond Pipeline Located in the Inner Area	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-134	200-E-134; Potentially Contaminated Soil in 241-AW Tank Farm	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	
200-E-154-PL	200-E-154-PL; Direct Buried Transfer Line from 241-C-151 to 241-AX-01A; Tank Farm Pipeline; Tank Farm Transfer Line V113	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-155-PL	200-E-155-PL; Pipeline from 241-C Fence to Radioactive Process Sewer Line 2904-CR-1	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-187-PL	200-E-187-PL; Chemical Sewer from 202-A to 216-A-29 Ditch; Lines 8819, 5802 and 5701; PUREX Chemical Sewer (CSL)	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-207-PL	200-E-207-PL; Encased Transfer Line from 241-A-151 Diversion Box to 241-A-152 Diversion Box; Lines V004, V005, V006, V007 and V008	Inactive	Encased Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-210-PL	200-E-210-PL; Encased Lines Between 241-AW Tank Farm and 242-A Evaporator Building; Lines SL-167, SL-168, SN-219, SN-220, SN-269 and SN-270	Active	Encased Tank Farm Pipeline	Pipeline and associated valves, etc.	Not Applic	
200-E-211-PL	200-E-211-PL; Lines DR334, DR335 and DR343; Transfer Lines from 241-AW to 242-A Evaporator Building	Active	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	Not Applic	
200-E-212-PL	200-E-212-PL; Lines SL-509, SL-510, SN-609 and SN-610; Transfer Lines Between 241-AW Tank Farm and 241-AP Tank Farm	Active	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	Not Applic	
200-E-218-PL	200-E-218-PL; Lines V021; Transfer Lines Between 241-A-151 Diversion Box and 241-AW Tank Farm; V022; V023	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-225-PL	200-E-225-PL; Line V720; Transfer Line from 241-AR-151 Diversion Box to 241-AY-102 Tank	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-229-PL	200-E-229-PL; Line SN-650; Transfer Line Between tank 241-AP-102 and 241-A-B Valve Pit	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-E-237-PL	200-E-237-PL; 2904-E-24; Line 2904-E-1; Pipeline to 200 East Powerhouse Ditch and Pipeline from Powerhouse Ditch to 216-B-3 Ditches	Active	Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-260-PL	200-E-260-PL; Line 8824A; Steam Condensate By-Pass Line from PUREX to 216-A-30	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-261-PL	200-E-261-PL; Effluent Recycle Line from 216-A-42 Basin to PUREX	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-271-PL	200-E-271-PL; Line 8823; PUREX Cooling Water Header Pipeline	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	
200-E-291-PL	200-E-291-PL; Pipeline from 241-C-106 to 241-AY-102, SN-200, SL-100, 241-C-106 Sluice line	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
216-A-39	216-A-39; 216-A-39 Crib; 216-A-39 Trench	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	Not Applic	

Note that only those waste sites with a WIDS (Waste Information Data System) Classification of "Accepted" are shown, along with non-duplicate facilities, identified via the Hanford Geographic Information System (HGIS).

Hanford Site-Wide Risk Review
CP-TF-8 (200-East DSTs)
Waste Site and Facility List

Site Code	Name	Site Status	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation
241-AN-101	241-AN-101; 241-AN-TK-101	Active	Double-Shell Tank	Underground Storage Tank	Not Applic	
241-AN-102	241-AN-102; 241-AN-TK-102	Active	Double-Shell Tank	Underground Storage Tank	Not Applic	
241-AN-103	241-AN-103; 241-AN-TK-103	Active	Double-Shell Tank	Underground Storage Tank	Not Applic	
241-AN-104	241-AN-104; 241-AN-TK-104	Active	Double-Shell Tank	Underground Storage Tank	Not Applic	
241-AN-105	241-AN-105; 241-AN-TK-105	Active	Double-Shell Tank	Underground Storage Tank	Not Applic	
241-AN-106	241-AN-106; 241-AN-TK-106	Active	Double-Shell Tank	Underground Storage Tank	Not Applic	
241-AN-107	241-AN-107; 241-AN-TK-107	Active	Double-Shell Tank	Underground Storage Tank	Not Applic	
241-AN-A	241-AN-A; 241-AN-A Diversion Box	Active	Valve Pit	Pipeline and associated valves, etc.	Not Applic	
241-AN-B	241-AN-B; 241-AN-B Diversion Box	Active	Valve Pit	Pipeline and associated valves, etc.	Not Applic	
241-AP VP	241-AP VP; 241-AP Valve Pit	Active	Valve Pit	Pipeline and associated valves, etc.	Not Applic	
241-AP-101	241-AP-101; 241-AP-TK-101	Active	Double-Shell Tank	Underground Storage Tank	Not Applic	
241-AP-102	241-AP-102; 241-AP-TK-102	Active	Double-Shell Tank	Underground Storage Tank	Not Applic	
241-AP-103	241-AP-103; 241-AP-TK-103	Active	Double-Shell Tank	Underground Storage Tank	Not Applic	
241-AP-104	241-AP-104; 241-AP-TK-104	Active	Double-Shell Tank	Underground Storage Tank	Not Applic	
241-AP-105	241-AP-105; 241-AP-TK-105	Active	Double-Shell Tank	Underground Storage Tank	Not Applic	
241-AP-106	241-AP-106; 241-AP-TK-106	Active	Double-Shell Tank	Underground Storage Tank	Not Applic	
241-AP-107	241-AP-107; 241-AP-TK-107	Active	Double-Shell Tank	Underground Storage Tank	Not Applic	
241-AP-108	241-AP-108; 241-AP-TK-108	Active	Double-Shell Tank	Underground Storage Tank	Not Applic	
241-AW-101	241-AW-101; 241-AW-TK-101	Active	Double-Shell Tank	Underground Storage Tank	Not Applic	
241-AW-102	241-AW-102; 241-AW-TK-102	Active	Double-Shell Tank	Underground Storage Tank	Not Applic	
241-AW-103	241-AW-103; 241-AW-TK-103	Active	Double-Shell Tank	Underground Storage Tank	Not Applic	
241-AW-104	241-AW-104; 241-AW-TK-104	Active	Double-Shell Tank	Underground Storage Tank	Not Applic	
241-AW-105	241-AW-105; 241-AW-TK-105	Active	Double-Shell Tank	Underground Storage Tank	Not Applic	
241-AW-106	241-AW-106; 241-AW-TK-106	Active	Double-Shell Tank	Underground Storage Tank	Not Applic	
241-AW-A	241-AW-A; 241-AW-A Diversion Box; 241-AW-A Valve Pit	Active	Valve Pit	Pipeline and associated valves, etc.	Not Applic	
241-AW-B	241-AW-B; 241-AW-B Diversion Box; 241-AW-B Valve Pit	Active	Valve Pit	Pipeline and associated valves, etc.	Not Applic	
241-AY-101	241-AY-101; 241-AY-TK-101	Active	Double-Shell Tank	Underground Storage Tank	Not Applic	
241-AY-102	241-AY-102; 241-AY-TK-102	Active	Double-Shell Tank	Underground Storage Tank	Not Applic	
241-AZ-101	241-AZ-101; 241-AZ-TK-101	Active	Double-Shell Tank	Underground Storage Tank	Not Applic	
241-AZ-102	241-AZ-102; 241-AZ-TK-102	Active	Double-Shell Tank	Underground Storage Tank	Not Applic	
241-AZ-151CT	241-AZ-151CT; 241-AZ-151 Catch Tank	Inactive	Catch Tank	Underground Storage Tank	Not Applic	
241-AZ-151DS	241-AZ-151DS; 241-AZ-151-DS Diverter Station; 241-AZ-151 Diverter Station	Inactive	Diversion Box	Pipeline and associated valves, etc.	Not Applic	
241-AZ-152	241-AZ-152; 241-AZ-152 Diversion Box; 241-AZ-152 Sluice Transfer Box	Inactive	Diversion Box	Pipeline and associated valves, etc.	Not Applic	
2607-EJ	2607-EJ; 2607-EJ Septic System	Inactive	Septic Tank	Septic System	Not Applic	X
600-269-PL	600-269-PL; Cross Site Transfer Line Replacement; Lines SNL-3150 and 3160; New Cross-Site Transfer Line	Active	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	Not Applic	
UPR-200-E-19	UPR-200-E-19; Contamination Release at 216-A-6 Sampler; UN-200-E-19	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	200-EA-1	
UPR-200-E-93	UPR-200-E-93; UN-216-E-21 Ground Contamination Along 200 East Area fence	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applic	

Note that only those waste sites with a WIDS (Waste Information Data System) Classification of "Accepted" are shown, along with non-duplicate facilities, identified via the Hanford Geographic Information System (HGIS).

Hanford Site-Wide Risk Review
CP-TF-8 (200-East DSTs)
Waste Site and Facility List

Site Code	Name	Site Status	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation
250600	TELECOMMUNICATIONS	ACTIVE	BUILDING	Infrastructure Building		X
220A	PROPORTIONAL SAMPLER PIT	INACTIVE	STRUCTURE	Infrastructure Building		X
241A201	EMERGENCY COOLING WATER STORAGE TANKS SE OF PUREX	INACTIVE	TANK	Infrastructure Building		X
241AN271	INSTRUMENT CONTROL HOUSE	ACTIVE	BUILDING	Infrastructure Building		X
241AN273	COMPRESSOR BUILDING	ACTIVE	BUILDING	Infrastructure Building		X
241AN274	MIXER PUMP AND CAUSTIC ADDITION CONTROL BLDG	ACTIVE	BUILDING	Process Building		
241AN801	WATER SERVICE BUILDING	ACTIVE	BUILDING	Infrastructure Building		X
241ANB	VALVE VAULT	ACTIVE	STRUCTURE	Pipeline and associated valves, etc.		
241AP271	TANK FARM INSTRUMENT BUILDING	ACTIVE	BUILDING	Infrastructure Building		X
241AP273	COMPRESSOR BUILDING	ACTIVE	BUILDING	Infrastructure Building		X
241AP801	WATER SERVICE BUILDING	ACTIVE	STRUCTURE	Infrastructure Building		X
241AW271	TANK FARM CONTROL HOUSE	ACTIVE	BUILDING	Infrastructure Building		X
241AW273	COMPRESSOR BUILDING	ACTIVE	BUILDING	Infrastructure Building		X
241AW801	WATER SERVICE BUILDING	ACTIVE	BUILDING	Infrastructure Building		X
241AY801A	TANK FARM INSTRUMENT HOUSE	ACTIVE	BUILDING	Infrastructure Building		X
241AZ152	SLUICE TRANSFER BOX	ACTIVE	STRUCTURE	Pipeline and associated valves, etc.		X
241AZ156	MIXER PUMP SPEED CONTROL HOUSE	ACTIVE	BUILDING	Infrastructure Building		X
241AZ271	CHANGE HOUSE / CONTROL BUILDING	ACTIVE	BUILDING	Infrastructure Building		X
241AZ301A	241AZ CHEMICAL ADDITIONAL BLDG	ACTIVE	BUILDING	Process Building		
241AZ701	DIESEL GENERATOR BUILDING	ACTIVE	BUILDING	Infrastructure Building		X
241AZ702	WASTE TANK VENTILATION BUILDING	ACTIVE	BUILDING	Process Building		
241AZ801A	INSTRUMENT BUILDING	ACTIVE	BUILDING	Infrastructure Building		X
2715AW	TANK FARM STORAGE / STAGING FACILITY	ACTIVE	BUILDING	Infrastructure Building		X
2724AZ	RAD MONITORING AND PROTECTIVE CLOTHING BLDG	INACTIVE	BUILDING	Infrastructure Building		X
272AW	TANK FARM OPERATIONS SUPPORT FACILITY	ACTIVE	BUILDING	Infrastructure Building		X
272EA	SWP CHANGE SHELTER NE CORNER OF 272AW	ACTIVE	BUILDING	Infrastructure Building		X
274AW	OFFICE BUILDING	ACTIVE	BUILDING	Infrastructure Building		X
278AW	TANK FARM MASK STATION	ACTIVE	BUILDING	Infrastructure Building		X
295AD	SWL SAMPLE STATION	INACTIVE	BUILDING	Infrastructure Building		X
CT0058	REMOVED FROM SITE -- SHOWER TRAILER EAST OF 272AW	REMOVED	BUILDING	Infrastructure Building		X
MO144	MOBILE OFFICE SOUTH OF 2715AW	ACTIVE	BUILDING	Infrastructure Building		X
MO149	MOBILE OFFICE SOUTH OF 2715AW	ACTIVE	BUILDING	Infrastructure Building		X
MO150	MOBILE OFFICE SOUTH OF 2715AW	ACTIVE	BUILDING	Infrastructure Building		X
MO151	MOBILE OFFICE SOUTH OF 2715AW	ACTIVE	BUILDING	Infrastructure Building		X
MO156	SHOWER/LOCKER TRAILER SOUTH OF 278AW	ACTIVE	BUILDING	Infrastructure Building		X
MO157	SHOWER/LOCKER TRAILER SOUTH OF 278AW	ACTIVE	BUILDING	Infrastructure Building		X
MO2240	MO2240 SOUTH OF AW FARM	ACTIVE	BUILDING	Infrastructure Building		X

Note that only those waste sites with a WIDS (Waste Information Data System) Classification of "Accepted" are shown, along with non-duplicate facilities, identified via the Hanford Geographic Information System (HGIS).

