APPENDIX H.3

CWC (CP-OP-1, CENTRAL PLATEAU)
EVALUATION UNIT SUMMARY TEMPLATE

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PART I. EXECUTIVE SUMMARY

EU LOCATION

Hanford 200 West Area

RELATED EUS

WRAP, Low Level Burial Grounds, T Plant

PRIMARY CONTAMINANTS, CONTAMINATED MEDIA AND WASTES:

In the Master Documented Safety Analysis for Solid Waste Operations Complex (SWOC) (HNF-14741), the bounding drum and array analysis assumptions of the Hanford Safety Analysis and Risk Assessment Handbook (SARAH, HNF-8739) are used. In that bounding drum, the radionuclides are assumed to be Pu-238, Pu-239 (more than 80% by activity), Pu-240, Pu-241 and Pu-242, along with the Pu decay product Am-241. The waste may also contain debris from D&D and operational wastes, notably from PNNL and Tank Farms, WRAP, Low Level Burial Grounds, and T Plant and may also contain fission products (Cs-137, Sr-90). However, majority of presently stored waste is classified as remote handled (RH) or contact handled (CH) TRU and TRUM. The waste also contains RCRA classified dangerous waste as well as pyrophoric materials including sodium.[1]

A list of all constituents in a sample container is included in Attachment 2. For the first sample container, the highest weight percent constituents include: inert material (wood, plastic, paper, etc.) and non-specified absorbents (~90% total weight); non-specified petroleum hydrocarbons and mineral oil and petroleum distillates (~1.5% total weight). All other constituents are <1%. For a second sample container, the highest weight percent constituents include: glass (40%), mixed esthers and phthalate (14.8%), aluminum (11%) and plastic (~5%). Constituents less than 10% include acetic acid, barium dinonylnaphthalenesulfonate, hydrotreated kerosene and naphtha, isopropyl alcohol and oil, among others. A third sample container includes inert material (paper, wood, plastic etc.) (~57%), conwed pads (~16%), carbon tetrachloride (~14.8%), oil (~4%) and tributyl phosphate (~2.3%).[2]

Two estimates on the inventory of radionuclides at the CWC are provided as follows:

The total dose equivalent using the bounding drum scenario from the Documented Safety Analysis as though each waste container (8,800 total containers) at the CWC contained the bounding estimate (82.5 DE-Ci) yields a total inventory of 726,000 DE-Ci.[3] The design basis estimate for the Design Basis Earthquake MAR at CWC estimates a total inventory of 195000 DE-Ci[4].

The SWOC Solid Waste Inventory Tracking System provides the following CWC Inventory Snapshot: Total Ci: 52,889 Pu. This is based on the estimated inventory of each individual container.[5]

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[1] Nester, (2014).
[2] SWITS (2014).
[3] HNF-14741-10, (2013).
[4] HNF 14741-10. (2013). Table 3-16.
[5] Snapshot inventory from SWITS posted on Sharepoint.

Table H.3-1. CWC Inventory Snapshot.

Contaminated Media, Nuclear Material	Primary Hazardous Materials Contributing to Risk	Amt. in Standard LLW or TRU Waste Packages[1]	Retrieved Large Boxes in Outdoor Storage	Total Containers	Total Volume	Est. amt. of each primary contaminant
Within facility						
Major Mission materials	Containerized waste being stored prior to final treatment.					
Waste Stored		~8,600	~175	~8,800	10,788 m3[6]	
Facility contamination (piping, gloveboxes, etc.)	Minor leaks and rainwater intrusion do occur. Regular RCRA inspection and radiological monitoring to identify problems, which are remediated.					
Facility Vicinity						
Known plumes	Facility is built over/adjacent two a known CCl_4 plume from the Plutonium Finishing Plant (PFP) that is under remediation via pump-and-treat with some wells within the CWC perimeter.					
Waste stored outside facility	There are several outside storage pads. The waste on these pads are managed and monitored similar to waste stored inside of the buildings but the pads do not have double containment.					
Subsurface infrastructure (i.e., piping, etc.)	Sumps in some storage buildings; electricity and fire suppression water lines in most buildings,					

BRIEF NARRATIVE DESCRIPTION:

The CWC provides storage, inspection (as required), limited processing, and staging for waste containers that are awaiting waste processing operations or disposal at other waste management facilities. The CWC receives waste from both onsite and offsite generators. Four types of waste are processed or stored at the CWC: low-level radioactive waste (LLW); mixed, low-level radioactive waste (MLLW), transuranic waste (TRU); and TRU mixed waste (TRUM). The CWC can receive, as necessary, unvented containers from retrieval operations for staging prior to venting (for example, at T-Plant).

[6] Total from a recent output of SWITS (Solid Waste Information Tracking System).

Personnel receive and inspect waste packages at the Waste Receiving and Staging Area. In accordance with all applicable procedures, transport offloading operations are performed using handtrucks, forklifts, or cranes operated by qualified personnel. Packages are transferred from the offloading area to the appropriate CWC storage building or other storage area. Alternatively, waste packages may be received, inspected, and unloaded at the specific CWC building or storage area where the waste would be stored. Typical stored waste packages include 208-liter (55-gallon) drums; 322-liter (85-gallon) overpacks; and fiberglass-reinforced plywood, plywood, or metal boxes. Atypical packages include, but are not limited to, radioisotopic thermoelectric generators, vault tank filter assemblies, blanked-off gloveboxes, overpacks, and pipe overpacks in 208-liter (55-gallon) drums.[7]

The CWC main structures include the 2402 series (excluding 2402-W and 2402-WC), 2403 series, and 2404 series buildings. Other CWC facilities include the Low Flash Point Storage Modules (FS-1 to FS-3, FS-5 to FS-7, FS-9 to FS-12, and FS-14 to FS-27), Alkali Metal Waste Modules (AMW-1 to AMW-4) the Waste Receiving and Staging Area, the Mixed Waste Storage Pad, and the 2420-W Cask Storage Pad.

Permitted and potential activities at the CWC include performing headspace gas sampling (HSGS) on containers; NDEs and NDAs using portable units to characterize container contents; intrusive sampling operations to characterize or verify contents; minimal waste treatment (encapsulating, absorbing, stabilizing, neutralizing, and venting); and packaging and repackaging (adding shielding inside containers, filling voids, removing noncompliant items, and decontaminating shipping container interiors).[8] Treatment may consist of absorption of free liquids, absorption to accomplish deactivation, neutralization of corrosive materials. Further, CWC has contracted with off-site radioactive waste treatment vendors that provide additional capacity and capabilities. The CWC Operating Unit Group provides storage for dangerous and/or mixed waste from Hanford onsite generating locations including waste from the Waste Retrieval Project (WRP), and off-site generators.[9][10]

The primary hazards at the CWC are radiological and chemical hazards to the workers, both remediation and co-located as well as the environment including near surface soils and groundwater. There are several waste containers at the facility that have been determined to have leaks or have the potential of developing leaks in the near future. Leaking of the waste containers is the primary source of the hazards described above. Along with potential leaks, there is an exposure pathway completed in the exposure of workers to some radiation as they perform daily activities around the waste. These hazards are described below in the report.

Accident scenarios with high consequences to co-located workers had an unlikely frequency. These included two fire scenarios and a seismic building collapse. Several accident scenarios with moderate consequences to co-located workers and anticipated frequency were analyzed including fires, energetic reactions and radiological spills. There were several accident scenarios that led to possible discharge to the groundwater; all of these had an unlikely frequency. No accident scenarios analyzed had other than low consequences to the off-site individual.

The CWC is equipped with several safety systems to mitigate the analyzed accident scenarios including engineered systems, operating procedures and processes as well as safety management systems. The engineered systems include the waste containers, designed barriers, fire protection systems, and facility specific systems such as sumps among others. Operating procedures and processes include a waste

[7] EIS 0391 (2012), Appendix E: Pages E236-E237
[8] EIS 0391 (2012), Appendix E: Page E237
[9] Permit WA7890008967, Part III, OU Group6, Central Waste Complex, Addendum C: Page 4
[10] The WA Department of Ecology Permit has not been finalized, however, the information included in the permit represents a satisfactory draft to make the risk evaluation.

acceptance criteria and waste characterization, container venting program, container management program, and abnormal container management program. Safety management systems include a nuclear safety program and transportation safety program. All are described in further detail in Attachment 1.

SUMMARY TABLES OF RISKS AND POTENTIAL IMPACTS TO RECEPTORS

Table H.3-2 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 is deemed to be an individual located anywhere within the physical boundaries of the Central Waste Complex or immediate areas around the outside of the building; a Co-located Person (CP) is an individual located 100 meters from the Central Waste Complex; and Public is an individual located at the closest point on the Hanford Site boundary not subject to DOE access control, which in this instance is a point along Highway 240 approximately 5 km away from the facility. The nuclear related risks to humans are based on unmitigated (unprotected or controlled conditions) dose exposures expressed in a range of from Not Discernible (ND) to High. The estimated mitigated exposure that takes engineered and administrative controls and protections into consideration, is shown in parentheses.

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

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

Cultural Resources: No risk ratings are provided for Cultural Resources. Table H.3-2 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.

Table H.3-2. Risk Rating Summary (for Human Health, unmitigated nuclear safety basis indicated, mitigated basis indicated in parentheses (e.g., "Very High" (Low)).

Population or Resource	Evaluation Time Period

		Active Cleanup (to 2064)	
		Current Condition: CWC Operating Facility	**From Cleanup Actions:** D&D of this facility is not yet planned.
Human Health	Facility Worker	High (Low)	D&D of this facility is not yet planned.
	Co-located Person	High (Low)	D&D of this facility is not yet planned.
	Public	Low (Low)	D&D of this facility is not yet planned.
Environmental	Groundwater	ND[(b)]	ND[(c)]
	Columbia River	ND[(b)]	ND[(c)]
	Ecological Resources[(a)]	ND	ND to Low
Social	Cultural Resources[(a)]	**Native American:** Direct: Known Indirect: Known **Historic Pre-Hanford:** Direct: Known Indirect: Known **Manhattan/Cold War:** Direct: None Indirect: None	**Native American:** Direct: Known Indirect: Known **Historic Pre-Hanford:** Direct: Known Indirect: Known **Manhattan/Cold War:** Direct: None Indirect: None

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.
b. CWC contamination is confined to the CWC building and there are no vadose zone sources or current groundwater contamination associated with this EU.
c. D&D of this facility is not yet planned.

SUPPORT FOR RISK AND IMPACT RATINGS FOR EACH POPULATION OR RESOURCE

Human Health

Current

The consequent categories and frequency estimates discussed in this section are consistent with the estimates made in HNF-15589, *Consolidated Hazard Analysis for the Master Documented Safety Analysis* (MDSA, Rev. 8). In the CHA, 91 total scenarios were evaluated for the CWC.

- There were sixteen (16) analyzed accident scenarios that produced consequences evaluated as "Moderate" for facility workers at CWC which had an estimated frequency of occurrence of "Anticipated"; these included eight (8) fire/energetic reaction scenarios and eight (8) radiological and/or chemical spills. Also, three (3) accident scenarios evaluated as "High" consequences with a frequency of "Low"; two fires and seismic building collapse.
- For on-site other workers, there were two accident scenarios that produced "High" consequences, but had an "Unlikely" estimated frequency of occurrence (Transportation-related fire & seismic building collapse); also, one fire was rated to have "Moderate" consequences with an estimate frequency of "Anticipated."

