CVP-2015-00002
Rev. 0

Cleanup Verification Package for the 600-334:2, Burn Area Near CMX Building Waste Site

Prepared for the U.S. Department of Energy by Washington Closure Hanford

August 2015

EXECUTIVE SUMMARY

This cleanup verification package documents a Closed Out decision for the 600-334:2, Burn Area Near CMX Building subsite. The 600-334 waste site is located in the 100-IU-6 Operable Unit of the Hanford Site in southeastern Washington State. The 600-334:1, CMX Building and Surface Anomalies subsite was reclassified as Interim No Action in 2011 (WCH 2011).

The 600-334:2 subsite is a 4.6-m (15-ft)-diameter burn area of unknown origin found off the northwest corner of the former Corrosion and Materials Experiment (CMX) Building Complex. The CMX Building was used to determine a satisfactory treatment for the process water to be used in the aluminum process tubes of the Hanford Reactors. The objective was to guarantee continuous operation without interruption due to failure of the aluminum canned slugs or corrosion of the aluminum tubes.

Sampling of the 600-334:2 subsite was performed on October 28, 2010, and consisted of one focused sample. A summary of the cleanup evaluation for the soil results against the applicable criteria is presented in Table ES-1. The results of the sampling are used to make reclassification decisions for the 600-334:2 subsite in accordance with the TPA-MP-14 procedure in the *Tri-Party Agreement Handbook Management Procedures* (DOE-RL 2011).

Table ES-1. Summary of Results for the 600-334:2 Subsite. (2 Pages)

Regulatory Requirement	Cleanup Levels	Results	Remedial Action Objectives Attained?
Direct Exposure – Radionuclides	Attain radionuclide total excess cancer risk of <1 x 10^{-4} over 1,000 years.	Radionuclides were not COCs for the 600-334:2 subsite.	NA
Direct Exposure – Nonradionuclides	Attain individual COC direct exposure cleanup levels (CULs).	All individual COC concentrations are below the direct exposure CULs.	Yes
Nonradionuclide Risk Requirements	Attain hazard quotient of <1 for noncarcinogens.	All hazard quotients for individual nonradionuclide COCs and non-COCs are <1.	Yes
	Attain cumulative hazard quotient of <1 for noncarcinogens.	The residential cumulative hazard quotient for 600-334:2 subsite COCs and non-COCs is 2.38 x 10^{-3}, which is <1.	
	Attain excess cancer risk of <1 x 10^{-6} for individual carcinogens in the residential scenario.	The maximum excess cancer risk for an individual 600-334:2 subsite COC is 3.4 x 10^{-7}, which is less than 1 x 10^{-6}.	
	Attain a total excess cancer risk of <1 x 10^{-5} for carcinogens.	The total excess cancer risk for 600-334:2 subsite COCs 3.4 x 10^{-7}, which is less than 1 x 10^{-5}.	
Groundwater/River Protection – Radionuclides	Attain single COC groundwater and river protection CULs.	Radionuclides were not COCs for the 600-334:2 subsite.	NA
	Attain National Primary Drinking Water Standards: 4 mrem/yr (beta/gamma) dose rate to target receptors/organs [a].		
	Meet drinking water MCL for alpha emitters.		
	Meet total uranium drinking water standard of 21.2 pCi/L [b].		

Table ES-1. Summary of Results for the 600-334:2 Subsite. (2 Pages)

Regulatory Requirement	Cleanup Levels	Results	Remedial Action Objectives Attained?
Groundwater/River Protection – Nonradionuclides	Attain individual nonradionuclide groundwater and river cleanup requirements.	All individual COC concentrations are below the groundwater and/or Columbia River protection criteria.	Yes

[a] "National Primary Drinking Water Regulations" (40 *Code of Federal Regulations* 141).
[b] Based on the isotopic distribution of uranium in the Hanford Site background, the 30 µg/L uranium MCL (40 *Code of Federal Regulations* 141.66) corresponds to 21.2 pCi/L. Concentration-to-activity calculations are documented in *Calculation of Total Uranium Activity Corresponding to a Maximum Contaminant Level for Total Uranium of 30 Micrograms per Liter in Groundwater*, 0100X-CA-V0038 (BHI 2001).

COC = contaminant concern
CUL = cleanup level
MCL = maximum contaminant level (drinking water standard)
NA = not applicable

The current site conditions achieve the remedial action objectives (RAOs) and the corresponding cleanup levels established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Areas* (100 Area RDR/RAWP) (DOE-RL 2009b) and the *Record of Decision, Hanford Superfund Site, 100-FR-1, 100-FR-2, 100-FR-3, 100-IU-2, and 100-IU-6 Operable Units*, Hanford Site, Benton County, Washington (Final Action ROD) (EPA 2014). The results of sampling show that residual contaminant concentrations meet human health direct exposure cleanup levels for residential land use in the shallow zone soils (i.e., surface to 4.6 m [15 ft] deep). The results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. Waste site contamination above direct exposure levels was not observed in shallow zone soils and is not believed to extend into the deep zone soils. Therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required.

The site meets cleanup standards and has been reclassified as Final Closed Out in accordance with the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1989) and the Waste Site Reclassification Guideline TPA-MP-14 (RL-TPA-90-0001) (DOE-RL 2011). A copy of the stand-alone waste site reclassification form is included as part of the Executive Summary of this document.