Hanford Site-Wide Risk Review
CP-TF-8 (200-East DSTs)
Waste Site and Facility List

Site Code	Name	Site Status	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation
MO2241	MO2241 SOUTH OF AW FARM	ACTIVE	BUILDING	Infrastructure Building		X
MO2242	MO2242 SOUTH OF AW FARM	ACTIVE	BUILDING	Infrastructure Building		X
MO2243	MO2243 SOUTH OF AW FARM	ACTIVE	BUILDING	Infrastructure Building		X
MO2244	DECON FIELD TRAILER EAST OF BUFFALO AVE AT 241AZ70	ACTIVE	BUILDING	Infrastructure Building		X
MO2350	RESTROOM TRAILER SW OF 2715AW	ACTIVE	BUILDING	Infrastructure Building		X
MO266	MOBILE OFFICE AT 272AW TANK FARMS	ACTIVE	BUILDING	Infrastructure Building		X
MO267	MOBILE OFFICE AT 272AW TANK FARMS	ACTIVE	BUILDING	Infrastructure Building		X
MO268	MOBILE OFFICE AT 272AW TANK FARMS	ACTIVE	BUILDING	Infrastructure Building		X
MO439	CHANGE TRAILER AT AY TANK FARM	ACTIVE	BUILDING	Infrastructure Building		X
MO497	MOBILE OFFICE NORTH OF 241AN	ACTIVE	BUILDING	Infrastructure Building		X
MO511	CONFRENCE TRAILER SE OF 272AW	ACTIVE	BUILDING	Infrastructure Building		X
MO513	HPT/CHANGE TRAILER AT 241AY TANK FARM	ACTIVE	BUILDING	Infrastructure Building		X
MO533	TANK OPERATIONS SUPPORT MOBILE SE OF 272AW	ACTIVE	BUILDING	Infrastructure Building		X
MO577	MOBILE OFFICE NORTH OF 244AR712	ACTIVE	BUILDING	Infrastructure Building		X
MO578	MOBILE OFFICE NORTH OF 244AR712	ACTIVE	BUILDING	Infrastructure Building		X
MO815	CHANGE TRAILER AT 241AP TANK FARM	ACTIVE	BUILDING	Infrastructure Building		X
MO818	CHANGE TRAILER AT 241AW TANK FARM	ACTIVE	BUILDING	Infrastructure Building		X
MO820	CHANGE TRAILER AT AN TANK FARM	ACTIVE	BUILDING	Infrastructure Building		X

Note that only those waste sites with a WIDS (Waste Information Data System) Classification of "Accepted" are shown, along with non-duplicate facilities, identified via the Hanford Geographic Information System (HGIS).

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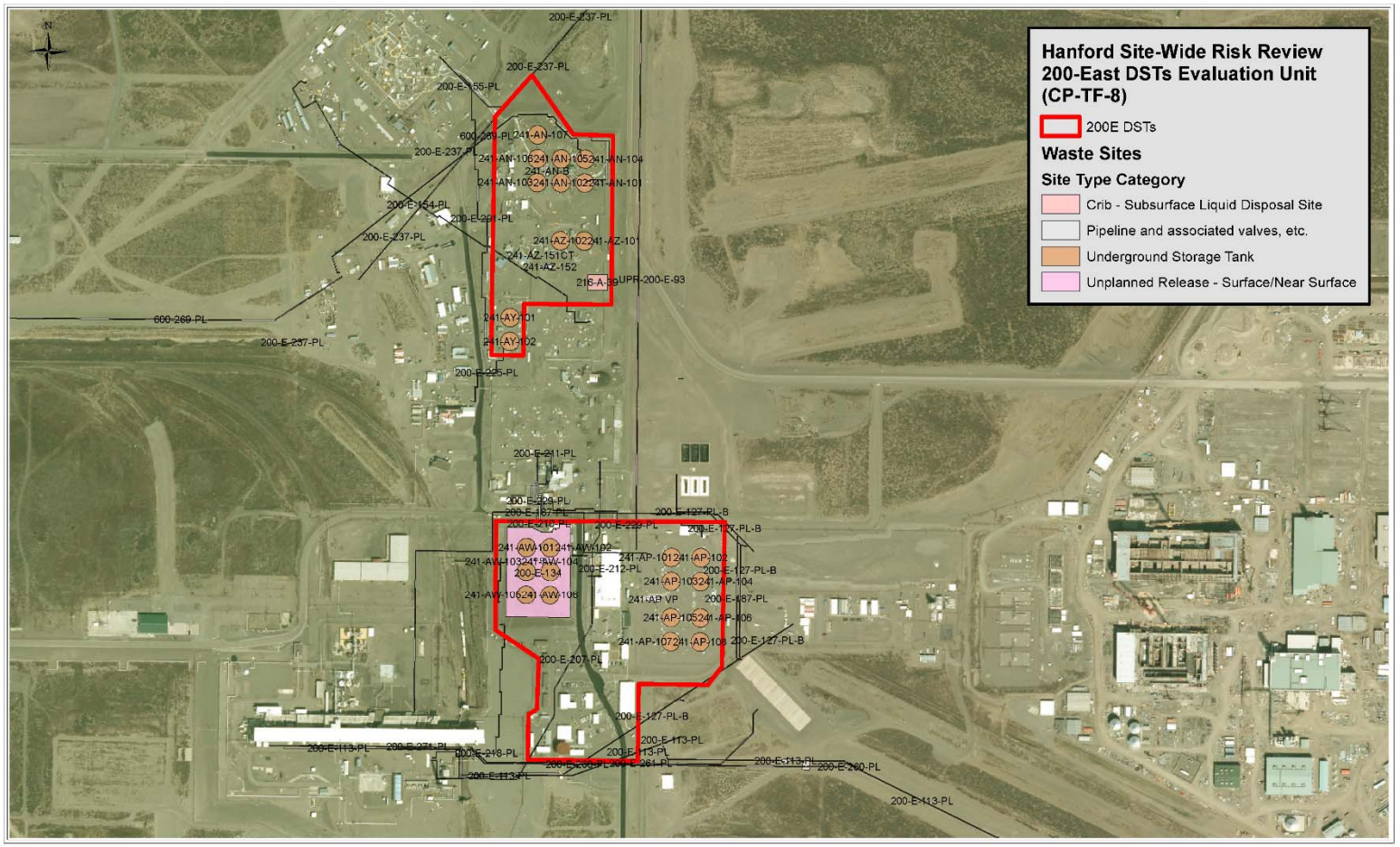
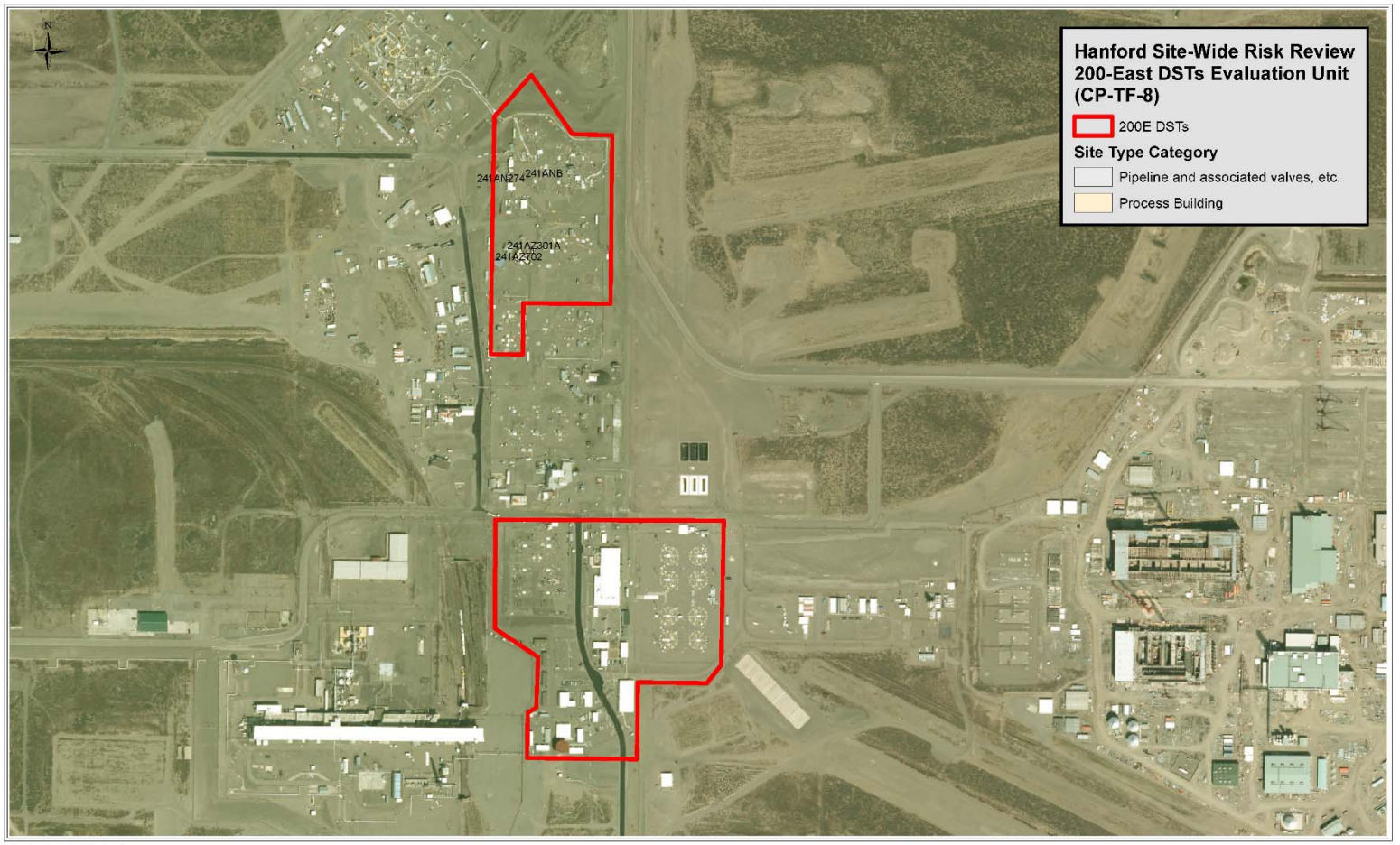


1 inch = 600 feet

DRAFT



1 inch = 600 feet

APPENDIX E.10

Tank Waste and Farm

CP-TF-9 (SY Double-shell Tank Waste and Farm) Evaluation Unit Summary Template

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PART E.10. CP-TF-9 SY DOUBLE-SHELL TANK WASTE AND FARM (200-W)

E.10.1. EXECUTIVE SUMMARY

EU LOCATION:

200 West Tank Farm

RELATED EUS:

S-SX Tank Farm (CP-TF-2), TX-TY Tank Farms (CP-TF-3), U Tank Farm (CP-TF-4), A-AX Tank Farms (CP-TF-5), B-BX-BY Tank Farms (CP-TF-6), C Tank Farm (CP-TF-7), 200-East DSTs (CP-TF-9), 200-W Groundwater (CP-GW-2), and 200 Area HLW Transfer Pipeline (CP-LS-7)

PRIMARY CONTAMINANTS, CONTAMINATED MEDIA AND WASTES:

The TC&WM EIS describes tank wastes as including radioactive (tritium or H-3, C-14, Sr-90, Tc-99, I-129, Cs-137, U-233, U-234, U-235, U-238, Np-237, Pu-239, and Pu-240)[148] and non-radioactive contaminants (chromium, mercury, nitrate, lead, total uranium, and PCBs) of potential concern (DOE/EIS-0391 2012, Appendix D). The tank wastes contain saltcake, sludge, and supernatant phases.

BRIEF NARRATIVE DESCRIPTION

To provide additional storage capacity, 28 double-shell tanks were built in six tank farms between 1968 and 1986. Five of these tank farms are located in the 200 East Area, and one (241-SY) is located in the 200 West Area.

SUMMARY TABLES OF RISKS AND POTENTIAL IMPACTS TO RECEPTORS

Table E.10-1 provides a summary of nuclear and industrial safety related consequences from the CP-TF-9 (200-West DST Farm EU) to humans and impacts to important physical Hanford Site resources. Receptors are described in Section E.1.6 (Appendix E.1).

[148] Other isotopes considered include U-232 and U-236 and Pu-238, Pu-241, and Pu-242 to be consistent with other EUs. These additional uranium and plutonium isotopes are included in the totals presented but are not used for rating because 1) uranium toxicity impacts (represented by total uranium drives corresponding risks and 2) plutonium has been found relatively immobile in the Hanford subsurface and has not been identified as a risk driver for groundwater impacts.

Table E.10-1. CP-TF-9 (200-West DST Farm) impact Rating Summary for Human Health (unmitigated basis with mitigated basis provided in parentheses (e.g., "High (Low)").