- There were no accidents evaluated to other than "Low" consequences to the maximum exposed off-site individual.
- Twenty (20) accidents evaluated, all "Unlikely" or less frequent, were deemed to have the potential to produce E3 consequences, that is: "off-site discharge to discharge to the groundwater." Discharges to the surface soil are assumed herein to be similar, as the primary dispersal pathway is airborne.
- Impacts to Cultural and Economic resources were evaluated by the appropriate CRESP teams and inserted.

Building and Facility: Work conducted at the CWC can be affected by the following design basis events from the Documented Safety Analysis:[11]

Small Outside Fire: A vehicle (propane-fueled forklift) impacts a single container or a pallet of containers, the containers breach, and any local ignition source burns the waste. The accident bounds impacts to a single container, pallet of containers, or a HEPA filter because it assumes fully loaded containers pursuant to the SARAH. Other release phenomena included in this bin are fires that spread to a single container, pallet of containers, or HEPA filters through vehicle impacts and ignition of liquid fuels such as gasoline, diesel fuel, or hydraulic oil. The small outside fire event is a conservative representation of other release phenomena contained within this bin because it is a high-energy event that ejects much of the contents and burns the contents outside and inside the container. It is also modeled as a small buoyant (0.2 MW sensible heat) non-meandering plume. The use of forklifts for handling containers or pallets of containers evaluated in FIR-2 is the highest probability initiator for a small outside fire event because of the frequency of use.

Unmitigated Consequence: Co-located Person – Low; Public – Low

Mitigation: Not credited: Passive: Storage container, Secondary Containment

Credited: Administrative: Waste Acceptance Criteria

Mitigated Risk: Co-located Person: Low; Public- Low

Small Inside Fire: A vehicle impacts a single container, the container breaches, and any local ignition source burns the waste. The accident bounds impacts to a single container, pallet of containers, or a HEPA filter because it assumes fully loaded containers pursuant to the SARAH. The unmitigated frequency is Anticipated. Other release phenomena included in this bin are fires that spread to a single container, pallet of containers, or HEPA filters through vehicle impacts and ignition of liquid fuels such as gasoline, diesel fuel, or hydraulic oil. The use of forklifts for handling containers or pallets of containers evaluated in FIR-5 is the highest probability initiator for a small outside fire event because of the frequency of use.

Unmitigated Consequence: Co-located Person – High; Public – Low

Mitigation: Active: Fire Protection; Passive: Storage container, Secondary Containment, Epoxy resin floor coating, Building stabilization and grading; and Administrative: Container Management and Venting Program, Waste Acceptance Criteria

Mitigated Risk: Co-located Person: Low; Public- Low

Medium Inside Fire: Studied initiating event is at WRAP, but a similar accident could occur at the CWC. A failure of the WRAP Automatic Stacker/Retriever System (AS/RS) results in a pallet of drums

[11] HNF-15589, Rev. 8. Appendix A.

falling and breaching. The hydraulic line bursts, releasing fluid, and burning additional drums. The accident bounds impacts of a medium inside fire because FIR-6 assumes that several dozen drums are involved in the fire. Although the accident could occur at any SWOC facility, it is assumed to occur at the WRAP because the most MAR is involved without spreading to the entire structure. The unmitigated frequency is Anticipated because it is caused by human error.

Unmitigated Consequence: Co-located Person – High; Public – Low

Mitigation: Active: Fire Protection; Passive: Storage container, Secondary Containment, Epoxy resin floor coating, Building stabilization and grading; and Administrative: Vehicle Controls, Container Management and Venting Program, Waste Acceptance Criteria

Mitigated Risk: Co-located Person: Low; Public- Low

Large Fire: The studied event is a fire involving 8 drums or other greenhouse (confinement structure) fire involving 82.5 De-Ci due to mishandling, equipment malfunction or properties of TRU waste cause burning of container contents resulting in breach of glovebox or greenhouse confinement. This type of event is described as a fire in the WRAP glovebox enclosure due to flammable or combustion–ignition sources in the waste or electric or static ignition sources, but a similar scenario[12] could occur at CWC. The accident bounds impacts from other confinement fires such as at the APL gloveboxes, and the 221-T or 2706-TA greenhouse because FIR-8 uses eight containers in the event and the most material at risk involved is at WRAP. Other release phenomena included in this bin are fires that spread as a result of incompatible materials, accidental crushing of a TRU waste drum in the LLW supercompactor, breach of pressurized containers, and ignition from a spark or other ignition source.

Unmitigated Consequence: Co-located Person – High; Public – Low

Mitigation: Active: Fire suppression systems, Fire Protection; Passive: Storage container, Secondary Containment, Epoxy resin floor coating, Building stabilization and grading; and Administrative: Vehicle Access Control, Container Management and Venting Program, Waste Acceptance Criteria, Source Strength Controls, and Emergency Response.

Mitigated Risk: Co-located Person: Low; Public- Low

Design Basis Seismic Event: As a result of the design basis seismic event, facility structural damage occurs due to overloading or acceleration energy. The MAR is considered to be the radioactive waste at each facility. This accident involves release from storage containers that are damaged as a result of falling building structures or falling from their stacked position, resulting in a spill.

Unmitigated Consequence: Co-located Person – High; Public – Low

Mitigation: Passive: Storage container, Secondary Containment, Building stabilization and grading; and Administrative: Container Management and Venting Program, Waste Acceptance Criteria

Mitigated Risk: Co-located Person: Low; Public- Low

External Event: The aircraft crash (EE-2) can occur at any SWOC facility. The bounding accident occurs at the CWC 2403-WD Building. The MAR is a portion of the total waste containers in the building. This accident involves release from storage containers that are damaged as a result of impact and resulting fuel fire. This accident is considered a high-energy event. The frequency of the

[12] FIR-08 is the scenario numbered in the DSA, CWC-06-01 is the applicable CWC scenario from the hazard analysis.

bounding event is Extremely Unlikely. Release phenomena included in this bin are restricted to an aircraft crash with fire.

Unmitigated Consequence: Co-located Person – Low; Public – Low

Mitigation: There are no controls to limit the risk from this event. However, there are some controls which might mitigate the effects. These include: Active: Fire Protection; Passive: Storage container, Secondary Containment, Building stabilization; and Administrative: Container Management and Venting Program, Waste Acceptance Criteria

Mitigated Risk: Co-located Person: Low; Public- Low

Contaminated Soils: Workers, CP and the Public are not directly exposed to the contaminated soil because it is located below grade beneath a concrete slab and portions of the building. There could be potential exposure on the outdoor storage areas without concrete.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

Addendum H of the RCRA Permit for CWC outlines closure activities as follows: (1) remove waste inventory; (2) decontaminate structural surfaces and equipment; (3) analyze decontamination waste to determine proper methods of treatment/disposal; and (4) dispose of decontamination waste based on results of waste analysis. The total duration of the cleanup phase is expected to be 180 days.[13]

Present information in the DSA indicates simply that SWOC facilities in general "have not identified any D&D activities that are unique, facility specific, or important to preventing or mitigating radiation exposure with respect to the D&D program."

Based on available information, we estimated the following ratings:

Unmitigated Risk: Facility Worker – Insufficient Information; CP – Insufficient Information; Public – Insufficient Information

Groundwater

CWC contamination is confined to the CWC building and there are no vadose zone sources or current groundwater contamination associated with this EU and none are expected over the next 150 years. This leads to a ND rating.

Columbia River

The Columbia River will not be impacted by the CWC due to the 13 km distance between the facility and the river. This leads a ND rating.

Ecological Resources

Current

There are little high quality resources on EU or on buffer.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

There are little high quality resources on EU or on buffer, but remediation options are unknown. Remediation options could result in contamination of the few resources on site (only 2% level 3 resources in EU). Remediation options unknown, thus whether area with be re-vegetated is unknown. If re-vegetated, risk could be low (rather than ND) due to presence of higher quality resources (e.g. level 3 or 4) created by re-vegetation.

[13] Permit WA7890008967, Part III, OU Group6, Central Waste Complex, Closure Plan: Page 6.

Cultural Resources

Current

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

National Register eligible historic trail runs through the EU. Two National Register ineligible sites/isolates are located within the EU. Potential for additional resources within pockets of undisturbed soil if it exists based on presence of Native American and Historic era resources within 500 meters of EU. Traditional cultural places are visible from the EU.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

Both direct and indirect effects are likely on National Register eligible trail. Other sites have been determined ineligible. There is the potential for additional archaeological resources where pockets of undisturbed soils exist. Long-term protection measures may be in place to resolve adverse effects to National Register eligible trail. Permanent effects are possible due to presence of contamination.

Considerations for timing of the cleanup actions

Delay in cleanup will result in continued operations and maintenance of the facility. This may lead to a potential for increased container maintenance due to normal degradation mechanisms (e.g., corrosion).

Near-Term, Post-Cleanup Risks and Potential Impacts

Dependent on D&D methods chosen.

PART II. ADMINISTRATIVE INFORMATION

OU AND/OR TSDF DESIGNATION(S)

CP-OP-1

COMMON NAME(S) FOR EU

Central Waste Complex (CWC)

KEY WORDS

radioactive waste, waste storage, mixed waste, transuranic waste (TRU)

REGULATORY STATUS

Regulatory basis: CWC is a Hazard Category 2 nuclear facility, as categorized by DOE-STD-1027. It is also categorized as Dangerous Waste Storage and Treatment Facility by Washington State Department of Ecology.

Applicable regulatory documentation:

In accordance with 10CFR830, Nuclear Safety Management, a documented safety analysis (HNF-14741) has been completed, with required safety controls. The State of Washington has issued a final status RCRA permit (WA7890008967, Part III, OU Group6, Central Waste Complex) for CWC operations, although CWC operates under interim status requirements.

Applicable Consent Decree or TPA milestones: M-091-Series Milestones (as applicable)

RISK REVIEW EVALUATION INFORMATION

Completed: Revised February 9, 2015

Evaluated by: S. Krahn, A. Croff, L. Fyffe

Ratings/Impacts Reviewed by: D. Kosson, J. Salisbury, A. Bunn, J. Burger, H. Mayer

PART III. SUMMARY DESCRIPTION

CURRENT LAND USE

DOE Hanford Site[14]

DESIGNATED FUTURE LAND USE

Industrial Exclusive[15]

PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

Not Applicable

[14] The current land use is Industrial, for Waste Storage, Treatment and Management. The CWC Operating Unit Group Dangerous Waste Management Units are designed for storage but can also perform operations such as: opening, sorting, treating (e.g., segregation, sorting for assignment to treatment), repackaging, sampling, physically/chemically screening to characterize retrieved waste, and to verify the characterization of containers of mixed waste. The facility can perform nondestructive examination (NDE) on an as needed basis using portable equipment. Limited treatment of mixed waste is permitted in the 2401-W, 2402-W, and 2403-W series dangerous waste management units. Sampling and verification may be done at the CWC Operating Unit Group. However, receiving, evaluating the integrity of packaging, repackaging when necessary and storing wastes for final disposition are the primary activities at the CWC; other operations mentioned above, while authorized by the RCRA permit and analyzed in the Documented Safety Analysis (DSA), are performed infrequently.

[15] CWC is projected to be operated as long as the waste management mission requires. Thereafter, the Central Plateau is designated for Industrial-Exclusive use. This designation is defined as an area suitable and desirable for treatment, storage, and disposal of hazardous, dangerous, radioactive, and nonradioactive wastes. It includes related activities consistent with Industrial-Exclusive uses. This designation would allow for continued Waste Management operations within the Central Plateau geographic area.