Population or Resource		Evaluation Time Period[a] Active Cleanup (to 2064) **Current Condition:** Maintenance & Monitoring (M&M)	**From Cleanup Actions:** Retrieval & Closure
Human Health	Facility Worker[b]	***M&M***: Low-High[d] (Low-High)[d] ***Soil***: Not Discernible (ND)-High (ND-Low)	***Preferred method*****:** High (Low) ***Alternative***: High (Low)
	Co-located Person[b]	***M&M***: Low-Moderate (Low) ***Soil*****:** ND (ND)	***Preferred method*****:** Low-Moderate (Low) ***Alternative***: Low-Moderate (Low)
	Public[b]	***M&M***: Low (Low) ***Soil*****:** ND (ND)	***Preferred method*****:** Low (Low) ***Alternative***: Low (Low)
Environmental	Groundwater (A&B) from vadose zone[c]	*ND* (All PCs)[f] **Overall**: *ND*	*ND* (All PCs)[f] **Overall**: *ND*
	Columbia River from vadose zone[c]	Benthic: *ND* Riparian: *ND* Free-flowing: *ND* **Overall**: *ND*[f]	Benthic: *ND* Riparian: *ND* Free-flowing: *ND* **Overall**: *ND*[f]
	Ecological Resources[e]	ND	ND to Medium
Social	Cultural Resources[e]	**Native American:** Direct: Unknown Indirect: Known **Historic Pre-Hanford:** Direct: Unknown Indirect: Unknown **Manhattan/Cold War:** Direct: Known Indirect: Known	**Native American:** Direct: Unknown Indirect: Known **Historic Pre-Hanford:** Direct: Unknown Indirect: Unknown **Manhattan/Cold War:** Direct: Known Indirect: Known

a. A rating for cultural resources is 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.

b. Evaluated in Section E.1.6 (Appendix E.1).

c. Groundwater threat for Group A and B contaminants remaining in the vadose zone or to the Columbia River for all primary contaminants. However, there is no vadose zone contamination associated with this EU (and none expected in the future) and thus there is no risk and a *Not Discernible* (*ND*) rating.

d. Industrial safety consequences range from low to high (based on the evaluation scale used) for both mitigated (with controls) and unmitigated (without controls). Mitigated radiological and toxicological consequences to facility workers are high (unmitigated) and low (mitigated).

e. 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.

f. There are no legacy source sites associated with the 200-West DST Farm EU or anticipated in the future; therefore, ratings are *Not Discernible* (*ND*).

SUPPORT FOR RISK AND IMPACT RATINGS FOR EACH POPULATION OR RESOURCE

Human Health

The current and cleanup-related consequences related to work being conducted at the Tank Farms in the 200 Areas (Hanford Central Plateau) was evaluated in Section E.1.6 (Appendix E.1).

Groundwater, Vadose Zone, and Columbia River

Current

Contaminants from the Hanford double-shell Tank Farms are not currently impacting groundwater nor are there secondary sources considered likely for future impacts to groundwater or the Columbia River.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

See Section E.1.1.

Ecological Resources

Current

No resources on site, but about 15% level 3 resources on buffer. If not trucks, ND effects currently.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

No resources on EU, but about 7% level 3 resources on buffer. Remediation could result in truck disturbance, increases in exotic species, changes in species composition in buffer, and contamination of sensitive species.

Cultural Resources

Current

Manhattan Project/Cold War significant resources have already been mitigated. Area is very disturbed and there are no known recorded archaeological resources within the EU. Traditional cultural places are visible from EU.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

Because area has not been investigated either on the surface or subsurface, archaeological investigations may need to occur within pockets of undisturbed land if any prior to remediation. Potential for intact archaeological material to be present is very low.

Considerations for Timing of the Cleanup Actions

See Section E.9.1 (Appendix E.9).

Near-Term, Post-Cleanup Risks and Potential Impacts

See Section E.9.1 (Appendix E.9).

E.10.2. ADMINISTRATIVE INFORMATION

OU AND/OR TSDF DESIGNATION(S):

The 200-West DST Tank and Waste Farms Evaluation Unit (EU), denoted *CP-TF-9*, consists of 3 waste tanks and ancillary structures.

COMMON NAME(S) FOR EU:

There is no common name for the 200-West DST EU because the EU is comprised of various elements from a double-shell Tank Farm. Other components in the EU (including any associated legacy waste sites) are listed below in the *Primary EU Source Components* section.

KEY WORDS:

Double-shell Tank Farm, 241-SY Tank Farm, waste tanks, tank farm

REGULATORY STATUS

Regulatory Basis

The 200 Areas of the Hanford Site have been placed by EPA on the National Priorities List (NPL). The completion of remediation of the 200 Areas overall will eventually be finalized via CERCLA decisions made by the EPA, and permitting decisions made by Ecology.

DOE is the responsible agency for the closure of all Tank Farms through post closure, in close coordination with other closure and cleanup activities of the Hanford Central Plateau. Washington State has a program that is authorized under RCRA and implemented through the HWMA and its associated regulations. Please refer to Section E.1.2 (Appendix E.1) for more information.

Applicable Regulatory Documentation

Please refer to Section E.1.2 (Appendix E.1).

Applicable Consent Decree or TPA Milestones

Not applicable.

RISK REVIEW EVALUATION INFORMATION

Completed: Revised August 25, 2015

Evaluated by: K. Jones and K. G. Brown

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

E.10.3. SUMMARY DESCRIPTION

CURRENT LAND USE

DOE Hanford Site for industrial use. All current land-use activities in the 200-West Area are *industrial* in nature (EPA 2012).

DESIGNATED FUTURE LAND USE

Industrial-Exclusive. All four land-use scenarios listed in the Comprehensive Land Use Plan (CLUP) indicate that the 200-West Area is denoted *Industrial-Exclusive* (DOE/EIS-0222-F). An industrial-exclusive area is "suitable and desirable for treatment, storage, and disposal of hazardous, dangerous, radioactive, and nonradioactive wastes" (DOE/EIS-0222-F).

PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

There are two unplanned release sites in the CP-TF-9 EU (Attachment Section E.10.8); however, the contributions from these sites are insignificant and not considered here.

Waste Tanks and Ancillary Equipment

The three double-shell waste tanks in the 241-SY (-101 through -103 tanks). The ancillary equipment included in the 200-East Tank and Waste Farms EU is listed in Attachment Section E.10.8 and consists primarily of pipelines, diversion boxes, and catch tanks.

Groundwater Plumes

There are no groundwater plumes associated with the 200-West DSTs.

Operating Facilities

The DSTs are considered an Operating Facility for this Review. See Section E.9.3 (Appendix E.9) for additional information.

D&D of Inactive Facilities

Not Applicable.

LOCATION AND LAYOUT MAPS

A series of maps are used to illustrate the location of the components within the CP-TF-9 EU and the 200-West DST Farm EU relative to the Hanford Site. Figure E.2-1 (Appendix E.2) shows the relationship between the 200-W (200 West) Area (where the 200-West DST Farm EU is located) and the Hanford Site. Figure E.10-1 illustrates the 200-West DST Farm EU boundary. Figure E.10-2 shows a detailed view of the waste tanks, ancillary equipment, and legacy source units in the 200-West DST Farm EU.

Figure E.10-1. Polygon representing the boundary of the 200-West DST Farm Evaluation Unit (Attachment Section E.10.8).

DRAFT

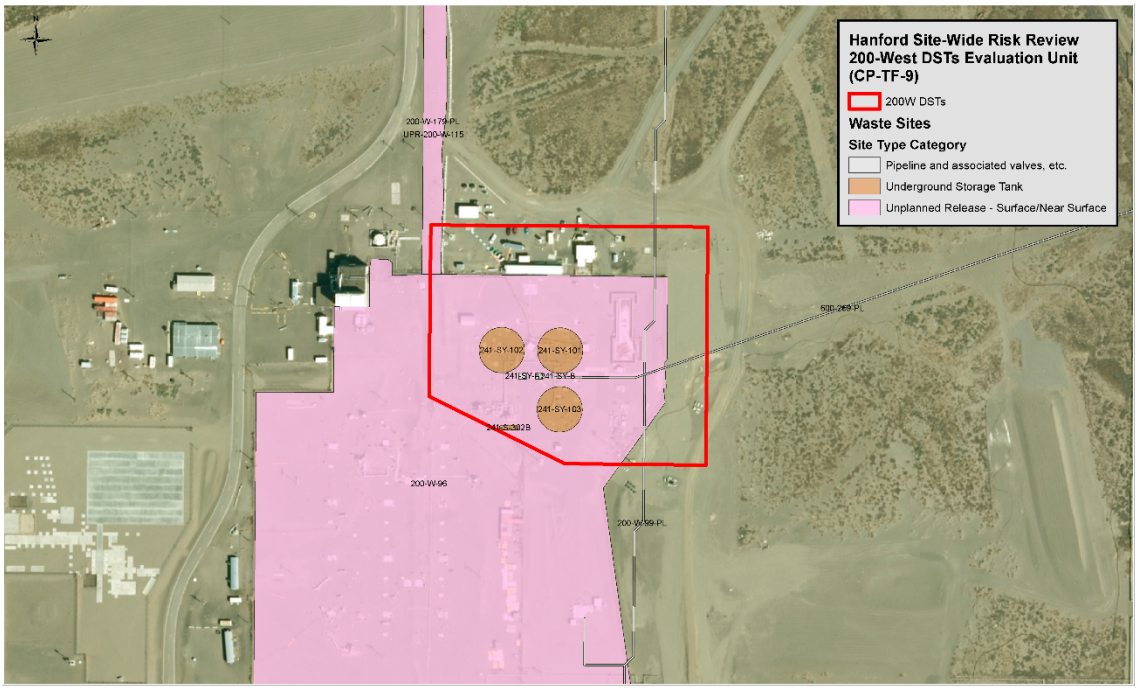


Figure E.10-2. Hanford 200-West DST Farm Evaluation Unit including tanks, legacy source units, and ancillary equipment (Attachment Section E.10.8).

E.10.4. UNIT DESCRIPTION AND HISTORY

EU Former / Current Uses

See Section E.9.4 (Appendix E.9).

Legacy Source Sites

Not applicable. There are two unplanned release sites in the CP-TF-9 EU (Attachment Section E.10.8); however, the contributions from these sites are insignificant (i.e., no inventories available) and not considered here.

Waste Tanks

See Section E.10.3 for details.

Groundwater Plumes

Not applicable.

D&D OF INACTIVE FACILITIES – NOT APPLICABLE

OPERATING FACILITIES – NOT APPLICABLE

The CP-TF-9 DSTs in the EU can be considered Operating Facilities for this Review since they will be used to process the single-shell tank waste.

ECOLOGICAL RESOURCES SETTING

Landscape Evaluation and Resource Classification:

The amount of each category of biological resources at and near the 200-West Double Shell Tanks EU was examined within a circular area radiating 204 m from the geometric center of the unit (equivalent to 32.2 acres). The entire EU (4.7 ac) is comprised of level 0 biological resources (Appendix J, Table 2, p. J-57). The major portion (18.6 ac, 67.6%) of the adjacent landscape buffer is made up of level 0 and 1 resources, with the remainder comprised of several small patches of level 2 (6.9 ac, 25.1%) located north and east of the EU and a single patch of level 3 (1.9 ac, 6.9%) located north of the EU (Appendix J, Table 2, p. J-57 and Figure 8, p. J-58). Overall, only six percent of the total combined area currently consists of higher quality (level 3 or above) biological resources based on habitat.

Field Survey:

PNNL biologists conducted a reconnaissance and visual survey of the 200-West Double Shell Tanks EU in October 2014. This field survey confirmed that nearly the entire EU consists of graveled surfaces, buildings, parking areas, and infrastructure related to the tanks. Only sparse vegetation, consisting of alien grasses and forbs, occurs along roadside margins outside the tank farm fence. No vegetation measurements were taken and no field data sheets are included. The table in Appendix J (Appendix J, Table 2, p. J-57) documents the surface conditions of the EU.

No wildlife were observed within the EU during the October reconnaissance, however, PNNL ECAP surveys conducted in 2009 noted the following birds: an American kestrel (*Falco sparverius*) apparently nesting in a light pole or nearby building, Say's phoebe (*Sayornis saya*), barn swallow (*Hirundo rustica*), and white-crowned sparrow (*Zonotrichia leucophrys*).

CULTURAL RESOURCES SETTING

There are no known archaeological sites, buildings or TCPs known to be recorded within the 200-West DSTs EU. None of the 200-West DSTs EU has been inventoried for archaeological resources. Given the extensive disturbance within the 200 West DSTs EU, it is unlikely, but there is a possibility 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), particularly if undisturbed soil deposits exist within the 200-West DSTs EU. Closure and remediation of the tank farms located within the 200-West DSTs has been addressed in an NHPA Section 106 review.

Two National Register-eligible properties associated with the Manhattan Project/Cold War Era Landscape (Hanford Site Plant Railroad with documentation required and the 242S Evaporator Facility with no documentation required) are located within 500 meters of the 200-West DST EU. Both have been documented as described in the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan* (DOE/RL-97-56).

Historic maps indicate that there is no evidence of historic-era settlement in or near the 200-West DST EU. Geomorphology and extensive ground disturbance further indicates a low potential for the presence of intact archaeological resources associated with all three landscape to be present subsurface

within the 200-West DST EU. Pockets of undisturbed soil may exist, it may be appropriate to conduct 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 associated with these landscapes (e.g. East Benton Historical Society, the Franklin County Historical Society, Prosser Cemetery Association, the Reach and B-Reactor Museum Association) may need to occur. Indirect effects are always possible when TCPs are known to be located in the general vicinity. 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.