EU Designation: CP-OP-1 (CWC)

High-Level Waste Tanks and Ancillary Equipment

Not Applicable

Groundwater Plumes

Facility rests on top of known Carbon Tetrachloride plume which is under active pump and treat remediation.

Operating Facilities

Containerized LLW, MLLW, TRU, TRUM

D&D of Inactive Facilities

Not Applicable

LOCATION AND LAYOUT MAPS

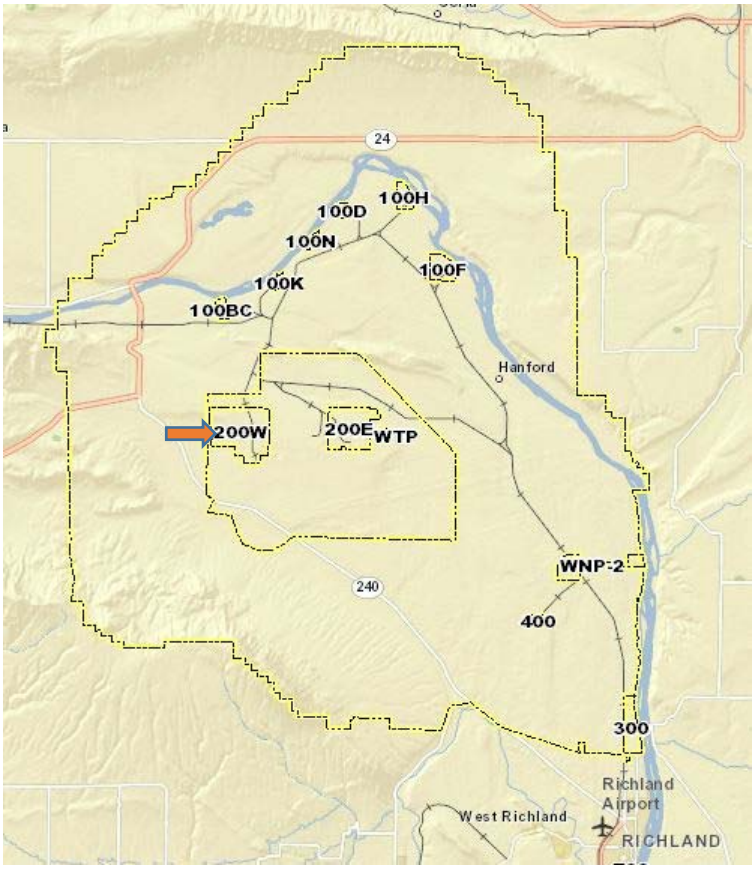

Figure H.3-1. Overall view of the Hanford Site with the 200W Area Highlighted[16]

This image illustrates the location of the 200 West (200W) Area in reference to the Hanford site and surrounding areas. The orange arrow indicates the location of the CWC. An important feature of this map is Highway 240, which is the closest public point to the CWC, and thus the location of the Maximum Exposed Individual.

[16] This image from the Hanford Phoenix System

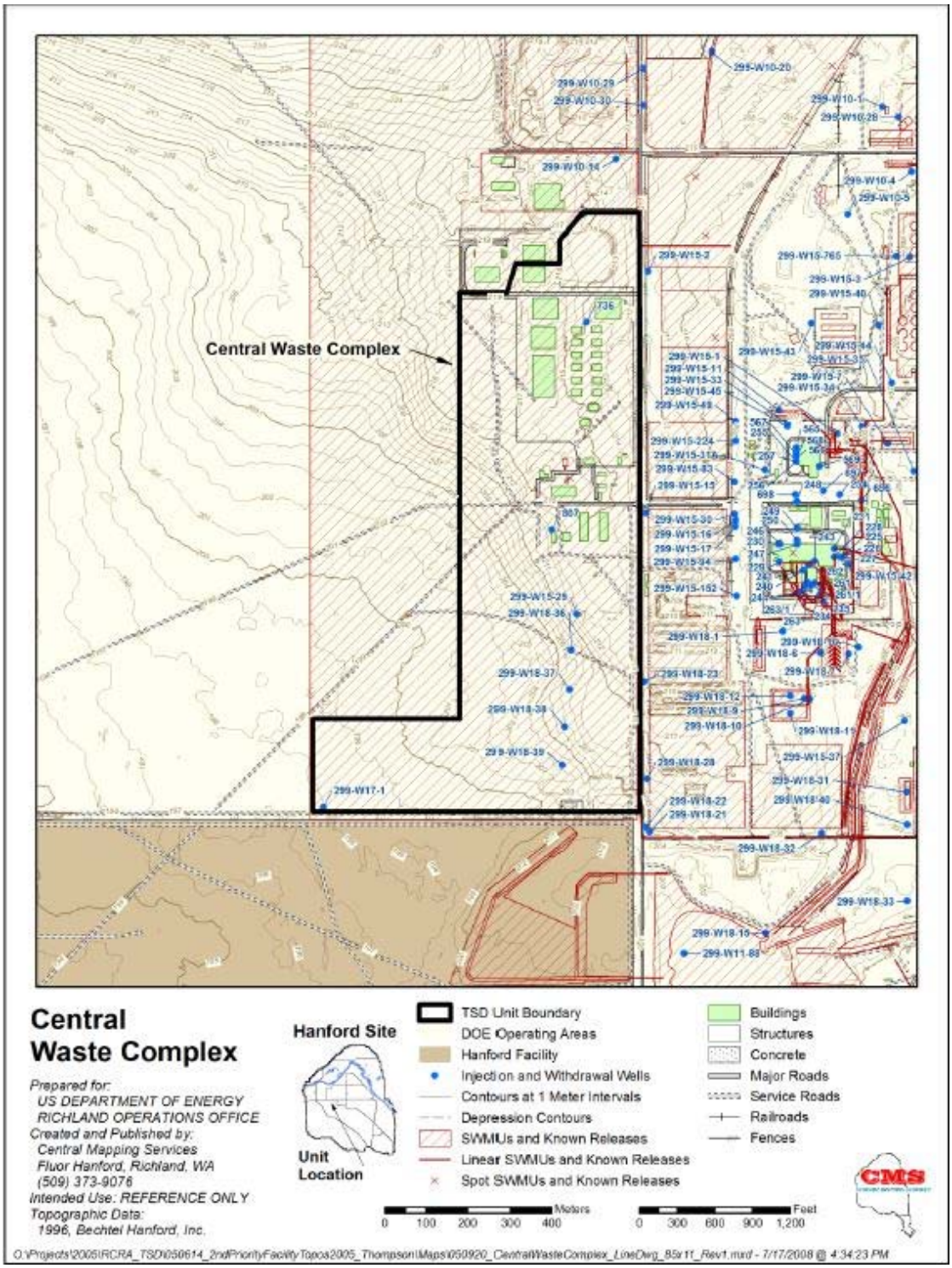

Figure H.3-2. Map of CWC within the SWOC[17]

[17] Permit WA7890008967, Part III, OU Group 6, Central Waste Complex, Addendum A Part A: Page 29

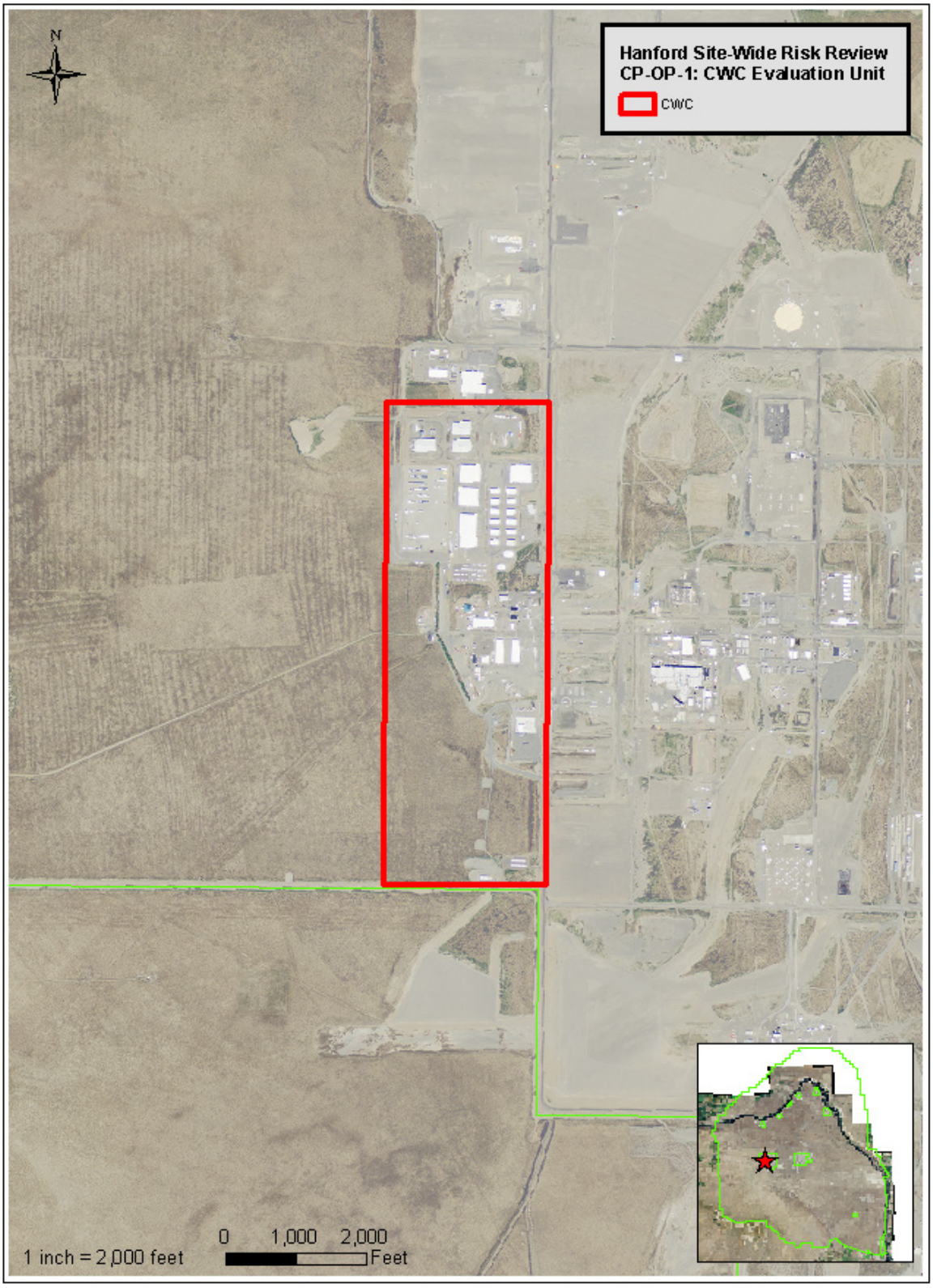

Figure H.3-3. EU Boundary Map

PART IV. UNIT DESCRIPTION AND HISTORY

EU FORMER/CURRENT USE(S)

See Operating Facilities

LEGACY SOURCE SITES

Not Applicable

HIGH-LEVEL WASTE TANKS

Not Applicable

GROUNDWATER PLUMES

Not Applicable

D&D OF INACTIVE FACILITIES

Not Applicable

OPERATING FACILITIES

What processes produced the radioactive material contained in the facility?

The radioactive material contained at the CWC includes MLLW, LLW, TRU and TRUM from both Hanford and offsite. In its current status, the majority of the waste in the CWC is retrievably stored TRU retrieved from the old burial grounds[18].

What types of containers or storage measures are used for radioactive materials at the facility?

The waste containers at the CWC are for the most part 55 gallon drums, composed of a noncombustible material with coatings or liners sufficient to maintain the integrity of the containment system from corrosion over the anticipated storage life of the waste; in some cases an overpack will be used and sorbent where necessary. There are some (175, or about 2% of all containers) legacy, large containers that are 'strong, tight packages,' most frequently wood boxes with fiberglass reinforcement; these containers have been provided additional weather protection. Further, waste packages will not exceed 1 mSv/hr 20 cm away from the surface or 2 mSV/hr on the surface.[19]

How is the radioactive material and waste contained or stored within the facility classified?

There are four distinct classes of material stored at the CWC including LLW, MLLW, TRU and TRUM. The waste generator must determine the physical and chemical characteristics of the waste. This information can come from the following sources: A representative sample, test data from a nonradioactive surrogate sample, MSDS, mass balance data from the waste generation process, interview information, log books, procurement records, and others[20]. Upon reaching the CWC, a small sample of the waste may be assayed to determine the accuracy of the information provided by the generator.

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[18] WA7 89000 8967, Part III, Operating Unit 6- (2009), Page 1
[19] HNF-EP-0063-Rev. 16- (2011), Page 4-3.
[20] HNF-EP-0063-Rev. 16- (2011), Page 2-2.

The waste also contains hazardous chemicals that are considered dangerous waste under RCRA. These include: Ignitable, Corrosive, and/or Reactive materials, Regulated RCRA metals (e.g., lead, mercury, chromium, etc.); Regulated RCRA organics (e.g., CCL4, Tetrachloroethylene, MEK, etc.); RCRA Listed Waste (e.g., F001-5, F039, P & U listed waste, etc.); and Extremely Dangerous Waste (EHW).[21]

What nuclear and non-nuclear safety accident scenarios dominate risk at the facility[22]?
There were sixteen (16) analyzed accident scenarios that produced consequences evaluated as "Moderate" for facility workers at CWC which had an estimated frequency of occurrence of "Anticipated"; these included eight (8) fire/energetic reaction scenarios and eight (8) radiological and/or chemical spills. Also, three (3) accident scenarios evaluated as "High" consequences with a frequency of "Low"; two fires and seismic building collapse.

For on-site other workers, there were two accident scenarios that produced "High" consequences, but had an "Unlikely" estimated frequency of occurrence (Transportation-related fire & seismic building collapse); also, one fire was rated to have "Moderate" consequences with an estimate frequency of "Anticipated."

There were no accidents evaluated to other than "Low" consequences to the maximum exposed off-site individual.

Twenty (20) accidents evaluated, all "Unlikely" or less frequent, were deemed to have the potential to produce E3 consequences, that is: "off-site discharge to discharge to the groundwater."

What are the average and maximum occupational radiation doses incurred at the facility?
The average dose (TED) is 36.5 mrem; the cumulative dose for 2013 is 2630 mrem; the maximum individual dose is 217 mrem.[23]
What processes and operations are conducted within the facility?
The primary actions at the CWC are shipping and receiving, waste container handling and waste storage.

However, permitted activities at the CWC for all types of wastes packages include the following[24]:

- Shipping and receiving
- Waste container handling
- Waste staging and storage
- Nonintrusive survey and inspection (including non-destructive examination and non-destructive assay)
- Waste loading/transfers
- Container venting
- Waste treatment
- Decontamination
- Packaging and repackaging (overpacking)
- Waste Verification
- Headspace gas sampling

[21] Nester (2014).
[22] HNF 15589-8 (2012), Appendix A.
[23] Collins, Mike (2014).
[24] HNF 14741-10 (2013). Pages 2-21 and 2-22

What is the process flow of material into and out of the facility?

See Figure H.3-4.

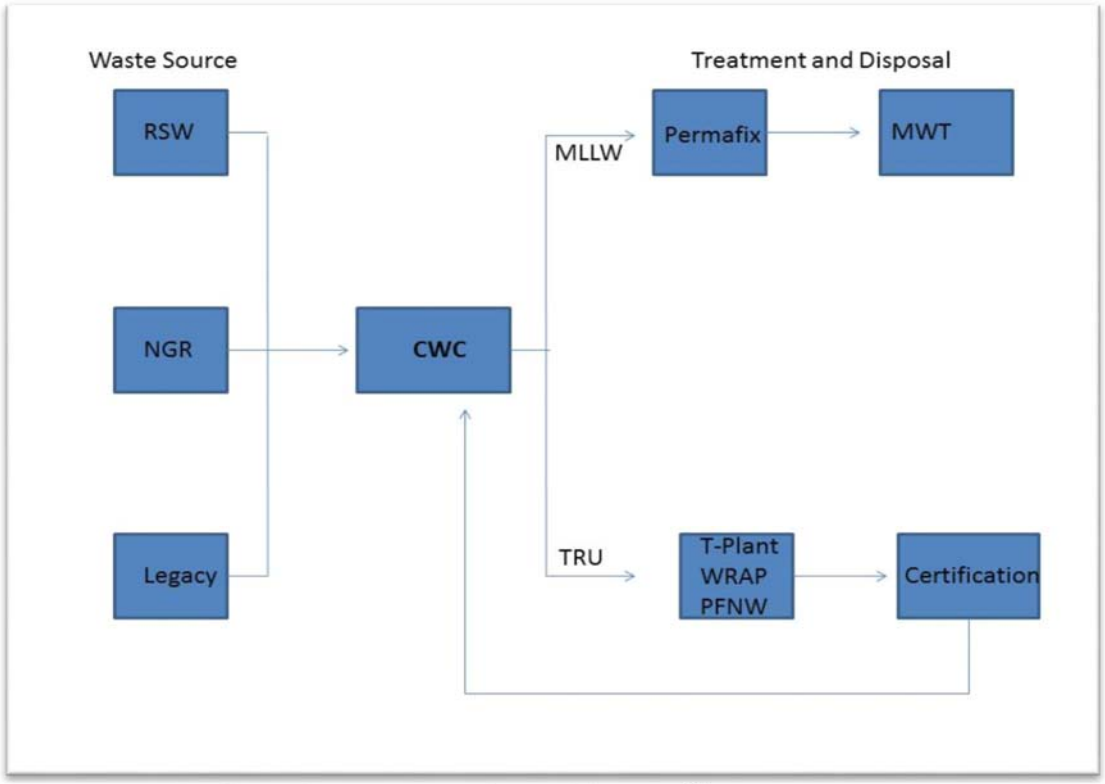


Figure H.3-4. The Flow of Waste into and out of the CWC[25]

What effect do potential delays have on the processes, operations, and radioactive materials in the facility?

For the CWC there are 2 foreseeable delays: (1) overall delays for which the impact would be that the risks and hazards of the operating facility would continue as they are, without moving into a cleanup phase; (2) problems with WIPP or other long term storage would require the CWC to remain available to store TRU for an extended period of time for which the impact would also be the continuation of operating risks and hazards.

What other facilities or processes are involved in the flow of radioactive material into and out of the facility?

The CWC is a part of the Solid Waste Operating Group which also includes T-Plant and WRAP. The following process flow diagram illustrates the solid waste flow into and out of the facilities in the SWOC.

[25] This diagram was created by Mike Collins during a group tour of the CWC.

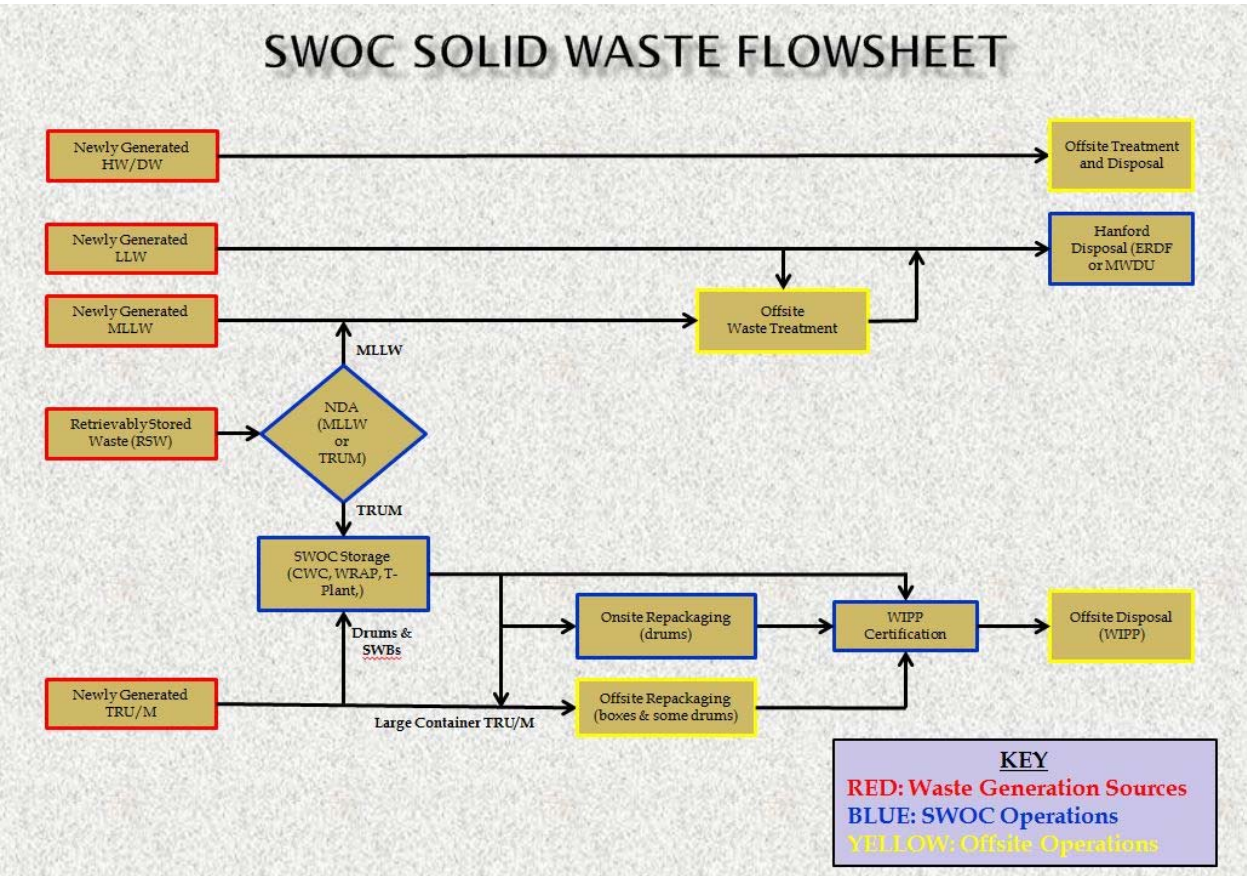


Figure H.3-5. SWOC Solid Waste Flow Sheet[26]

Is shipping of material involved and if so, how often and by what means?