E.10.5. WASTE AND CONTAMINATION INVENTORY

Table E.10-2 provides inventory estimates of the various source components associated with the 200-West DST Farm EU (CP-TF-9) that are primarily tank wastes and ancillary equipment. There are no significant legacy sources associated with the 200-West DST Farm EU. Thus the focus will be on the tank waste and ancillary equipment for the EU.

The major sources for before assumed retrieval are the 200-West DSTs. A 99% retrieval as used for the Hanford SSTs (CP-TF-1 through CP-TF-7) is also assumed for the 200-West DST Farm EUs. The tank residuals represent the largest source after assumed 99% retrieval for the contaminants with the remaining contribution from ancillary equipment as shown in Figure E.10-3 through Figure E.10-11. The current maximum groundwater threat metric (GTM) (Figure E.10-12)[149] is dominated by the Tc-99 and I-129 in the 200-West DST Farms wastes before retrieval and by residual waste after assumed 99% retrieval[150].

CONTAMINATION WITHIN PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

There are no significant legacy sources associated with the 200-West DST Farm (Table E.10-2).

Waste Tanks and Ancillary Equipment

The estimated total inventory for the 200-West DST Farm waste tanks and Ancillary Equipment is provided in Table E.10-2 for both as assumed 90% and 99% retrieval scenarios. The tank-by-tank inventories are provided in Table E.10-3 through Table E.10-6. Safety-related information (i.e., hydrogen generation rates and times to the lower flammability limit are also provided in Table E.10-3. The inventories for the various contaminant in the 200-East DST Farm tanks vary over several orders of

[149] Maximum of the GTMs for Tc-99 and I-129 only.

[150] According to the Tri-Party Agreement (Ecology, EPA, and DOE, 1998), retrieval limits for residual wastes are 360 ft^3 and 30 ft^3 for 100-Series and 200-Series tanks, respectively, corresponding to the 99% waste retrieval goal as defined in TPA Milestone M-45-00. For purposes of this Review the 99% and 90% Retrieval Scenarios reflect assumptions described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 and apply only to tank volumes and inventories. They are calculated assuming retrieval of a fully mixed tank of homogeneous composition. For tanks that have been declared "Retrieval Completed" or "Retrieved to Limit of … Technologies" (Templeton, AM 2016, page 9, partially duplicated in Table E.1-7), no further retrieval for either the 99% or 90% retrieval scenario is assumed. This includes tank 241-S-112 and all C Tank Farm tanks except 241-C-105. For tanks that are currently undergoing retrieval (tanks 241-AY-102 and 241-C-105), a retrieval amount equivalent to the 99% and 90% retrieval volumes described in DOE/ORP-2003-02, Rev. 0 and DOE/ORP 2003-06, Rev 0 are calculated.

magnitude as does the GTM. This information is further summarized in Figure E.10-3 through Figure E.10-11 before and after assumed 99% retrieval and for the maximum GTM in Figure E.10-12.

Vadose Zone Contamination

There are no vadose zone, saturated zone, and treatment amounts associated with the 200-West DST Farm EU (Table E.10-2). Thus the ratings associated with potential vadose zone threats related to the 200-West DST Farm EU are *Not Discernible* for all contaminants and all evaluation periods.

Groundwater Plumes

There are no plumes associated with 200-West DST Farm EU sources (Table E.10-2) nor are any expected in the foreseeable future.

Columbia River – Benthic, Riparian, and Free-flowing Ecology – All Evaluation Periods

The process illustrated in Chapter 6 of the Methodology Report (CRESP 2015a) as revised for 2015 groundwater monitoring results (Appendix D.1) is used to evaluate potential impacts to the Columbia River. Note that the evaluation of potential benthic and riparian impacts has a common thread up to the point when the shoreline impact (benthic) or riparian zone impact area is used to define ratings. With this in mind, a common evaluation for the ecological receptors is performed here.

Since there are no plumes associated with the 200-West DST Farm EU (Table E.10-2) nor are any expected in the foreseeable future, the potential for impacts to the Columbia River benthic, riparian, or free-flowing ecology is not credible based on current information. Thus the ratings associated with potential threats from 200-West DST Farm EU to Columbia River benthic, riparian, or free-flowing receptors are *Not Discernible* for all contaminants and all evaluation periods.

Facilities for D&D – Not Applicable

Operating Facilities

The CP-TF-9 DSTs in the EU can be considered Operating Facilities for this Review since they will be used to process the single-shell tank waste. The inventory associated with these facilities is thus that shown in Table E.10-2 for the Waste Tanks and Ancillary Equipment.

Table E.10-2. Summary Table of Infrastructure and Subsurface Contamination Inventory for the SY Tank and Waste Farms EU (CP-TF-9) [(a,b)]

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario	99% Retrieval Scenario
Infrastructure (Tanks and Ancillary Equipment)				
Tank Waste	Waste (kGal)	2398	239.8	23.98
	Sludge (kGal)	219	21.9	2.19
	Saltcake (kGal)	580	58	5.8
	Supernatant (kGal)	1599	159.9	15.99
Tank Waste (rad)	Am-241 (Ci)	8200	820	82
	C-14 (Ci)	8.6	0.86	0.086
	Co-60 (Ci)	23	2.3	0.23
	Cs-137 (Ci)	1300000	130000	13000
	Eu-152 (Ci)	28	2.8	0.28
	Eu-154 (Ci)	1200	120	12
	H-3 (Ci)	11	1.1	0.11
	I-129 (Ci)	1.4	0.14	0.014
	Ni-59 (Ci)	9.3	0.93	0.093
	Ni-63 (Ci)	900	90	9
	Pu (total) (Ci)	6700	670	67
	Sr-90 (Ci)	260000	26000	2600
	Tc-99 (Ci)	1700	170	17
	U (total) (Ci)	12	1.2	0.12
Tank Waste (non-rad)	Cr (kg)	77000	7700	770
	Hg (kg)	17	1.7	0.17
	NO3 (kg)	1000000	100000	10000
	Pb (kg)	1800	180	18
	U (total) (kg)	7600	760	76
Ancillary Equipment (rad)	C-14 (Ci)	0.14	0.14	0.14
	Cs-137 (Ci)	9200	9200	9200
	H-3 (Ci)	3.9	3.9	3.9
	I-129 (Ci)	0.0095	0.0095	0.0095
	Pu (total) (Ci)	17	17	17

Contaminated Media	Primary Contaminants	Total Amount. of Each Contaminant Before Retrieval	90% Retrieval Scenario	99% Retrieval Scenario
	Sr-90 (Ci)	780	780	780
	Tc-99 (Ci)	8.8	8.8	8.8
	U (total) (Ci)	0.016	0.016	0.016
Ancillary Equipment (non-rad)	Cr (kg)	170	170	170
	Hg (kg)	0.032	0.032	0.032
	NO3 (kg)	8900	8900	8900
	Pb (kg)	5.6	5.6	5.6
	U (total) (kg)	8.5	8.5	8.5
Vadose Zone Source (Leaks and Intentional Discharges into Cribs and Trenches)				
Vadose Zone (from Vadose Zone Sources)				
Saturated Zone (from Vadose Zone Sources)				

a. Tanks (SST and DST): Best Basis Inventory (BBI) February 2017; Ancillary Equipment (Anc Eq): Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix D; Unplanned Releases (UPRs): Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0); Ponds: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0); Cribs: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0); Trenches: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0) and Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix S; Leaks: Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix D; MUSTs: Soil Inventory Model (SIM) Rev 1 (RPP-26744, Rev 0) and Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement (DOE/EIS-0391) Appendix S.

b. All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

Table E.10-3. Current Bulk Inventory and Steady State Flammability Results (by Tank) for the SY Tank Farm (CP-TF-9)

Tank ID	Tank Type	Capacity (kGal)[a]	Sludge (kGal)[a]	Saltcake (kGal)[a]	Supernatant (kGal)[a]	HGR (ft^3/d)[b]	Days to 25% LFL Barometric[c]	Days to 25% LFL Zero Ventilation[d]
SY-101	DST	1160	0	223	893	11	30	28
SY-102	DST	1160	219	0	331	11	114	89
SY-103	DST	1160	0	357	375	18	44	40

a. Volumes from the Waste Tank Summary Report for Month Ending November 30, 2016 (Templeton, AM 2016).

b. Hydrogen generation rate (ft^3/d) (RPP-5926 Rev. 17). Note in 2001 all 24 tanks were removed from the flammable gas watch list (including T-110 in the T Tank and Waste Farms EU) (Johnson, et al. 2001, p. iii).

c. Time (in days) to 25% of the Lower Flammability Limit (LFL) under a barometric (barom) breathing scenario (RPP-5926, Rev. 17). "NA" indicates that the headspace will not reach specified flammability level.

d. Time (in days) to 25% of the LFL under a zero ventilation scenario (RPP-5926, Rev. 17).

Table E.10-4. Current Primary Contaminant Inventory (by Tank) for the SY Tank Farm (CP-TF-9) [a]

Tank ID	Baseline Status[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)
SY-101	2001	620	2.5	NR[c]	3.5	240000	5.5	200	8.2
SY-102	2001	6300	2.1	NR	1.9	100000	17	360	1
SY-103	2001	1300	3.9	NR	18	970000	5.5	660	1.5

a. From Best Basis Inventory (BBI) Summary (February 2017). All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

b. This is the "Baseline Status" date as reported in the BBI (February 2017) as "Baselined 2001." It should not be necessarily be considered the decay date for isotope inventories.

c. NR = Not reported for this EU

Table E.10-5. Current Primary Contaminant Inventory[a] and Groundwater Threat Metric (by Tank) for the SY Tank Farm (CP-TF-9)

Tank ID	I-129 (Ci)	Ni-59 (Ci)	Ni-63 (Ci)	Pu (total) (Ci)[b]	Sr-90 (Ci)	Tc-99 (Ci)	U (total) (Ci)[c]	GTM (Mm3)[d]
SY-101	0.24	4.4	100	120	55000	330	1.1	370
SY-102	0.11	2	540	6300	140000	320	9	360
SY-103	1	2.9	270	290	64000	1000	2.1	1100

a. From Best Basis Inventory (BBI) Summary (February 2017). All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

b. Sum of plutonium isotopes 238, 239, 240, 241, and 242

c. Sum of uranium isotopes 232, 233, 234, 235, 236, and 238

d. The Groundwater Threat Metric (GTM) shown for tanks is equal to the maximum of the GTM for Tc-99 and I-129.

Table E.10-6. Current Primary Contaminant Inventory (by Tank) for the SY Tank Farm (CP-TF-9) [(a)]

Tank ID	CCl4 (kg)	CN (kg)	Cr (kg)	Cr-VI (kg)	Hg (kg)	NO3 (kg)	Pb (kg)	TBP (kg)	TCE (kg)	U (total) (kg)
SY-101	NR[(b)]	NR	23000	NR	0.48	300000	440	NR	NR	570
SY-102	NR	NR	40000	NR	14	180000	700	NR	NR	4000
SY-103	NR	NR	15000	NR	2.6	500000	520	NR	NR	1400

a. From Best Basis Inventory (BBI) Summary (February 2017). All primary contaminant inventories are reported to 2 significant figures. The source document should be consulted for greater precision data.

b. NR = Not reported for this EU

Table E.10-7. Summary of the Evaluation of Threats to Groundwater as a Protected Resource from Remaining Vadose Zone (VZ) Contamination associated with the SY Tank Farm (CP-TF-9). Despite no significant vadose zone sources, this information is provided for consistency with the other TF EUs.

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	0.23	0	1.84	---	---	---	---	---	*ND*
I-129	A	1 pCi/L	0.23	0.2	1.84	---	---	---	---	---	*ND*
Sr-90	B	8 pCi/L	0.23	22	1.84	---	---	---	---	---	*ND*
Tc-99	A	900 pCi/L	0.23	0	1.84	---	---	---	---	---	*ND*
CCl_4	A	5 µg/L	0.23	0	1.84	---	---	---	---	---	*ND*
Cr	B	100 µg/L	0.23	0	1.84	---	---	---	---	---	*ND*
Cr-VI	A	48 µg/L[b]	0.23	0	1.84	---	---	---	---	---	*ND*
TCE	B	5 µg/L	0.23	2	1.84	---	---	---	---	---	*ND*
U(tot)	B	30 µg/L	0.23	0.8	1.84	---	---	---	---	---	*ND*

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

b. "Model Toxics Control Act−Cleanup" (WAC 173-340) Method B groundwater cleanup level for hexavalent chromium. The other WQS values are drinking water standards.

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 2015a).