Waste transportation involves shipments from offsite and onsite waste generators to CWC facilities. Onsite shipments must comply with the Transportation Safety Document (TSD), required under DOE O 460.1C, Packaging and Transportation Safety. The TSD is the approved documented safety analysis for onsite transportation and packaging activities. Offsite shipments (arriving or leaving) must comply with the requirements of 49 CFR 171, "Hazardous Materials Regulations" unless exceptions are made, usually with attendant special provisions like temporary closure of public roads for transportation to Permafix NW. Offsite shipments may be made by truck, railroad, or other transportation conveyance. The railroad tracks are located outside of the boundaries of the CWC facilities with the exception of T Plant, which has taken measures to preclude entry of a train without positive actions by Operations.[27]

What infrastructure is considered a part of the facility?

The following units are considered a part of the CWC: 2403WA, 2403WB, 2403WC, 2403WD, 2404WA (permitted under WRAP but operated as a part of CWC), as well as the Flammable and Alkali Metal Waste Storage Modules, the 2401-W Building, the 2402-W Series of 12 buildings and outside storage areas A-F.

[26] This flowsheet was provided after our site visit via SharePoint. It was loaded by Mike Collins, but the author may be a different party.
[27] HNF 14741-10 (2013). Page 2-89

ECOLOGICAL RESOURCES SETTING

Landscape Evaluation and Resource Classification

The CWC EU includes levels 0, 1, 2, and 3 resources as classified in the existing resource level map (DOE/RL-96-32 2013). However, two locations classified as level 3 resources in the existing resource map have become degraded and were reclassified as level 2 for this assessment. Central and western portions of the EU have been converted into industrial areas and were reclassified as level 0 resources. The majority of the CWC site is characterized by level 0 (i.e., industrial sites, paved and compacted gravel areas) and level 2 resources (i.e., small patches with sparse climax or successional shrub overstory and non-native understory). Much of the area on the west side of the EU was reclassified as level 2 because it had burned previously, and was revegetatated with non-native and native species.

The amount and proximity of biological resources to the CWC EU was evaluated within the adjacent landscape buffer area radiating 1504 m from the geometric center of the site (equivalent to 1755 acres). Small patches of level 3 resources (ranging from 1.9 to 11.5 acres) are located to the east and southeast of the EU, including several point occurrences of sensitive species.

Field Survey

PNNL biologists conducted a reconnaissance and pedestrian survey of the EU. Much of the unit consists of buildings and parking areas with some scattered shrubs bordering the graveled areas. Some small patches of remnant shrub-steppe vegetation occur in between buildings, and canopy cover was visually evaluated, but not physically measured in the field. The patches between buildings contain some scattered big sagebrush (*Artemisia tridentata*) with mixed native and alien grass understory. Cheatgrass (*Bromus tectorum*) cover ranged from 30% to 50%. The canopy cover of dominant vegetation in the revegetated area that occurs to the west and south of the buildings and parking areas was primarily crested wheatgrass (*Agropyron cristatum*) along with sparse shrubs (*Artemisia tridentata and Atriplex canescens*).

No wildlife were observed within the unit during the July reconnaissance, however, PNNL ECAP surveys done in 2010 noted the following wildlife or wildlife signs: side-blotched lizard (*Uta stansburiana*), coyote (*Canis latrans*), mountain cottontail (*Sylvilagus nutalli*), and old scat from black-tailed jackrabbit (*Lepus californicus*).

CULTURAL RESOURCES SETTING

Cultural resources known to be recorded within the CWC EU consists of both contributing and noncontributing segments of a National register-eligible T historic/ethnohistoric trail/Road corridor associated with the Native American Precontact/Ethnographic and Pre-Hanford Early Settlers/Farming Landscapes as well as a historic site, likely associated with the Pre-Hanford Early Settlers/Farming Landscape. Additionally two isolated finds; one associated with the Native American Precontact and Ethnohistoric Landscape and one associated with the Pre-Hanford Early Settlers/Farming Landscape have also been identified. With the exception of the contributing portion of an historic/ethnohistoric Trail/Road, none of these resources is considered to be National Register-eligible. Previous cultural resources reviews have recommended a 60-foot easement of avoidance on either side of the contributing segment of the White Bluffs Trail/Road Corridor through this area.

Almost all of the CWC EU has been inventoried for archaeological resources. In addition to the archaeological resources already identified within the CWC EU, 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 CWC EU.

The closest recorded archaeological sites, located within 500 meters of the CWC EU, consist of four isolated finds; one associated with the Native American and Ethnographic Landscape and three historic-era isolated finds that may be associated with the Pre-Hanford Early Settlers/Farming Landscape. All four are considered to be National Register ineligible.

The physical evidence of an historic/ethnohistoric Trail/Road within the CWC EU, indicates evidence of historic and ethnohistoric land use through the CWC EU. The geomorphology and presence of undisturbed soils suggests that there is a moderate potential for the presence of archaeological resources associated with all three landscapes to be present both in the surface and subsurface within the CWC EU. 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, 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.

PART V. WASTE AND CONTAMINATION INVENTORY

Brief description of contaminated media and materials

The predominant waste type at the CWC is containerized TRU/TRUM. There is presently one container 231ZDR-11 on an outside storage pad that is in a controlled area with rainwater collection and a roped off radiation/contamination protection zone.

What is the origin of the nuclear materials/wastes?

The CWC provides storage and staging for waste containers that are awaiting processing or shipment to other waste facilities. LLW, MLLW, TRU and TRUM waste is shipped from remediation projects elsewhere on the Hanford Site. Material is also received back from off-site treatment contractors (e.g., Perma-Fix Northwest) and prepared for shipment to final disposal sites, such as the Waste Isolation Pilot Plant (WIPP) for TRU waste; TRU and TRUM are the predominant waste types at CWC.

What are the primary radionuclides/contaminants?

In the Master Documented Safety Analysis for Solid Waste Operations Complex (HNF-14741), the bounding drum and array analysis assumptions of the SARAH are used. In that bounding drum, the radionuclides are assumed to be Pu-238, Pu-239 (more than 80% by activity), Pu-240, Pu-241 and Pu-242, along with the Pu decay product Am-241. Debris from D&D and operational wastes, notably from PNNL and Tank Farms, can also contain fission products (Cs-137, Sr-90). However, majority of presently stored waste is classified as TRU or TRUM. The contaminant inventory is provided in Table H.3-3.

What is the physical state of the materials, facility(ies), stored waste, and area surrounding the facility?

Waste received that the CWC is containerized LLW, MLLW, TRU, and TRUM in 55-gallon drums; less-frequently in larger packages (85-gallon over-packs), along strong, tight LLW containers such as wood

and metal boxes[28]. The material condition is verified by the shipper as being satisfactory prior to shipment. Containers received in the CWC are either in good condition or are over-packed[29]. Shipping documentation is reviewed by CWC personnel upon receipt and a sample containers may be opened and visually inspected for adequate material condition and waste verification prior to entering the facility inventory[30].

The contaminant inventory is provided in Table H.3-3.

[28] EIS 0391 (2012), Section E.3.1.2.
[29] Permit WA7890008967, Part III, OU Group6, Central Waste Complex, Section C.2.1.1
[30] Permit WA7890008967, Part III, OU Group6, Central Waste Complex, Addendum B

Table H.3-3. CWC Contaminant Inventory[31,32]

WIDS	Description and Reference	Isotope Inventory (Ci)								Chemical Inventory (kg)				
		Cs-137	Sr-90	Tc-99	I-129	H-3	Pu (total)	Am-241	U (total)	CCl4	Cr (total)	Cr (VI)	TCE	NO3
2120-WA	Snapshot inventory for CWC provided as estimate for all waste containers and storage areas as a total amount. The reference for this material is an e-mail from Mike Collins. The total Pu is based on a snapshot inventory estimate from the solid waste inventory tracking system (SWITS)						52,889			10700	2040	1.41	Not known.	2590
2120-WB	See 2120-WA for combined inventory estimate.													
213-W	Not presently known.													
213-W-1	See 2120-WA for combined inventory estimate.													
213-WTK-1	Not presently known.													
216-ZP-1A	See 2120-WA for combined inventory estimate.													
2401-W	See 2120-WA for combined inventory estimate.													
2402-W	See 2120-WA for combined inventory estimate.													
2402-WB	See 2120-WA for combined inventory estimate.													
2402-WC	See 2120-WA for combined inventory estimate.													
2402-WD	See 2120-WA for combined inventory estimate.													
2402-WE	See 2120-WA for combined inventory estimate.													
2402-WF	See 2120-WA for combined inventory estimate.													

[31] Total Pu from Snapshot inventory from SWITS, 2014.
[32] Chemical inventory from Personal Communication with Mike Collins via e-mail from January, 2015.

WIDS	Description and Reference	Isotope Inventory (Ci)								Chemical Inventory (kg)				
		Cs-137	Sr-90	Tc-99	I-129	H-3	Pu (total)	Am-241	U (total)	CCl4	Cr (total)	Cr (VI)	TCE	NO3
2402-WG	See 2120-WA for combined inventory estimate.													
2402-WH	See 2120-WA for combined inventory estimate.													
2402-WI	See 2120-WA for combined inventory estimate.													
2402-WJ	See 2120-WA for combined inventory estimate.													
2402-WK	See 2120-WA for combined inventory estimate.													
2402-WL	See 2120-WA for combined inventory estimate.													
2403-WA	See 2120-WA for combined inventory estimate.													
2403-WB	See 2120-WA for combined inventory estimate.													
2403-WC	See 2120-WA for combined inventory estimate.													
2403-WD	See 2120-WA for combined inventory estimate.													
2404-WA	See 2120-WA for combined inventory estimate.													
2404-WB	See 2120-WA for combined inventory estimate.													
2404-WC	See 2120-WA for combined inventory estimate.													
240-W	See 2120-WA for combined inventory estimate.													
2420-W	See 2120-WA for combined inventory estimate.													
286-W	See 2120-WA for combined inventory estimate.													
CC0594	See 2120-WA for combined inventory estimate.													
HS0057	See 2120-WA for combined inventory estimate.													
HS0058	See 2120-WA for combined inventory estimate.													
HS0059	See 2120-WA for combined inventory estimate.													

WIDS	Description and Reference	Isotope Inventory (Ci)								Chemical Inventory (kg)				
		Cs-137	Sr-90	Tc-99	I-129	H-3	Pu (total)	Am-241	U (total)	CCl4	Cr (total)	Cr (VI)	TCE	NO3
HS0060	See 2120-WA for combined inventory estimate.													
HS0061	See 2120-WA for combined inventory estimate.													
HS0062	See 2120-WA for combined inventory estimate.													
HS0063	See 2120-WA for combined inventory estimate.													
HS0064	See 2120-WA for combined inventory estimate.													
HS0077	See 2120-WA for combined inventory estimate.													
RMWSF	See 2120-WA for combined inventory estimate.													

CONTAMINATION WITHIN PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

Not Applicable

High Level Waste Tanks and Ancillary Equipment

Not Applicable

Vadose Zone Contamination

Not Applicable

Groundwater Plumes

Carbon Tetrachloride plume exists below the CWC which is under active pump and treat remediation.

Facilities for D&D

Not Applicable

Operating Facilities

Stored radioactive material is normally contained within its engineered containers. Exceptions to this are remediated.

Detailed inventories are provided in Table H.3-4, Table H.3-5, and Table H.3-6. All values are to 2 significant figures. The source document should be consulted for greater precision data. The sum for each primary contaminant is shown in the first row. Table H.3-7 provides a summary of the evaluation of threats to groundwater as a protected resource from saturated zone and remaining vadose zone contamination associated with the evaluation unit.