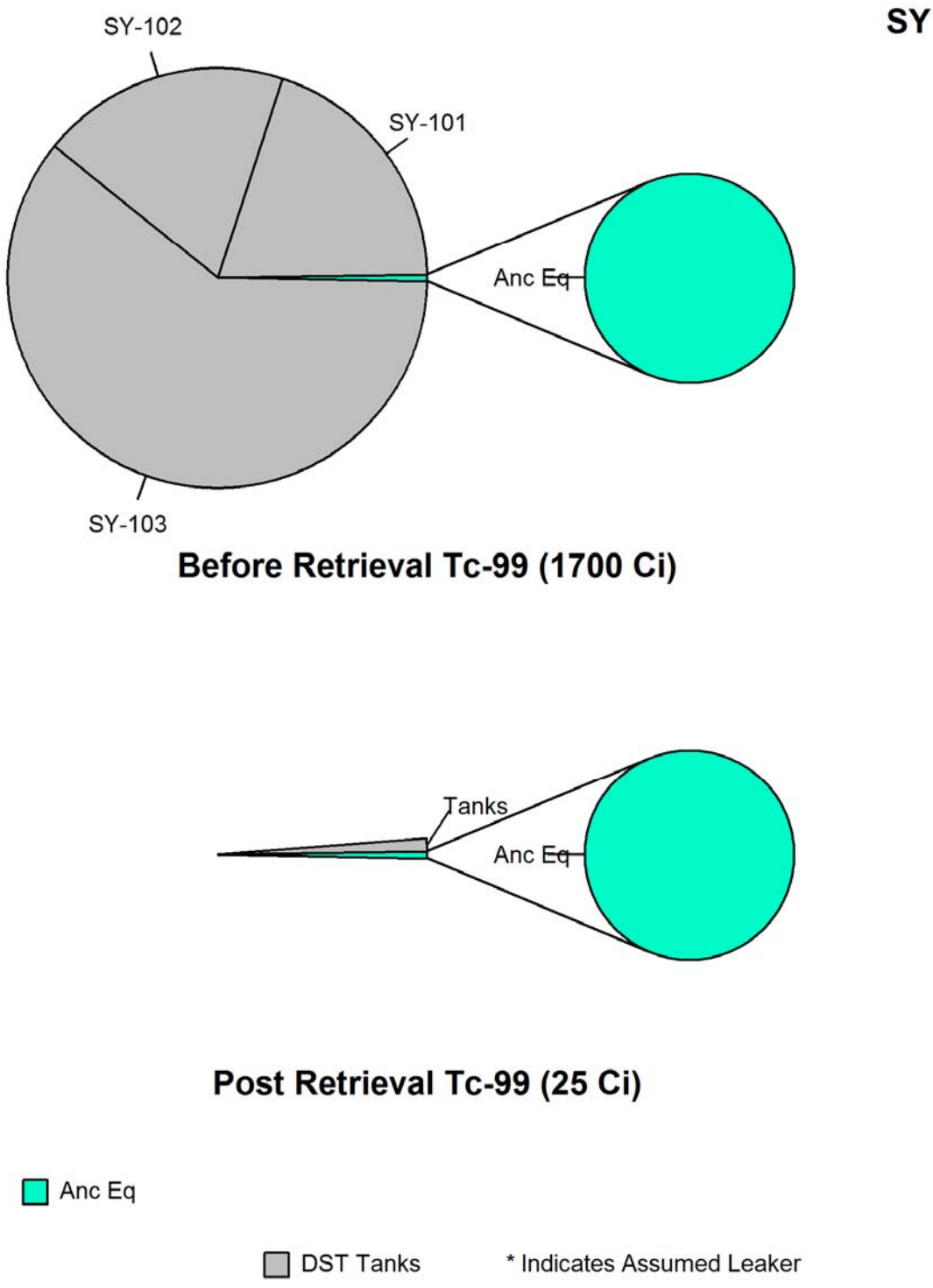


Figure E.10-3. SY Tank and Waste Farms Evaluation Unit Inventory Estimates for Tc-99 Before and After 99% Retrieval

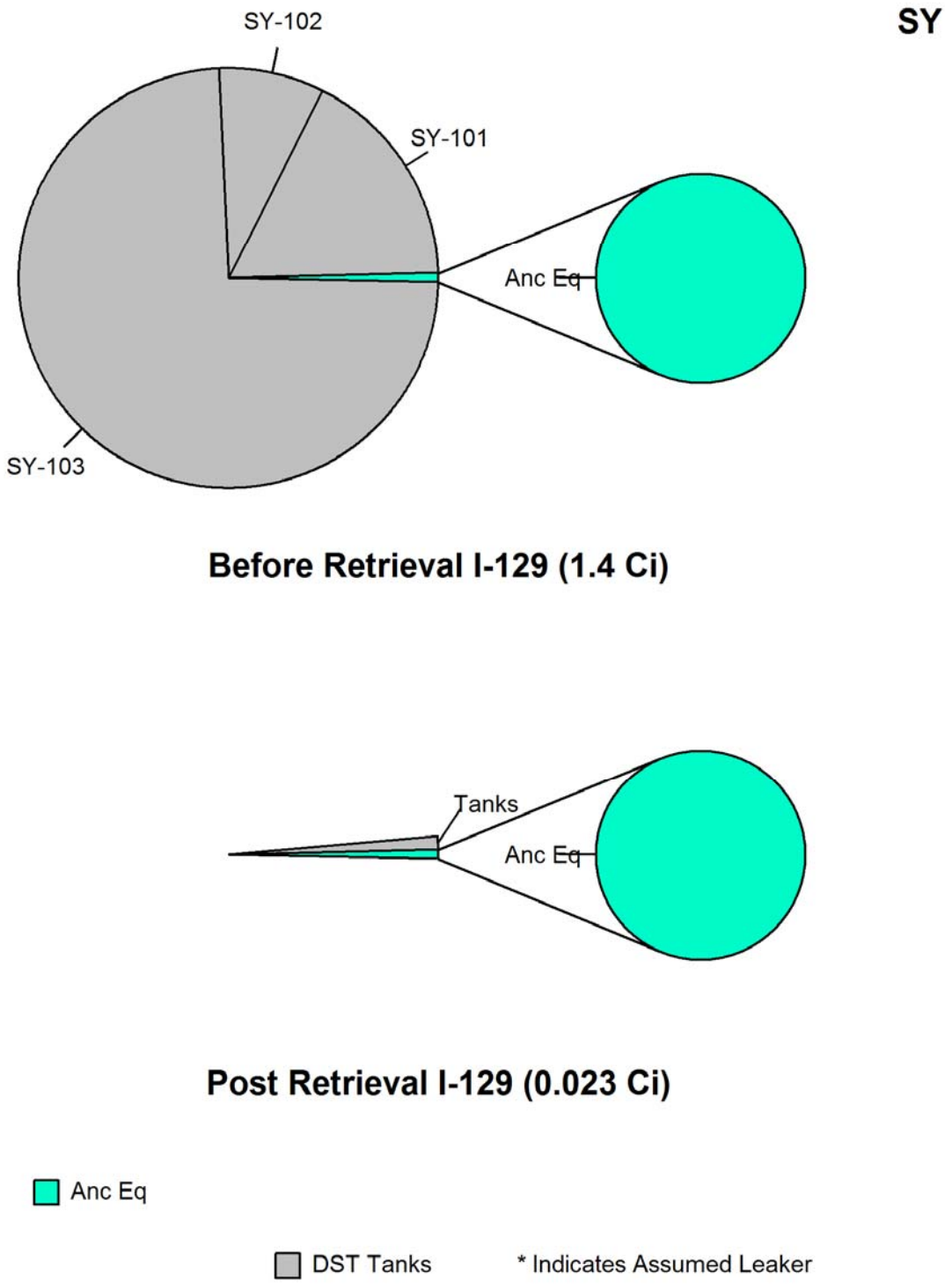


Figure E.10-4. SY Tank and Waste Farms Evaluation Unit Inventory Estimates for I-129 Before and After 99% Retrieval

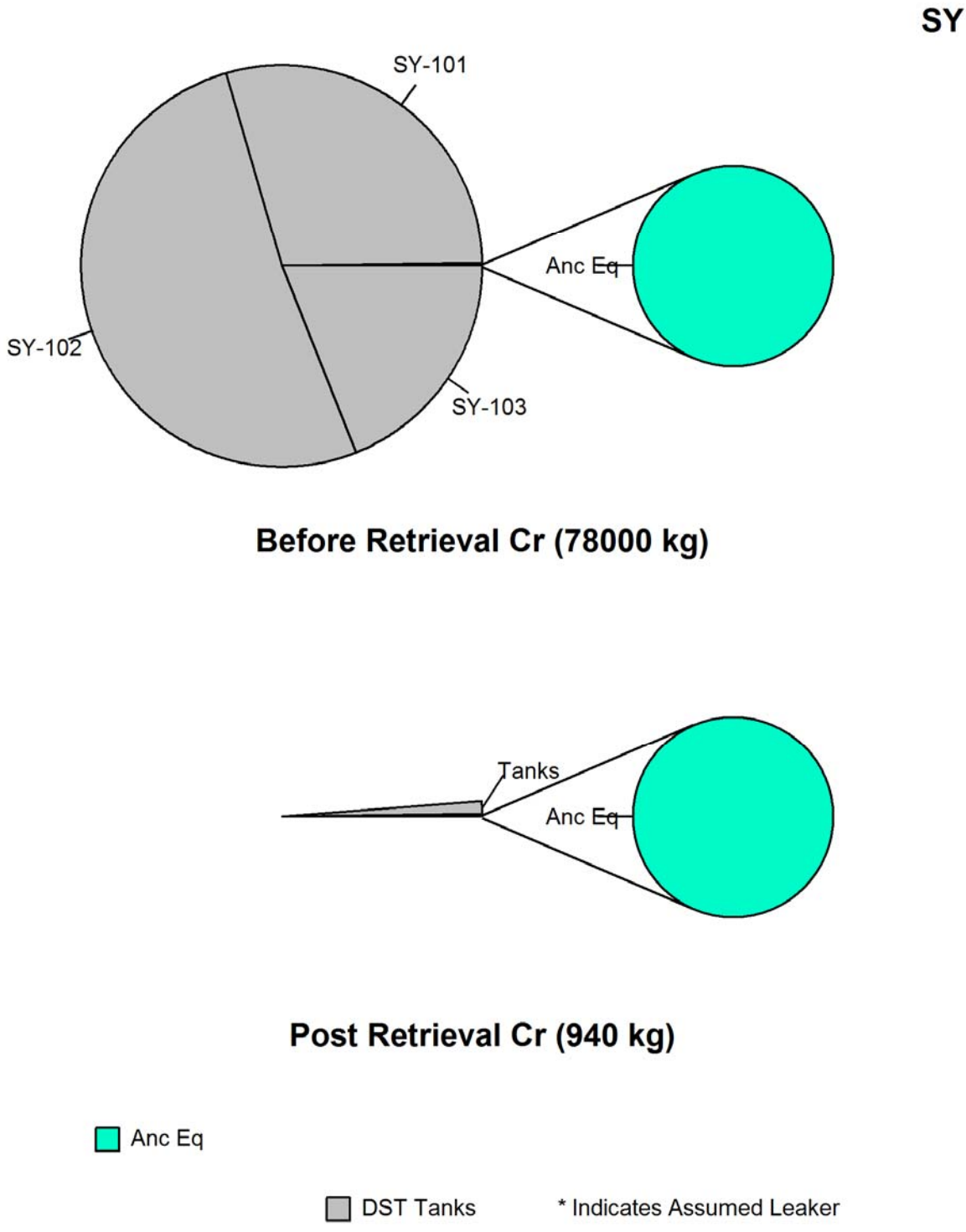


Figure E.10-5. SY Tank and Waste Farms Evaluation Unit Inventory Estimates for Chromium Before and After 99% Retrieval

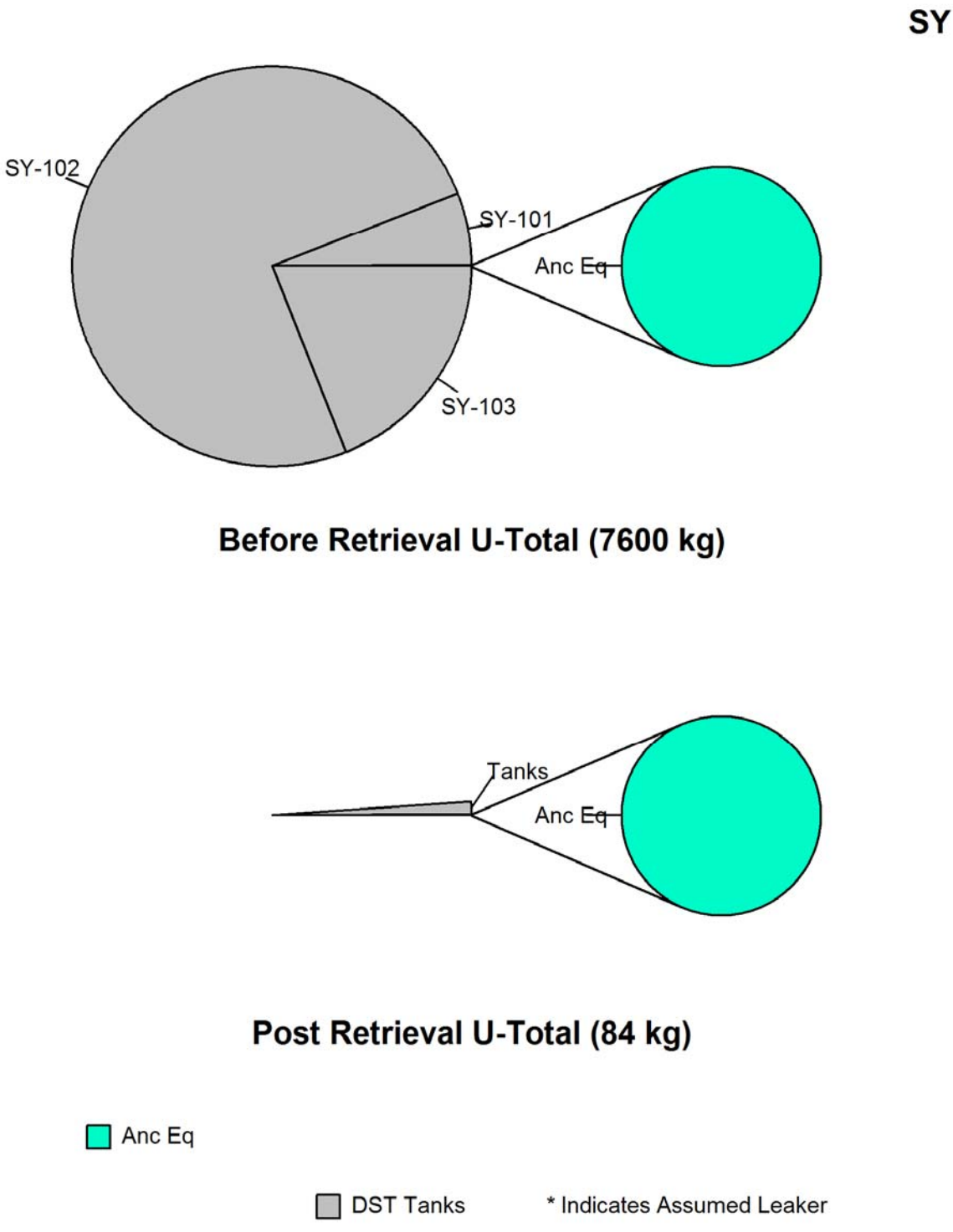


Figure E.10-6. SY Tank and Waste Farms Evaluation Unit Inventory Estimates for U(tot) Before and After 99% Retrieval

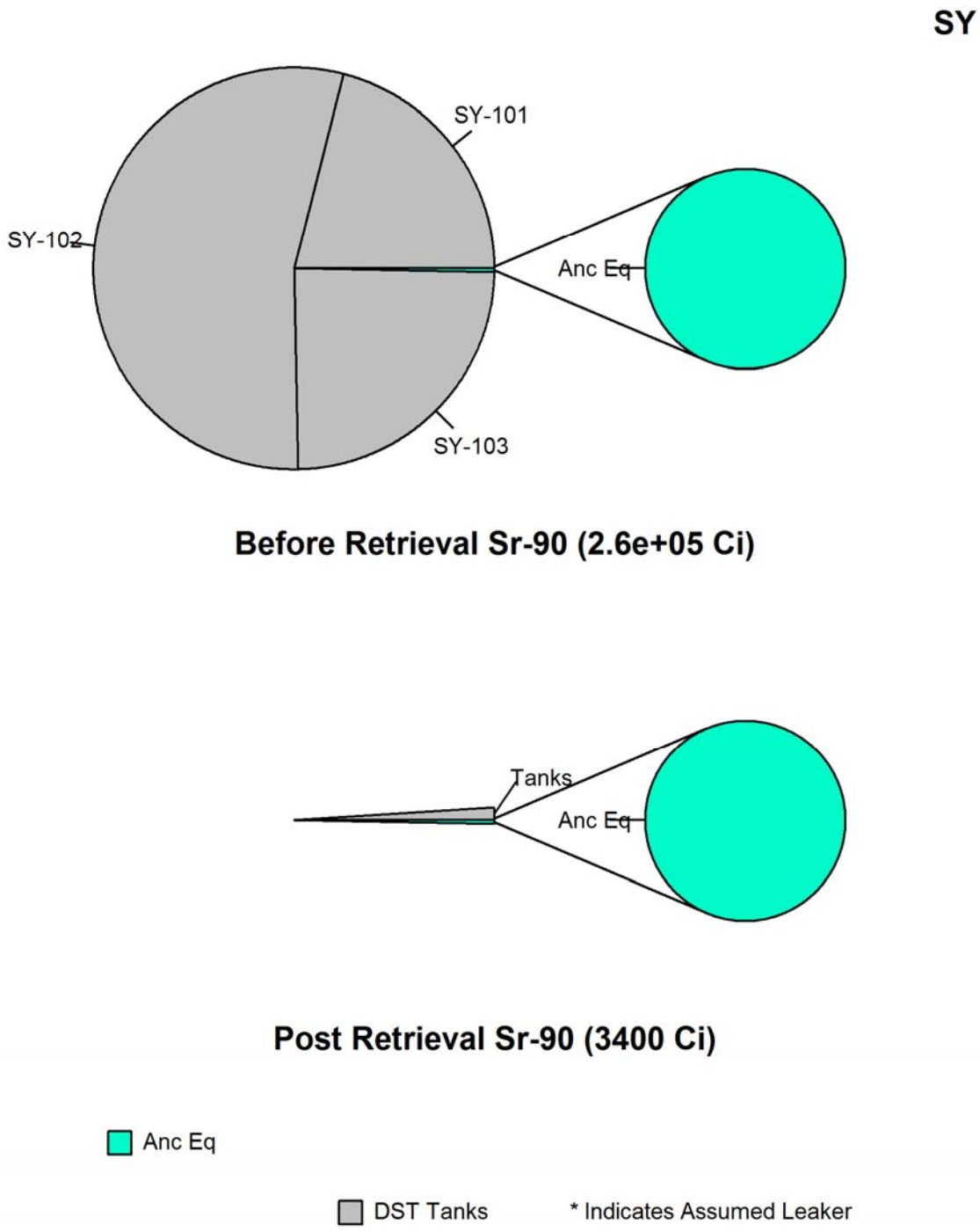


Figure E.10-7. SY Tank and Waste Farms Evaluation Unit Inventory Estimates for Sr-90 Before and After 99% Retrieval

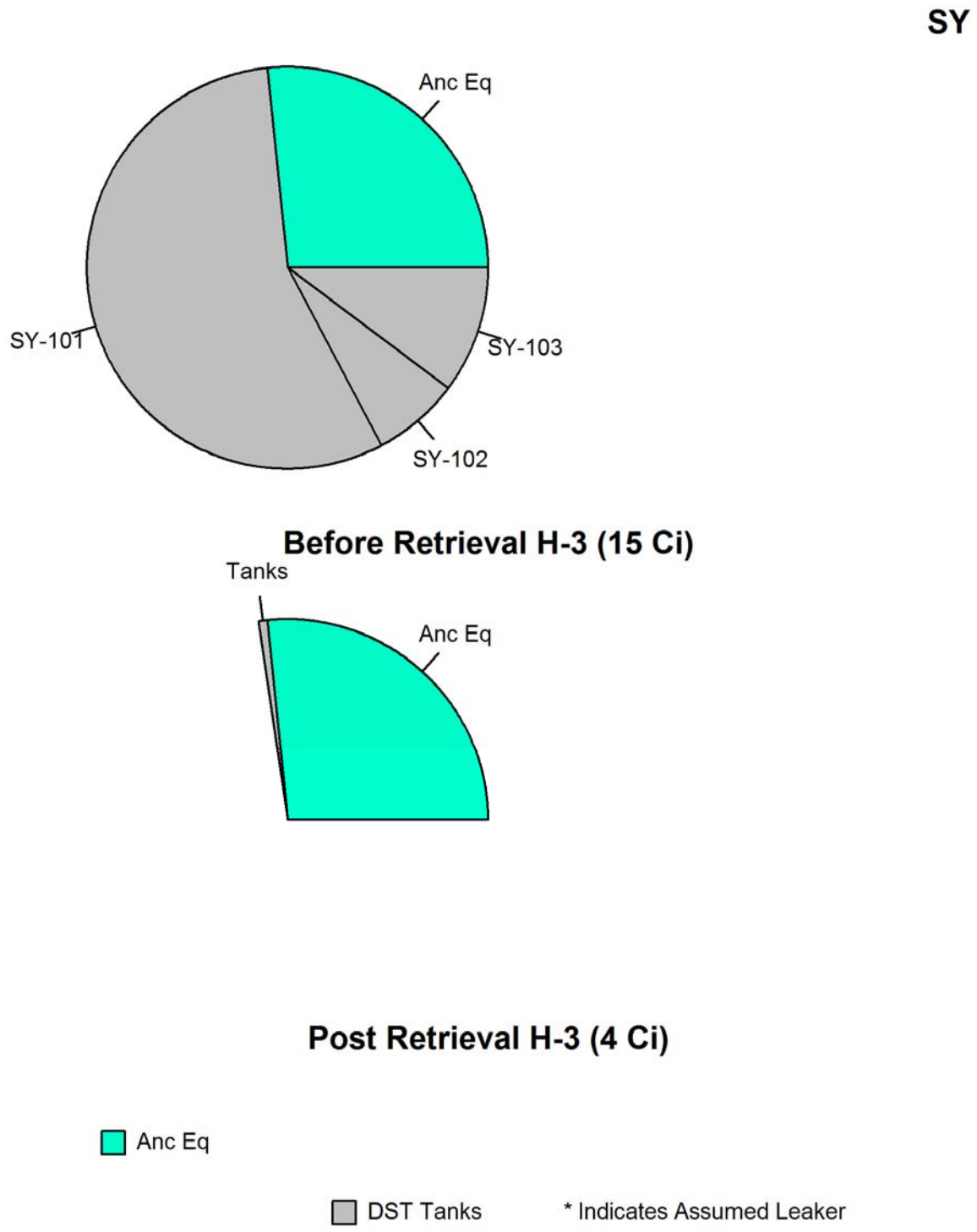


Figure E.10-8. SY Tank and Waste Farms Evaluation Unit Inventory Estimates for Tritium (H-3) Before and After 99% Retrieval

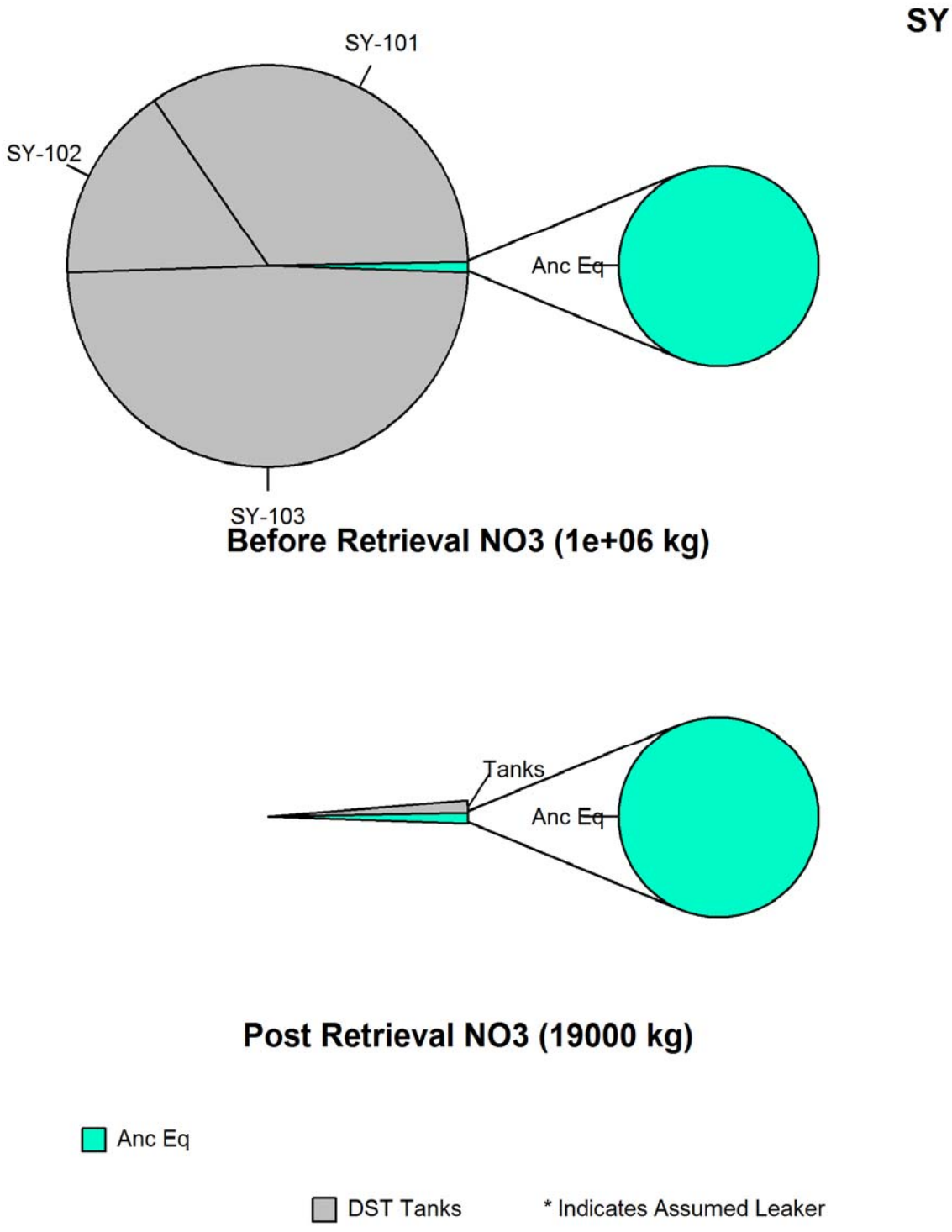


Figure E.10-9. SY Tank and Waste Farms Evaluation Unit Inventory Estimates for Nitrate (NO3) Before and After 99% Retrieval