Table H.3-4. Inventory of Primary Contaminants[a]

WIDS	Description	Decay Date	Ref[b]	Am-241 (Ci)	C-14 (Ci)	Cl-36 (Ci)	Co-60 (Ci)	Cs-137 (Ci)	Eu-152 (Ci)	Eu-154 (Ci)	H-3 (Ci)	I-129 (Ci)
All	Sum			NR	NR	NR	NR	NR	NR	NR	NR	NR
2120-WA	Infrastructure Building		SWITS	NR	NR	NR	NR	NR	NR	NR	NR	NR

a. NR = Not present at significant quantities for indicated EU

Table H.3-5. Inventory of Primary Contaminants (cont)[a]

WIDS	Description	Decay Date	Ref[b]	Ni-59 (Ci)	Ni-63 (Ci)	Pu (total) (Ci)	Sr-90 (Ci)	Tc-99 (Ci)	U (total) (Ci)
All	Sum			NR	NR	53000	NR	NR	NR
2120-WA	Infrastructure Building		SWITS	NR	NR	53000	NR	NR	NR

a. NR = Not present at significant quantities for indicated EU

Table H.3-6. Inventory of Primary Contaminants (cont)[a]

WIDS	Description	Ref[b]	CCl4 (kg)	CN (kg)	Cr (kg)	Cr-VI (kg)	Hg (kg)	NO3 (kg)	Pb (kg)	TBP (kg)	TCE (kg)	U (total) (kg)
All	Sum		11000	NR	2000	1.4	NR	2600	NR	NR	NR	NR
2120-WA	Infrastructure Building	SWITS	11000	NR	2000	1.4	NR	2600	NR	NR	NR	NR

a. NR = Not present at significant quantities for indicated EU

Table H.3-7. Summary of the Evaluation of Threats to Groundwater as a Protected Resource from Saturated Zone (SZ) and Remaining Vadose Zone (VZ) Contamination associated with the Evaluation Unit

PC	Group	WQS	Porosity[a]	K_d (mL/g)[a]	ρ (kg/L)[a]	VZ Source M^{Source}	SZ Total M^{SZ}	Treated[c] M^{Treat}	VZ Remaining M^{Tot}	VZ GTM (Mm^3)	VZ Rating[d]
C-14	A	2000 pCi/L	0.23	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*
CCl4	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 2015).

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

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

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

PART VI. POTENTIAL RISK/IMPACT PATHWAYS AND EVENTS

CURRENT CONCEPTUAL MODEL

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

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

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

1. *What are the current barriers to release or dispersion of contamination from the primary facility? What is the integrity of each of these barriers? Are there completed pathways to receptors?*

There are three major types of barriers to release of contamination from the primary facility: (1) Engineered systems including the waste container, and secondary containment systems (buildings, berms, sumps, etc.); (2) Operating Procedures such as Waste Acceptance Criteria, Venting Programs, RCRA and radiological inspections, and others; and (3) Safety Management Systems such as nuclear criticality safety and transportation safety. These are further defined in Attachment 1.

There is one identified completed pathway to receptors, which is the ionizing radiation associated with these packages. People in the vicinity of the packages do accumulate occupational exposure, but it is monitored to ensure it stays well below regulatory levels of concern.

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

The initiating events that may lead to degradation or failure of the barriers include: worker accidents, loss of institutional controls, loss of engineering controls, structural decay or failure, wild fire or facility fire, earthquake, dam failure, ash fall and plane crash; these are evaluated in the DSA (HNF-14741).

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

The primary pathway of concern is airborne dispersion of material from containerized waste; the populations at risk from this source include workers (on site and non-collocated).

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

For all initiating events, because the primary pathway to the receptors is airborne, the time frame to human exposure or impacts will be very short, on the order of hours, days or weeks.

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

At the time of this study, we are unaware of on-going releases to the environment or receptors, but as mentioned previously, we do have one completed pathway to workers of an occupational radiation dose.

The rate at which CWC has been able to ship its inventory to disposal sites – especially for TRU waste – has been curtailed in recent years because of higher budget priorities elsewhere. The slow rate of shipping wastes for disposal has been exacerbated by the curtailment of operations at WIPP. As a consequence, the TRU waste inventory at CWC (the material at risk in accident scenarios) and, thus, the

inventory available for release (material at risk) during certain accidents, has and will continue to increase until the facility inventory can be reduced.

POPULATIONS AND RESOURCES CURRENTLY AT RISK OR POTENTIALLY IMPACTED

Workers

Workers are the resource impacted by the only current completed pathway of occupational radiation exposure. In the instance of the initiating events described above, any exposure would likely be airborne dispersion of containerized waste and exposure via inhalation or external radiation due to proximity to contamination.

Public

The low level public is at risk due to airborne exposure of containerized waste in an event scenario.

Groundwater

CWC contamination is confined to the CWC building and there are no vadose zone sources or current groundwater contamination associated with this EU. This leads a ND rating.

Columbia River

The Columbia River will not be impacted by the CWC due to the 13 km distance between the facility and the river. This leads a ND rating.

Ecological Resources

- No level 3 or higher quality habitat patches occur within the CWC EU.
- Cleanup activities would result in no net change in the amount of level 3 or higher resources within a 1.5 km radius.
- The CWC EU is adjacent and contiguous to multiple industrial sites—no significant change in habitat connectivity would be expected if habitat resources within the EU are lost.

Cultural Resources Setting:

- Four isolated finds consisting of one associated with the Native American Precontact and Ethnographic Landscape and three historic-era finds associated with the Pre-Hanford Early Settlers/Farming Landscape are located within 500 meters of the CWC EU. All four are considered to be National Register ineligible.

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 CWC EU.

CLEANUP APPROACHES AND END-STATE CONCEPTUAL MODEL

Selected or Potential Cleanup Approaches

Addendum H of the RCRA Permit for CWC outlines closure activities as follows: (1) remove waste inventory; (2) decontaminate structural surfaces and equipment; (3) analyze decontamination waste to

determine proper methods of treatment/disposal; and (4) dispose of decontamination waste based on results of waste analysis. The total duration of the cleanup phase is expected to be 180 days.[33]

The DSA states that D&D and cleanup activities have yet to be planned. The following cultural and ecological risks have been identified:

Ecological Resources

Trucks, heavy equipment and drill rigs on roads through non-target areas or remediation site 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. Often permanent or long-term compaction can result in the 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. 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. Use of non-specific herbicides results in some mortality of native vegetation (especially native forbes), and allows exotic species to move in. It may change species composition of native communities, but it also could make it easier for native species to move in. Improved methods could result in positive results. 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.

Cultural Resources

Personnel, car, and truck traffic on paved and two-track roads as well as use of heavy equipment will not have any direct impact on archaeological resources because there is no disturbance to soil/ground or alteration to the landscape. Assuming heavy equipment locations and staging areas have been cleared for cultural resources, then it is assumed adverse effects would have been resolved and/or mitigated. If heavy equipment locations and staging areas have not been cleared, this could result in artifact breakage and scattering, compaction and disturbance to the soil surface and immediate subsurface, thereby compromising stratigraphic integrity of an archaeological site. TCPs may be directly affected if personnel are on roads located on TCP and if personnel are unaware of cultural resource sensitivity, appropriate behaviors and protocols. For traffic on paved roads located on TCP, direct effects include visual, auditory and vibrational alterations to landscape/setting. Heavy equipment may cause direct effects to TCPs including destruction of culturally important plants, physical attributes of the TCP and introduction of noise and vibrations also altering the setting. These actions may interfere with traditional uses of TCP. Construction of staging areas 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 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

[33] Permit WA7890008967, Part III, OU Group 6, Central Waste Complex, Closure Plan: Page 6.

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 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. 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 and two-track 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.

Not Applicable

Risks and Potential Impacts Associated with Cleanup

The DSA states that D&D and cleanup activities have yet to be planned. The following cultural and ecological risks and impacts have been identified:

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

Workers (directly involved)

Not Applicable

Co-located (CW)

Not Applicable

Public

Not Applicable

Groundwater

CWC contamination is confined to the CWC building and there are no vadose zone sources or current groundwater contamination associated with this EU. However, threats to groundwater could emerge from container degradation and subsequent leaks into the subsurface. It is assumed that this will not occur over the next 50 years. This leads to a ND rating.

Columbia River

The Columbia River will not be impacted by the CWC due to the 13 km distance between the facility and the river. This leads to a ND rating.

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

None, continued operations and maintenance of the facility. Potential for increased container maintenance due to normal degradation mechanisms (e.g., corrosion).

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

Populations and Resources at Risk or Potentially Impacted After Cleanup Actions (from residual contaminant inventory or long-term activities)

Table H.3-8. Population or Resource Risk/ Impact Rating.

Population or Resource		Risk/Impact Rating	Comments
Human	Facility Worker	Unknown	Dependent on D&D methods chosen
	Co-located Person	Unknown	Dependent on D&D methods chosen
	Public	Unknown	Dependent on D&D methods chosen
Environmental	Groundwater	Not Discernible (ND)	Dependent on D&D methods chosen. CWC contamination is confined to the CWC building and there are no vadose zone sources or current groundwater contamination associated with this EU. However, threats to groundwater could emerge from container degradation and subsequent leaks into the subsurface. It is assumed that this will not occur over the next 150 years. This leads to a ND rating.
	Columbia River	ND	Dependent on D&D methods chosen. The Columbia River will not be impacted by the CWC due to the 13-km distance between the facility and the river. This leads to a ND rating.
	Ecological Resources[(a)]	ND-Low	Remediation options unknown, thus whether area with be re-vegetated is unknown. If re-vegetated, risk could be low (rather than ND) due to presence of higher quality resources (e.g. level 3 or 4) created by re-vegetation.
Social	Cultural Resources[(a)]	**Native American:** Direct: Known Indirect: Known **Historic Pre-Hanford:** Direct: Known Indirect: Known **Manhattan/Cold War**: Direct: None Indirect: None	Long-term protection measures may be in place to resolve adverse effects to National Register eligible trail. Permanent effects possible due to presence of contamination.

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.

Ecological Resources: Remediation options unknown, thus whether area with be re-vegetated is unknown. If re-vegetated, risk could be low (rather than ND) due to presence of higher quality resources (e.g. level 3 or 4) created by re-vegetation.

Cultural Resources: Long-term protection measures may be in place to resolve adverse effects to National Register eligible trail. Permanent effects possible due to presence of contamination.

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

Unknown.