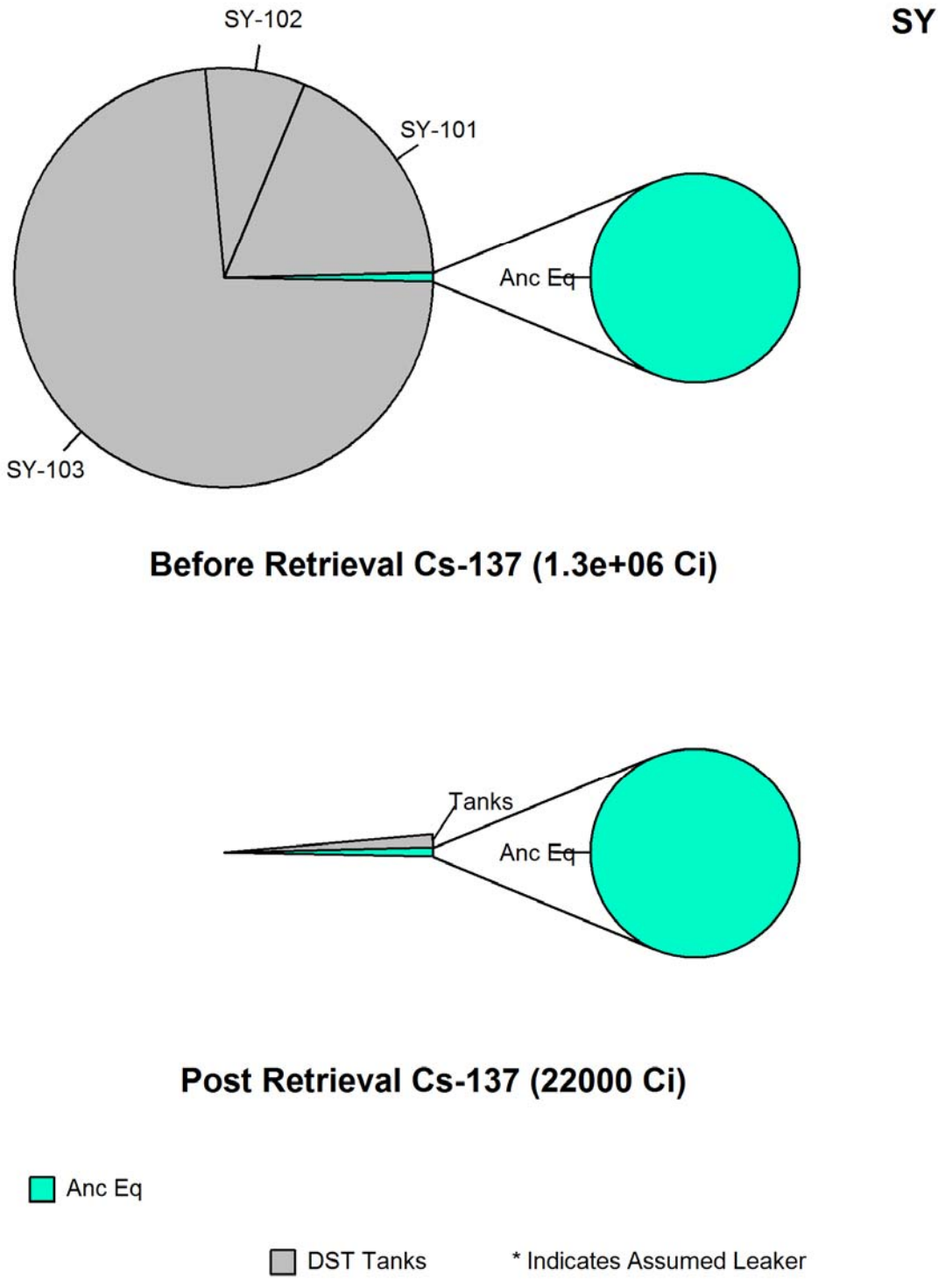


Figure E.10-10. SY Tank and Waste Farms Evaluation Unit Inventory Estimates for Cs-137 Before and After 99% Retrieval

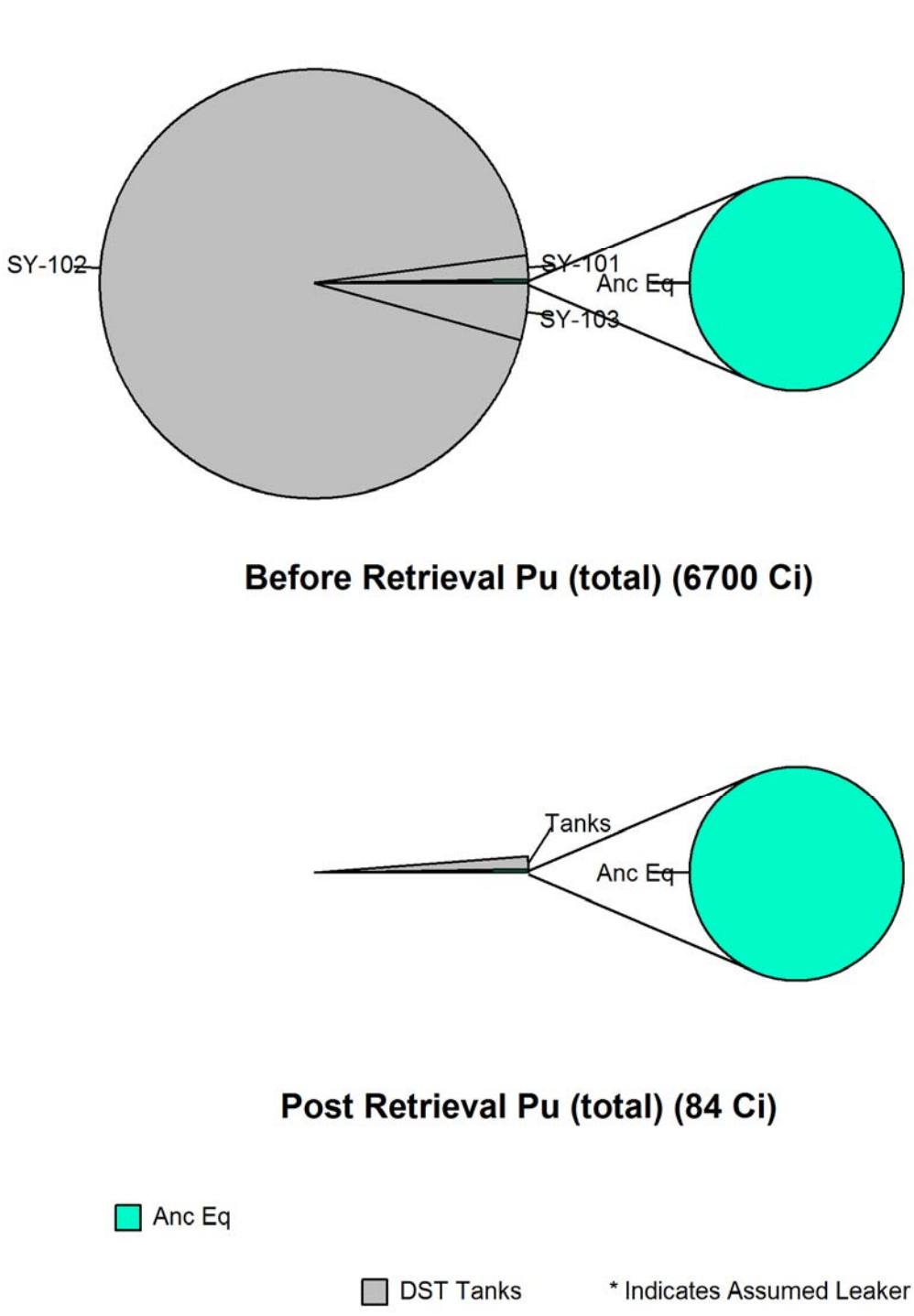


Figure E.10-11. SY Tank and Waste Farms Evaluation Unit Inventory Estimates for Plutonium (total) Before and After 99% Retrieval

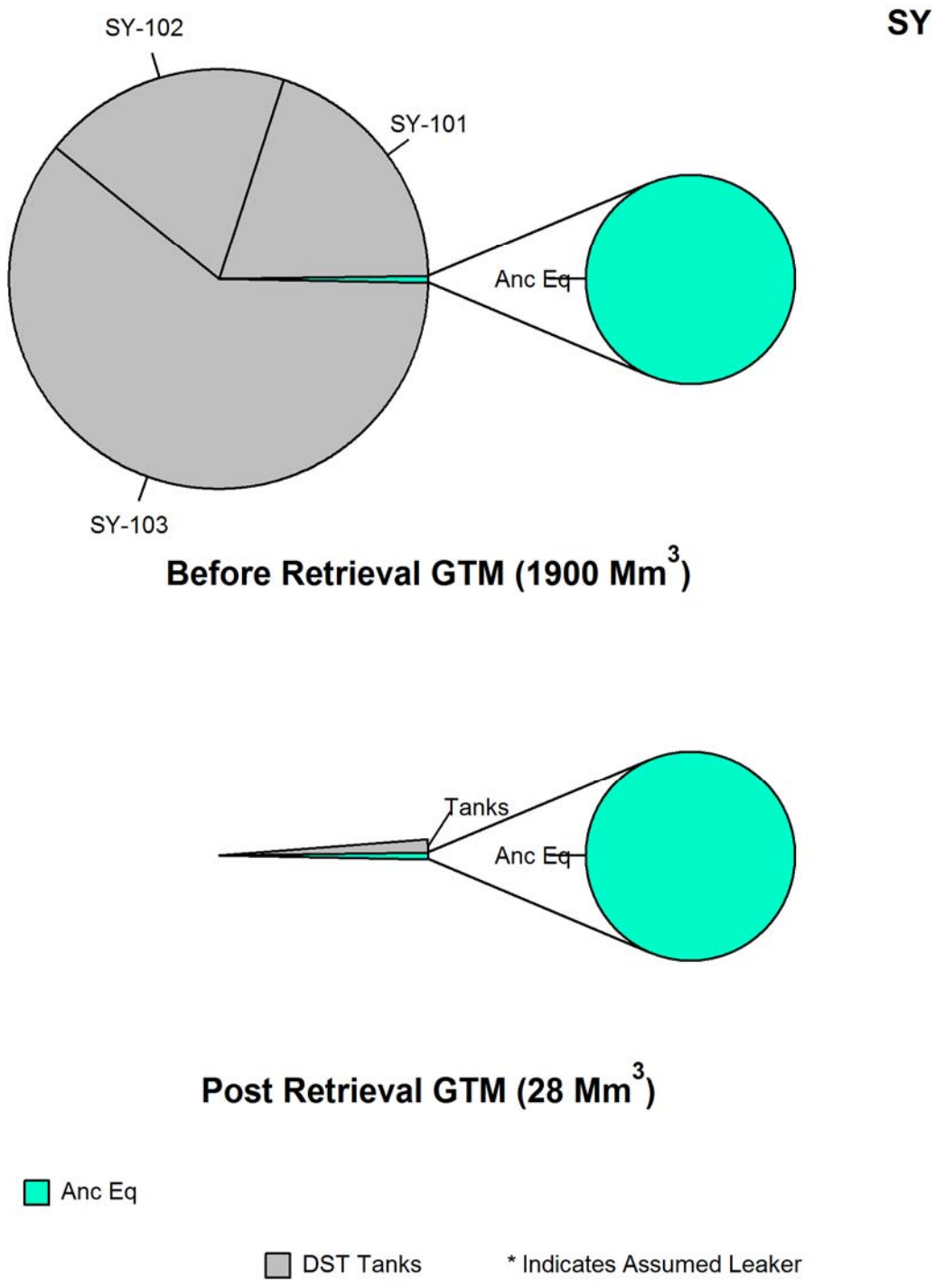


Figure E.10-12. SY Tank and Waste Farms Evaluation Unit Maximum Groundwater Threat Metric (GTM) of I-129 and Tc-99 Estimates Before and After 99% Retrieval

E.10.6. POTENTIAL RISK/IMPACT PATHWAYS AND EVENTS

CURRENT CONCEPTUAL MODEL

A common safety analysis was performed for all the single- and double-shell tanks including pathways and barriers (safety scenarios that dominate risk, safety systems and controls, barriers to release, failure mechanisms, pathways and receptors, time frames for exposure). See Section E.1.6 in Appendix E.1 for details.

POPULATIONS AND RESOURCES CURRENTLY AT RISK OR POTENTIALLY IMPACTED

Facility Worker, Co-located Person, and Public

A common analysis was performed for the Facility Worker, Co-located Person, and Public. See Section E.1.6 (Appendix E.1) for details.

Groundwater

There are no plumes associated with the 200-West DST Farm EU (Table E.10-2 and Table E.10-7) nor are any expected in the foreseeable future. Thus the ratings for all primary contaminants and all time periods is *Not Discernible* (*ND*).