PART VII. SUPPLEMENTAL INFORMATION AND CONSIDERATIONS

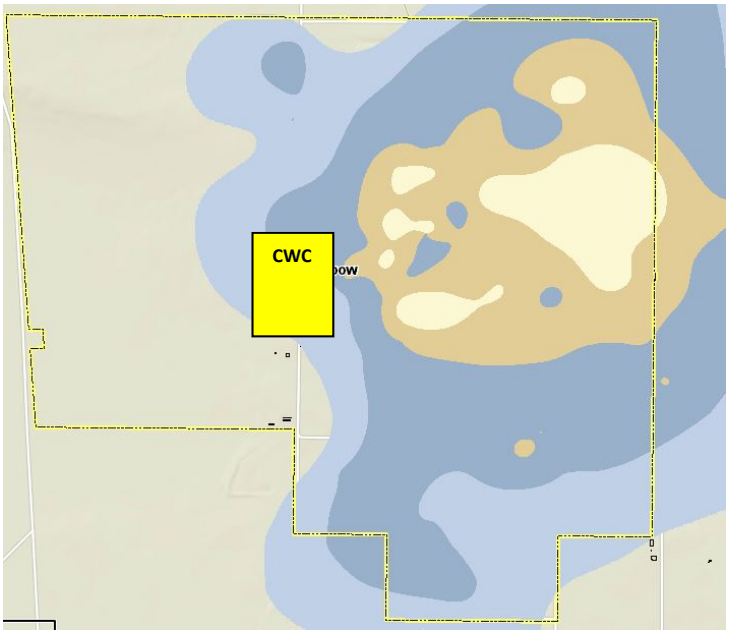
CURRENT CONDITIONS THAT IMPAIR OR PRECLUDE PLANNED FUTURE LAND USE:

The CWC is an active radioactive waste storage facility. Several large and number of smaller steel-framed structures are built on concrete pads for waste storage. In addition, several outdoor storage areas exist, the largest of which is compacted gravel, others are concrete or asphalt pads. Most other structures associated with CWC are mobile/modular in construction and are re-locatable.

Other uses would await post D&D condition assessment; however, CWC is located on the Central Plateau, an area presently scheduled for continued federal custody.

Remedial processes and impacts

There is a potential future impact from the carbon tetrachloride plume. The following figure illustrates the plume and its proximity to the CWC within the 200 West Area:



Attachment 1

Description of Barriers

There are several barriers in place to prevent risk or impacts as follows:

Engineered Systems

- The waste container and/or overpack
- Secondary Containment
- CWC Fire Protection and Automatic Fire Suppression Systems[34]
    - 2403 buildings contain manual dry chemical, 20-lb, Type ABC fire extinguishers at strategic locations throughout each building.
    - In 2404-WA, fire protection water lines comply with applicable fire protection orders and standards. Each building has a manual fire extinguisher.
    - The LFMW storage modules are supplied with portable fire extinguishers in accordance with NFPA 10, Standard for Portable Fire Extinguishers. The LFWM modules have Class ABC (approximately 10 lbs agent weight) stored pressure dry chemical extinguishers. The AMW modules, including Module FS-19, have Class D portable fire extinguishers. A 14 kg, Type D fire extinguisher is mounted on the exterior of each module. All extinguishing equipment is hand operated.
    - Fire suppression for buildings 2402-W through -WL is provided by a single dry pipe automatic sprinkler system in each building. Piping is sized in accordance with National Fire Protection Association (NFPA) 13, *Standard for the Installation of Sprinkler Systems* (ordinary hazard pipe schedule or better). These buildings have two fire pull boxes located near personnel exit doors.
    - The 2401-W, 2402-W and 2402-WC buildings have been categorized as <HC-3 facilities. The fire suppression systems for these buildings are not a credited safety-significant (SS) structure, system or component (SSC).
    - Fire suppression for Buildings 2403-WA through -WD is provided by two dry pipe automatic sprinkler systems in each building. Each half of the structure is protected by a separate system, one located in each of two small heated rooms outside each building. Piping for the dry pipe sprinkler systems is sized in accordance with NFPA 13Fire pull boxes are located near exit doors.
    - The 2404-WA through WC buildings fire suppression systems (FSSs) were hydraulically designed with a density of 0.30 gpm/ft2 over 3,000 ft2 with high temperature heads. Adjustments made to the design basis of the sprinkler systems to allow storage of NFPA containers, resulted in a revised design specification of 0.25 gpm/ft2 over 3,900 ft2.
- Building specific features for the CWC Dangerous Waste Management Units[35]:

    Flammable and Alkali Metal Waste Storage Modules

    - Vented catch sump under the storage floor provides spill containment
    - Dedicated secondary containment system

    2401 – W Building

[34] HNF 14741-10 (2013). Page 2-139

[35] Permit WA7890008967, Part III, OU Group6, Central Waste Complex, Addendum C: Pages 5-9.

- Perimeter concrete curb 15.2 cm above grade with ramps for loading and unloading operations
- Floors coated with an epoxy resin floor surfacing system compatible with the waste

2402 – W Series Buildings

- Perimeter concrete curb 15.2 cm above grade with ramps for loading and unloading operations
- Floors are coated with an epoxy resin floor surfacing system compatible with the waste

2403 – W Series Buildings

- Floors are divided into quadrants by concrete curbs 12.7 cm high
- Floors are coated with an epoxy resin floor surfacing system compatible with the waste
- Adjacent areas to the buildings are stabilized and graded to slope away from the buildings

CWC Outside Storage Area A (gravel)

- Storage area graded and leveled with gravel
- No double containment

CWC Outside Storage Area B (gravel)

- Storage area graded and leveled with gravel
- No double containment

CWC Outside Storage Area C (gravel)

- Storage area graded and leveled with gravel
- No double containment

CWC Outside Storage Area D (epoxy coated concrete pad)

- Curbed with concrete and provided with epoxy coating to prevent contaminants from entering the concrete with access ramps
- Rainwater collection and removal system

CWC Outside Storage Area E (asphalt pad)

- No double containment

CWC Outside Storage Area F (asphalt pad)

- No double containment

Operating Procedures and Processes

- Waste Acceptance Criteria and Waste Characterization
  - Waste screening and documentation occurs as required by HNF-EP-0063, Hanford Site Solid Waste Acceptance Criteria, before waste is shipped to CWC.
    • Generators must receive advance approval to ship a waste package and must certify before shipment that the waste meets the SWOC waste acceptance criteria.

• The Hanford Site can accept only waste from offsite generators that have been approved by DOE. Offsite generators must submit information to DOE, Richland Operations Office, which forwards the information for evaluation.

• The information necessary to verify that the waste meets acceptance requirements (HNF-EP-0063) must be provided before the waste can be shipped to CWC. The information must address the following seven elements (as well as any other pertinent information necessary to ensure proper management of the waste):

− Identification number (must be the corresponding waste specification record number)

− Waste generating process description

− Physical characterization

− Radioactive characterization

− Chemical characterization

− Segregation

− Packaging

- Analytical data or process knowledge documentation must be included with the waste information. Once waste is shipped to CWC, it is checked to ensure that each container matches the information approved during initial information review. Waste containers are inspected to determine if they meet acceptance criteria. Those meeting the criteria are accepted, offloaded, and stored. Noncompliant containers are isolated and evaluated, and either returned to the generator for resolution or remedied at SWOC using approved methods for handling the nonconforming condition safely.

- Venting Waste Containers[36]
  - There is a potential for hydrogen generation within specific waste containers, based on their contents. The amount of hydrogen generated is dependent on the radionuclide activity, organic or hydrogenous waste matrix, and distribution of the radionuclides in the organic or hydrogenous material matrix. Venting is performed to reduce the potential for flammable gas accumulations within waste containers.
  - Several different drum venting systems currently are available for use although other systems are also acceptable if they meet the safety functions specified in HNF-EP-0063. The venting systems facilitate installation of WIPP-certified filters in waste drums. These filters are designed to allow hydrogen and other flammable gases to diffuse from the drum while retaining radioactive materials.
  - While these capabilities exist in CWC, SWOC operations has decided that venting will normally be performed at T Plant.
- Container Management Program – limits source term (i.e., release fraction) for certain accidents
  - Container Management (Technical Safety Requirement-Specific Administrative Control (TSR-SAC)): The SAC elements of this program establish credited controls to ensure safe container staging and storage as follows. This control ensures that container handling, staging, and storing are conducted in a safe manner by providing controls on container acceptance, handling damaged containers, waste

[36] HNF 14741-10 (2013). Page 2-102

acceptance, and characterization. The SAC elements under this program that are credited as important controls are the following:[37]

- Bulged Container Exam
- Intrusive Operations
- Bulged Container Venting
- Container Integrity
- Venting/Staging Requirements

- Abnormal Container Management Program[38]
  - This control ensures that containers are inspected for potential damage prior to being handled (readily visible container surface areas), thus minimizing a potential accident that could lead to loss of containment and release of radioactive material during handling activities. The inspection allows early warning and taking a protective posture for identified hazardous conditions (e.g., bulging containers, unvented containers at inappropriate locations).

Safety Management Systems

- Nuclear Criticality Safety – spacing of high-SNM content containers, physical barriers
  - Criticality Safety Program at the Hanford Site (HNF-7098, CHPRC Criticality Safety Program) implements key requirements including the following[39]:
    - Fissionable material controls at locations where significant amounts of these materials might be present
    - Criticality safety training
    - CSERs
    - Criticality prevention specifications (CPS)
    - Criticality safety postings
    - Fissionable material labeling
    - Fissionable material storage
    - Criticality safety configuration control
    - Fissionable material packaging and transportation
    - Criticality safety for firefighting
    - Criticality safety inspections and assessments
    - Criticality safety nonconformance response
    - Emergency procedures following a criticality or potential criticality accidents
- Transportation Safety – for onsite and off-site shipments

Waste transportation involves shipments from offsite and onsite waste generators to CWC facilities. Onsite shipments must comply with the Transportation Safety Document (TSD), required under DOE O 460.1C, Packaging and Transportation Safety. The TSD is the approved documented safety analysis for onsite transportation and packaging activities. Offsite shipments (arriving or leaving) must comply with the requirements of 49 CFR 171, "Hazardous Materials Regulations" unless exceptions are made, usually with attendant special provisions like temporary closure of public roads for transportation to PermafixNW. Offsite shipments may be made by truck, railroad, or other transportation conveyance.

[37] HNF 14741-10 (2013). Page 3-155
[38] HNF 14741-10 (2013). Page 3-157
[39] HNF 14741-10 (2013). Page 3-360

The railroad tracks are located outside of the boundaries of the CWC facilities with the exception of T Plant, which has taken measures to preclude entry of a train without positive actions by Operations.[40]

Attachment 2

Full List of Chemical Container Inventory for a Sample Container at the CWC

SWITS R310 for Container 0089068[41]

STYRENE

BARIUM NITRATE

CHROMIC CHLORIDE

FERRIC SULFATE

CALCIUM IODIDE

MAGNESIUM PERCHLORATE

STRONTIUM NITRATE

ALUMINUM SULFATE

BORIC ACID

CALCIUM CHLORIDE

FERROUS AMMONIUM SULFATE

MERCURIC NITRATE

NEODYMIUM NITRATE

LANTHANUM NITRATE

LEAD NITRATE

CALCIUM SULFATE (PLASTER OF PARIS)

URANYL NITRATE

CEROUS NITRATE

CALCIUM NITRATE

FERRIC AMMONIUM SULFATE

AMMONIUM BISULFITE, SOLID

SODIUM TUNGSTATE

SILVER SULFATE

CERIUM NITRATE

CADMIUM NITRATE

SODIUM METAPHOSPHATE

[40] HNF 14741-10 (2013). Page 2-89
[41] SWITS (2014).