Columbia River

Since there are no plumes associated with the 200-West DST Farm EU (Table E.10-2) nor are any expected in the foreseeable future, the potential for impacts to the Columbia River benthic, riparian, or free-flowing ecology is not credible based on current information. Thus the ratings associated with potential threats from 200-West DST Farm EU to Columbia River benthic, riparian, or free-flowing receptors are defined to be *Not Discernible* (*ND*) for all contaminants and all evaluation periods.

Ecological Resources

- The EU for the 200-West DSTs consists entirely of level 0 habitat resources.
- No wildlife or signs were observed during the October survey of the EU.
- Remediation actions undertaken within the 200-West DSTs EU boundary would result in no net change in biological resources within a 2.1 km radius.
- Because the area is an industrial site, and is contiguous with adjacent tank farms and other industrial areas—no significant change in habitat connectivity would be expected if habitat resources within the EU are lost.

Cultural Resources

- There are no cultural resources known to be located within the 200-West DST.

Archaeological sites and TCPs located within 500 meters of the EU

- The 242S Evaporator Facility a contributing property within the Manhattan Project and Cold War Era Historic District, with no documentation required is located adjacent to the 200-West DST Evaluation Unit.
- The Hanford Site Plant Railroad, a contributing property within the Manhattan Project and Cold War Era Historic District, with documentation required is located in the vicinity of the 200-West DST Evaluation Unit.

Closest Recorded TCP

- There are two recorded TCPs associated with the Native American Precontact and Ethnographic Landscape that are visible from 200-West DSTs EU.

CLEANUP APPROACHES AND END-STATE CONCEPTUAL MODEL

Selected or Potential Cleanup Approaches

A common analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

Contaminant Inventory Remaining at the Conclusion of Planned Active Cleanup Period

See Section E.10.5 including Table E.10-2 and Figure E.10-3 through Figure E.10-11 for the inventory information after planned 99% retrieval. Furthermore, a more general analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

Risks and Potential Impacts Associated with Cleanup

A common analysis was performed for all the single- and double-shell tanks for workers and the Public. See Section E.1.6 (Appendix E.1) for details.

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

Facility Worker, Co-located Person, and Public

A common analysis was performed for the Facility Worker, Co-located Person, and Public. See Section E.1.6 (Appendix E.1) for details.

Groundwater

There are no current or anticipated plumes or impacts to groundwater from the 200-West DST Farms.

It is considered unlikely that additional groundwater resources would be impacted as a result of assumed final closure activities (that are not covered in the Ecological or Cultural Resources results).

Columbia River

There are no current or anticipated plumes or impacts to the Columbia River from the 200-West DST Farms.

It is considered unlikely that additional benthic or riparian resources would be impacted as a result of assumed final closure activities (that are not covered in the Ecological or Cultural Resources results).

Ecological Resources

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

Cultural Resources

See Section E.1.6 (Appendix E.1) for details.

ADDITIONAL RISKS AND POTENTIAL IMPACTS IF CLEANUP IS DELAYED

A common analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

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

A common analysis was performed for all the single- and double-shell tanks. See Section E.1.6 (Appendix E.1) for details.

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

Table E.10-8. Summary of Populations and Resources at Risk or Potentially Impacted after Cleanup

Population or Resource		Impact Rating	Comments
Human	Facility Worker	Low	Workers will be low risk from exposure to direct radiation and waste contaminants after waste retrieval, grouting, and capping.
	Co-located Person	Low	These persons will be at low risk from exposure to direct radiation and waste contaminants after waste retrieval, grouting, and capping.
	Public	Not Discernible (ND)	The Tank Farms will be in secure and controlled areas that prevent intentional and inadvertent intruders. No complete groundwater pathway and no impact from air pathway.
Environmental	Groundwater (A&B) from vadose zone[a]	*ND* (All PCs) **Overall**: *ND*	No current plumes or expected significant transport from vadose zone to groundwater. No significant legacy source sites in the EU.
	Columbia River from vadose zone[a]	Benthic: *ND* Riparian: *ND* Free-flowing: *ND* **Overall**: *ND*	No current plumes or expected significant transport from vadose zone to groundwater and thus no credible impact to the Columbia River ecology over the foreseeable future.
	Ecological Resources[b]	ND to Low	Likely monitoring of caps, little disturbance, but potential for disruption due to monitoring, and some contamination of receptors. Re-vegetation could result in higher quality habitat on EU.
Social	Cultural Resources[b]	**Native American:** Direct: Unknown Indirect: Known **Historic Pre-Hanford:** Direct: Unknown	Permanent indirect effects to viewshed are possible from capping. Permanent effects may be possible due to presence of contamination if capping occurs.

Population or Resource		Impact Rating	Comments
		Indirect: Unknown **Manhattan/Cold War**: Direct: None Indirect: None	No other expected cultural resources impacts.

a. Groundwater threat for Group A and B contaminants remaining in the vadose zone or to the Columbia River for all primary contaminants. Threats from existing plumes associated with the 200 West DST Tank and Waste Farms EU are described in Section E.10.5 and Appendix D.6 (CP-GW-2) for the 200-UP and 200-ZP Groundwater Interest Areas. However, there is no vadose zone contamination associated with this EU (and none expected in the future) and thus there is no risk and a *Not Discernible* (*ND*) rating.

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

There are no current plumes or expected significant transport from vadose zone to groundwater and thus no credible impact to groundwater or the Columbia River ecology over the foreseeable future.

E.10.7. SUPPLEMENTAL INFORMATION AND CONSIDERATIONS

A common analysis was performed for all the single- and double-shell tanks. See Section E.1.7 (Appendix E.1) for details.

E.10.8. ATTACHMENT – SY TANK AND WASTE FARMS EVALUATION UNIT WIDS REVIEW

Hanford Site-Wide Risk Review

Evaluation Unit:	200-West DSTs
ID:	CP-TF-9
Group:	Tank Farm
Operable Unit Cross-Walk:	WMA S/SX
Related EU:	CP-LS-7 CP-TF-2
Sites & Facilities:	SY tank farm, ancillary structures, associated liquid waste sites, and soils contamination
Key Data Sources Docs:	NA

Figure 1. Site Map with Evaluation Unit Boundaries and Tank Locations

Attached:

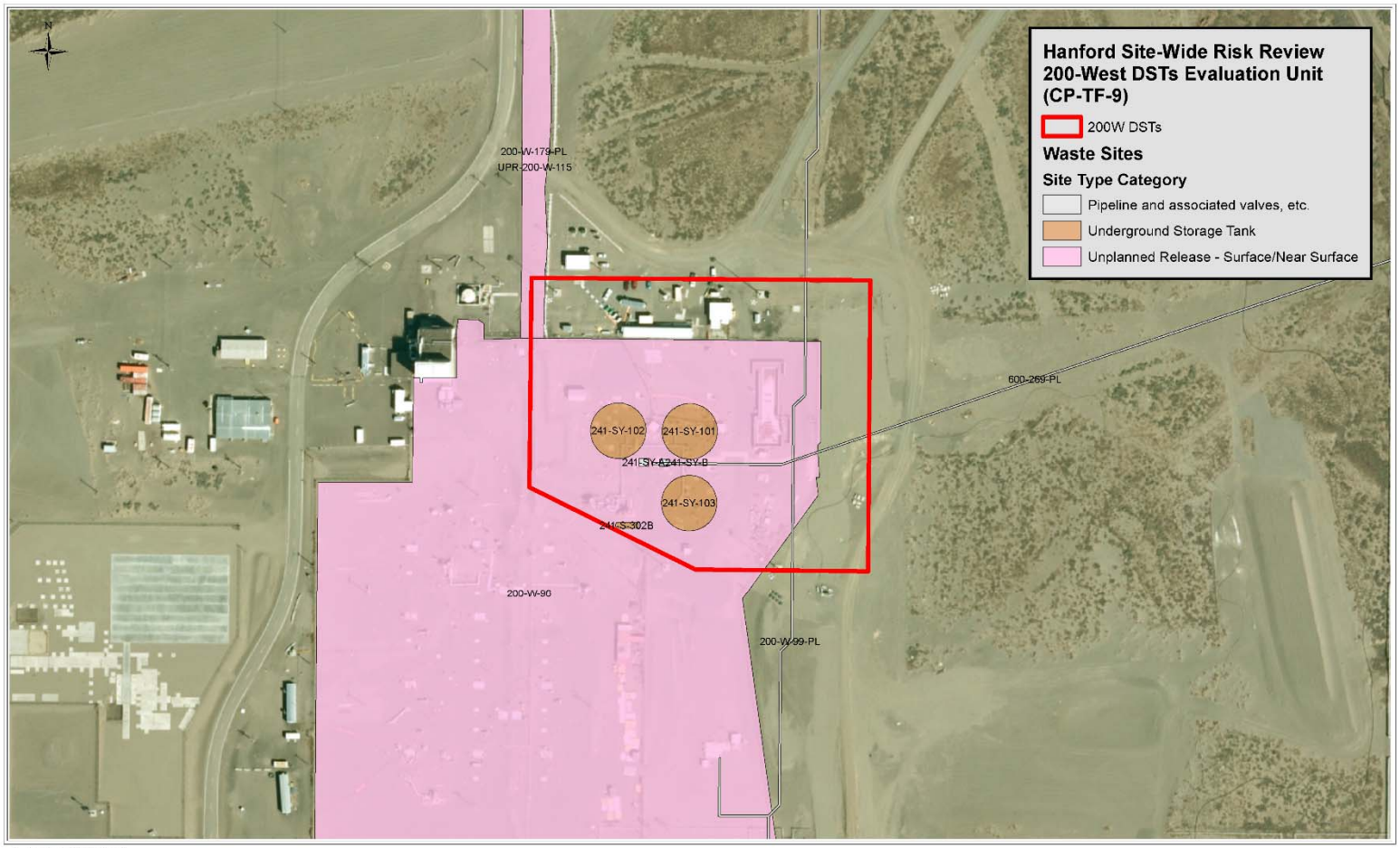
- Waste Site and Facility List
- Site Map with Evaluation Unit Boundaries and Associated Waste Sites

Hanford Site-Wide Risk Review
CP-TF-9 (200-West DSTs)
Waste Site and Facility List

Site Code	Name, Aliases, Description	Site Status	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation
200-W-179-PL	200-W-179-PL; Lines SL100, SL101, SN216/281 and DR327; Pipelines Between 241-S-152 Diversion Box and 241-U Tank Farm	Inactive	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
200-W-96	200-W-96; Contaminated Soil at 241-S/SX/SY Tank Farm	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	WMA S/SX	
200-W-99-PL	200-W-99-PL; Encased Pipeline from 241-U-151 to 241-S-151 Diversion Boxes; Lines V455 and V456	Inactive	Encased Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD	
241-S-302B	241-S-302B; 241-S-302-B Catch Tank; IMUST; Inactive Miscellaneous Underground Storage Tank	Inactive	Catch Tank	Underground Storage Tank	Not Applic	
241-SY-101	241-SY-101; 241-SY-TK-101	Active	Double-Shell Tank	Underground Storage Tank	Not Applic	
241-SY-102	241-SY-102; 241-SY-TK-102	Active	Double-Shell Tank	Underground Storage Tank	Not Applic	
241-SY-103	241-SY-103; 241-SY-TK-103	Active	Double-Shell Tank	Underground Storage Tank	Not Applic	
241-SY-A	241-SY-A; 241-SY-A Diversion Box; 241-SY-A Valve Pit	Active	Valve Pit	Pipeline and associated valves, etc.	Not Applic	
241-SY-B	241-SY-B; 241-SY-B Diversion Box; 241-SY-B Valve Pit	Active	Valve Pit	Pipeline and associated valves, etc.	Not Applic	
600-269-PL	600-269-PL; Cross Site Transfer Line Replacement; Lines SNL-3150 and 3160; New Cross-Site Transfer Line	Active	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	Not Applic	
UPR-200-W-115	UPR-200-W-115; Ground Contamination Above Transfer Line Along Cooper Street; UN-216-W-25	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	200-IS-1	
241SY271	INSTRUMENT AND ELECTICAL CONTROL HOUSE	ACTIVE	BUILDING	Infrastructure Building		X
241SY272	ELECTRICAL BUILDING	ACTIVE	BUILDING	Infrastructure Building		X
241SY274	GAS MONITORING SHELTER (GMS-1)	ACTIVE	BUILDING	Infrastructure Building		X
241SY275	GAS MONITORING SHELTER (GMS-2)	ACTIVE	BUILDING	Infrastructure Building		X
2724SY	RAD MONITORING AND PROTECTIVE CLOTHING BLDG	INACTIVE	BUILDING	Infrastructure Building		X
MO2173	MOBILE OFFICE NORTH OF SY FARM	ACTIVE	BUILDING	Infrastructure Building		X
MO296	CHANGE TRAILER BY 241SY NEAR EVAPORATOR	INACTIVE	BUILDING	Infrastructure Building		X
MO450	STORAGE MOBILE NORTH OF 241SY TANK FARM	ACTIVE	BUILDING	Infrastructure Building		X
MO655	POWER OPERATION CENTER FOR SY TANK FARM	ACTIVE	BUILDING	Infrastructure Building		X

Note that only those waste sites with a WIDS (Waste Information Data System) Classification of "Accepted" are shown, along with non-duplicate facilities, identified via the Hanford Geographic Information System (HGIS).

DRAFT



1 inch = 200 feet

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