EU Designation: CP-OP-1 (CWC)

BARIUM CHLORIDE

YTTRIUM NITRATE

LITHIUM SULFATE

MAGNESIUM NITRATE

MANGANESE NITRATE

FERRIC NITRATE (TOX PER CAS 7782-61-8)

PERIODIC ACID

SODIUM DICHROMATE

P-CRESOL

P-DICHLOROBENZENE

VINYL CYCLOHEXENE DIOXIDE

1,2-DICHLOROETHANE

ETHYLENE GLYCOL

DIBUTYL PHOSPHATE

PROPYLENE GLYCOL MONOMETHYL ETHER

2-DIMETHYLAMINOETHANOL

4-METHYL-2-PENTANONE

M-CRESOL

TOLUENE

PHENOL

N-HEXANE

CYCLOHEXANE

PYRIDINE

ADIPONITRILE

SODIUM ALUMINATE

TRIOCTYLAMINEINE

OLEIC ACID

AMORPHOUS SILICA

BROMOCRESOL PURPLE

1,8-DIHYDROXYANTHRAQUINONE

GALLIUM OXIDE

PLUTONIUM II OXIDE

ARSENIC (V) OXIDE, HYDRATE

EU Designation: CP-OP-1 (CWC)

NICKEL HYDROXIDE

HAFNIUM OXIDE

BORON CARBIDE

2,4-DINITROTOLUENE

TRIETHYLAMINE

AMMONIUM FLUORIDE

AMMONIUM CHLORIDE

BORIC ACID, DISODIUM SALT, PENTAHYDRATE

HYDROQUINONE

BUTYL STEARATE

ALUMINUM HYDROXIDE SILICATE

TRIBUTYL PHOSPHATE (TBP)

ACETIC ACID, POTASSIUM SALT (POTASSIUM ACETATE)

TETRACHLOROETHYLENE

SODIUM BORATE, DECAHYDRATE

CALCIUM HYDROXIDE

CALCIUM OXIDE

CERIC OXIDE

FERRIC OXIDE

MAGNESIUM OXIDE

LEAD DIOXIDE

POTASSIUM HYDROXIDE

LITHIUM HYDROXIDE

SODIUM HYDROXIDE

AMMONIUM MOLYBDATE

MANGANESE DIOXIDE

NEODYMIUM OXIDE

NICKEL (II) NITRATE (1:2)

ZINC OXIDE

TUNGSTEN TRIOXIDE

PHOSPHORUS PENTOXIDE

VANADIUM PENTOXIDE (DUST) FUME NOT TOXIC

COPPER OXIDE

EU Designation: CP-OP-1 (CWC)

CALCIUM CARBONATE

SILICA, CRYSTALLINE - TRIPOLI

URANIUM OCTAOXIDE

TRANS-1,2-DIAMINOCYCLOHEXANE-N,N,N',N'-TETRAACETIC ACID

XYLENE (MIXED ISOMERS)

PROPYLENE GLYCOL

CHROMIUM TRIOXIDE

ALUMINUM SILICATE

AMMONIUM HYDROXIDE

SODIUM SELENATE

ALUMINUM OXIDE

URANIUM DIOXIDE

VANADYL SULFATE

TITANIUM OXIDE

ARSENOUS ACID, TRISODIUM SALT

HYDROXYLAMINE NITRATE

FERROUS CHLORIDE

CUPFERRON

CERIUM SULFATE

SODIUM PHOSPHITE

POTASSIUM FERROCYANIDE

ZINC NITRATE

THORIUM NITRATE

ZIRCONYL NITRATE

SODIUM SILICATE

NITRILOTRIACETIC ACID

AMMONIUM OXALATE

SODIUM OLEATE

SODIUM TETRAPHENYL BORON POWDER

SODIUM CITRATE

SODIUM BICARBONATE

OXALIC ACID

SILICA, CRYSTALLINE-CRISTOBALITE

EU Designation: CP-OP-1 (CWC)

CRYSTALLINE QUARTZ SILICA

SODIUM FORMALDEHYDE SULFOXYLATE

HYDROXYETHYLETHYLENEDIAMINETRIACETIC ACID, 2,NSODIUM

FLUOALUMINATE

HYDROFLUOSILICIC ACID

BARIUM HYDROXIDE

AMMONIUM THIOCYANATE

CHROMIUM (VI)

COPPER (II) NITRATE

SILVER (1+) OXIDE

CADMIUM HYDROXIDE

MERCURIC OXIDE

DIPHOSPHORIC ACID

SODIUM DODECYLBENZENESULFONATE

POLYETHYLENE GLYCOL

TRIHEPTYLAMINE, 6,6',6''-TRIMETHYLNONENYLSUCCINIC

ANHYDRIDE

BIS(2 ETHYL HEXYL)HYDROGEN PHOSPHATE

POTASSIUM BICARBONATE

LEAD ACETATE

POTASSIUM SODIUM TARTRATE

THENOYLTRIFLUOROACETONE

CHLORIC ACID, POTASSIUM SALT

EPOXY RESIN

ACETIC ACID, (1,2-CYCLOHEXYLENEDINITRILO)TETRA

SODIUM CARBONATE

FORMALDEHYDE

ASCORBIC ACID

SILVER CYANIDE

DINITROPHENOL, 2,4-

BARIUM CARBONATE

2-PROPANOL, 1-BUTOXY

GLUCONICACID 50% IN WATER

EU Designation: CP-OP-1 (CWC)

SULFAMIC ACID

HYDROXYLAMINE HYDROCHLORIDE

P-METHYLAMINOPHENOL SULFATE

ZINC STEARATE

CARBON TETRACHLORIDE

GLYCINE

GLYCEROL OR 1,2,3-PROPANETRIOL

UREA

SUCROSE

1,2-PROPANEDIOL

POTASSIUM CARBONATE

MERCURIC THIOCYANATE

EDTA (ETHYLENEDIAMINETETRAACETIC ACID)

SODIUM ACETATE

CRESOL RED, WATER SOLUBLE, INDICATOR GRADE

AMMONIUM ACETATE

SILICA GEL

TETRASODIUM N,N'-ETHYLENEDIAMINEDIACETATE

ETHANOL

FORMIC ACID

MINERAL OIL, PETROLEUM DISTILLATES (MILD & SEVERE)

NORMAL PARAFFINS

CLAY-TREATED RESIDUAL OILS (PETROLEUM)

HYDROTREATED (MILD & SEVERE) HEAVY PARAFFINIC DISTILLATE

HYDRODESULFURIZED KEROSENE (PETROLEUM)

GLYCINE, N,N-BIS(2-(BIS(CARBOXYMETHYL)AMINE)ETHYL)-

METHANOL

ISOPROPYL ALCOHOL

ACETONE

CHLOROFORM

HEXACHLOROETHANE

COTTONSEED OIL, HYDROGENATED

ZINC SALTS OF DIALKYLPHOSPHORODITHIOIC ACID (ADDITIVE INGRD)

EU Designation: CP-OP-1 (CWC)

D-MANNITOL

STYRENE/DVB ION EXCHANGE RESIN

BENZENE, DIETHENYL-, POLYMER; ETHENYLBENZENE &

ETENYLETHYLBENZENE, SU

SULFONATED COPOLYMER OF STYRENE AND DIVINYLBENZENE IN SODIUM

BUTYL ALCOHOL

BENZENE

1,1,1-TRICHLOROETHANE

PROPANE

ALUMINUM

IRIDIUM POWDER

IRON

LEAD

LITHIUM

MANGANESE

MERCURY

MOLYBDENUM

NICKEL

PLATINUM

PLUTONIUM

SILICON

SILVER

SODIUM

TIN

ARSENIC

BARIUM

BERYLLIUM

CADMIUM

CARBON

CHROMIUM

COPPER

GADOLINIUM

GOLD

EU Designation: CP-OP-1 (CWC)

VANADIUM

ZINC

ZIRCONIUM

BISMUTH

CALCIUM

ALUMINUM CHLORIDE

POTASSIUM CHLORIDE

VINYL CHLORIDE (CHLOROETHYLENE)

DICHLOROMETHANE

ISOBUTANE

1,1-DICHLOROETHYLENE

TRIMETHYL CHLOROSILANE

IODINE

SODIUM PHOSPHATE DIBASIC

1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE

PERCHLORIC ACID

SILICON DIOXIDE

SODIUM BISULFITE (PH = 4.56 PER T. HUGHES)

SODIUM NITRATE

SODIUM NITRITE

STANNIC CHLORIDE

ZINC CHLORIDE (REFERENCE MERCK INDEX)(PH = 2.5 OF 1:1 SOLN)

HYDROCHLORIC ACID

SODIUM CHLORIDE

SODIUM BROMIDE

HYDROFLUORIC ACID

AMMONIA

SULFURIC ACID

POTASSIUM IODIDE

SODIUM BISULFATE

SODIUM FLUORIDE

SODIUM HYPOCHLORITE

SODIUM IODIDE

EU Designation: CP-OP-1 (CWC)

NITRIC ACID

2-AMINO-2-(HYDROXYMETHYL)-1-3-PROPANNEDIOL

CITRIC ACID

SULFUR

TITANIUM TRICHLORIDE

FERRIC CHLORIDE

NICKEL (II) CHLORIDE (1:2)

FERROUS SULFATE

POTASSIUM PERMANGANATE

HYDROGEN PEROXIDE

BARIUM SULFATE

CHROMIC (VI) ACID

SODIUM SULFATE

SODIUM SULFITE

POTASSIUM BROMIDE

POTASSIUM IODATE

PYROPHOSPHORIC ACID, DISODIUM SALT

LEAD CHLORIDE (PB = 74.5% WT.)

SILVER NITRATE

DISODIUM SALT THIOSULFURIC ACID

STANNOUS CHLORIDE

MANGANESE CHLORIDE

MERCURIC IODIDE

CALCIUM SALT SULFURIC ACID

DIPOTASSIUM DICHROMATE

POTASSIUM PHOSPHATE

ZINC NITRATE

GRAPHITE

SELENIUM

NITROUS ACID

MOLYBDIC ACID

AMMONIUM THIOSULFATE

AMMONIUM PHOSPHATE DIBASIC

EU Designation: CP-OP-1 (CWC)

MERCUROUS SULFATE

ALUMINUM NITRATE

SODIUM ARSENITE

MANGANOUS SULFATE

AMMONIUM CHROMATE

POTASSIUM CHROMATE

POTASSIUM FLUORIDE

CALCIUM FLUORIDE

POTASSIUM PYROSULFATE

DIETHYL ETHYLPHOSPHONATE

2-BUTOXYETHANOL, PHOSPHATE

METHYL ETHYL KETONE

HYDROXYLAMINE

AMMONIUM VANADATE

TRICHLOROETHYLENE

CHLOROACETIC ACID

METHYL LACTIC ACID (ETHYLESTER)

METHYL ESTER METHACRYLIC ACID

CORN OIL

CASTOR OIL

KEROSENE

ACENAPHTHENE

SODIUM TARTRATE

TARTARIC ACID

PENTACHLOROPHENOL

GLUCONIC ACID, DELTA-LACTONE, DTRITON

X-100

ACRYLIC ACID, POLYMERS (RESIN)

POLYOXYETHYLENE MONOOCTYLPHENL ETHER

GLYCOLS, POLYETHYLENEPOLYPROPYLENE, MONOBUTYL ETHER

COPOLYMER OF STYRENE AND DIVINYLBENZENE

NAPHTHALENE

DIMETHYLGLYOXIME

EU Designation: CP-OP-1 (CWC)

O-CRESOL

NITROBENZENE

CONWED PADS

PETROLEUM HYDROCARBONS (NON-SPECIFIED)

PIGMENTS

ABSORBENTS (NON-SPECIFIED)

INERT MATERIAL (PAPER, WOOD, PLASTIC, ETC.)

POLYESTER RESIN

NAPHTHENIC OIL (NON-SPECIFIED)

ACRYLIC EMULSION/POLYMER

SILICONES (EMULSIFIED)

ETHERS (NON-SPECIFIED)

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