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-IU-6 **Control No.:** 2015-008

Waste Site Code(s)/Subsite Code(s): 600-334:2

Reclassification Category: Interim ☐ Final ☒

Reclassification Status: Closed Out ☒ No Action ☐ Rejected ☐

RCRA Postclosure ☐ Consolidated ☐ None ☐

Approvals Needed: DOE ☒ Ecology ☐ EPA ☒

Description of current waste site condition:

The 600-334:2, Burn Area Near CMX Building, part of the 100-IU-6 Operable Unit, was identified as a subsite requiring remediation in the *Record of Decision, Hanford Superfund Site, 100-FR-1, 100-FR-2, 100-FR-3, 100-IU-2, and 100-IU-6 Operable Units*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington (Final Action ROD) (EPA 2014). The 600-334:2 subsite was previously included in the *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington (EPA 2009) as a candidate site for further evaluation

The 600-334:2 subsite is a burned area of unknown origin found off the northwest corner of the former Corrosion and Materials Experiment (CMX) Building Complex. The CMX Building was used to determine a satisfactory treatment for the process water to be used in the aluminum process tubes of the Hanford Reactors.

Sampling of the 600-334:2 subsite was performed on October 28, 2010, and consisted of one focused sample. No further action was necessary to achieve remedial action goals at this subsite.

Basis for reclassification:

The sampling results were evaluated in comparison to the cleanup levels and remedial action objectives (RAOs) from the Final Action ROD (EPA 2014). In accordance with this evaluation, the sampling results support a reclassification of the 600-334:2 subsite to Final Closed Out. The waste site was demonstrated to achieve cleanup levels for a residential land-use scenario and to protect groundwater and the Columbia River. The results of sampling show that contaminant concentrations meet human health direct exposure cleanup levels for residential land use and applicable standards for groundwater and river protection in the shallow zone (i.e., surface to 4.6 m [15 ft] deep). Contamination above direct exposure levels was not observed in shallow zone soils and is not believed to extend into the deep zone soils. Therefore, institutional controls to prevent uncontrolled drilling or excavation into deep zone soils are not required. The basis for reclassification is described in detail in the *Cleanup Verification Package for the 600-334:2, Burn Area Near CMX Building Subsite.*

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-IU-6 **Control No.:** 2015-008

Waste Site Code(s)/Subsite Code(s): 600-334:2

Regulator comments:

Waste Site Controls:

Engineered Controls: ☐ Yes ☒ No Institutional Controls: ☐ Yes ☒ No O&M Requirements: ☐ Yes ☒ No

If any of the Waste Site Controls are checked Yes, specify control requirements including reference to the Record of Decision, TSD Closure Letter, or other relevant documents:

J. P. Neath DOE Federal Project Director (printed)	Signature	8/13/15 Date
NA Ecology Project Manager (printed)	Signature	Date
C. Guzzetti EPA Project Manager (printed)	Signature	8/13/15 Date

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ACRONYMS AND ABBREVIATIONS

COC	contaminant of concern
CUL	cleanup level
CVP	cleanup verification package
DQA	data quality assessment
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
RAO	remedial action objective
ROD	record of decision
RTD	remove, treat, dispose
SAP	sampling and analysis plan
WAC	*Washington Administrative Code*

1.0 INTRODUCTION

This cleanup verification package (CVP) documents that the 600-334:2, Burn Area Near CMX Building subsite is closed as Final Closed Out in accordance with the *Record of Decision, Hanford Superfund Site, 100-FR-1, 100-FR-2, 100-FR-3, 100-IU-2, and 100-IU-6 Operable Units*, (Final Action ROD) (EPA 2014). Remedial action objectives (RAOs), and associated cleanup levels (CULs) for this site are documented in the Final Action ROD (EPA 2014).

The remedy specified in the Final Action ROD (EPA 2014) for the 600-334:2 subsite included excavating the site to the extent required to meet specified soil CULs and disposing of contaminated excavation materials at the Environmental Restoration Disposal Facility (ERDF) in the 200 Area of the Hanford Site. However, upon evaluation of sampling data for this subsite, the 600-334:2 subsite meets the specified soil CULs without remove, treat, dispose (RTD). The Final Action ROD (EPA 2014) for the 600-334:2 subsite established RAOs based on a residential land use scenario. Professional judgment and available site history were used to identify final contaminants of concern (COCs) for the sampling as discussed in the *Work Instruction for Confirmatory Sampling of 600-334, CMX Building* (WCH 2010). The 600-334:1, CMX Building and Surface Anomalies subsite was previously reclassified as Interim No Action (WCH 2011).

2.0 SITE DESCRIPTION AND SUPPORTING INFORMATION

2.1 SITE DESCRIPTION

The 600-334:2 subsite is a 4.6-m (15-ft)-diameter burn area of unknown origin found off the northwest corner of the former Corrosion and Materials Experiment (CMX) Building Complex (Figure 1, Area 4). The CMX Building was used to determine a satisfactory treatment for the process water to be used in the aluminum process tubes of the Hanford Reactors. The 600-334:2 subsite was identified through the orphan sites evaluation process (*100-D Area Orphan Sites Evaluation Report* [WCH 2009]).

Sampling of the 600-334:2 subsite was performed on October 28, 2010, and consisted of one focused sample (Figure 2). Sample results determined that remediation was not necessary to achieve residential RAOs and CULs established by the Final Action ROD (EPA 2014).

Figure 1. The 600-334 Waste Site Waste Site Location Map, Including the 600-334:2 Subsite (Area 4).

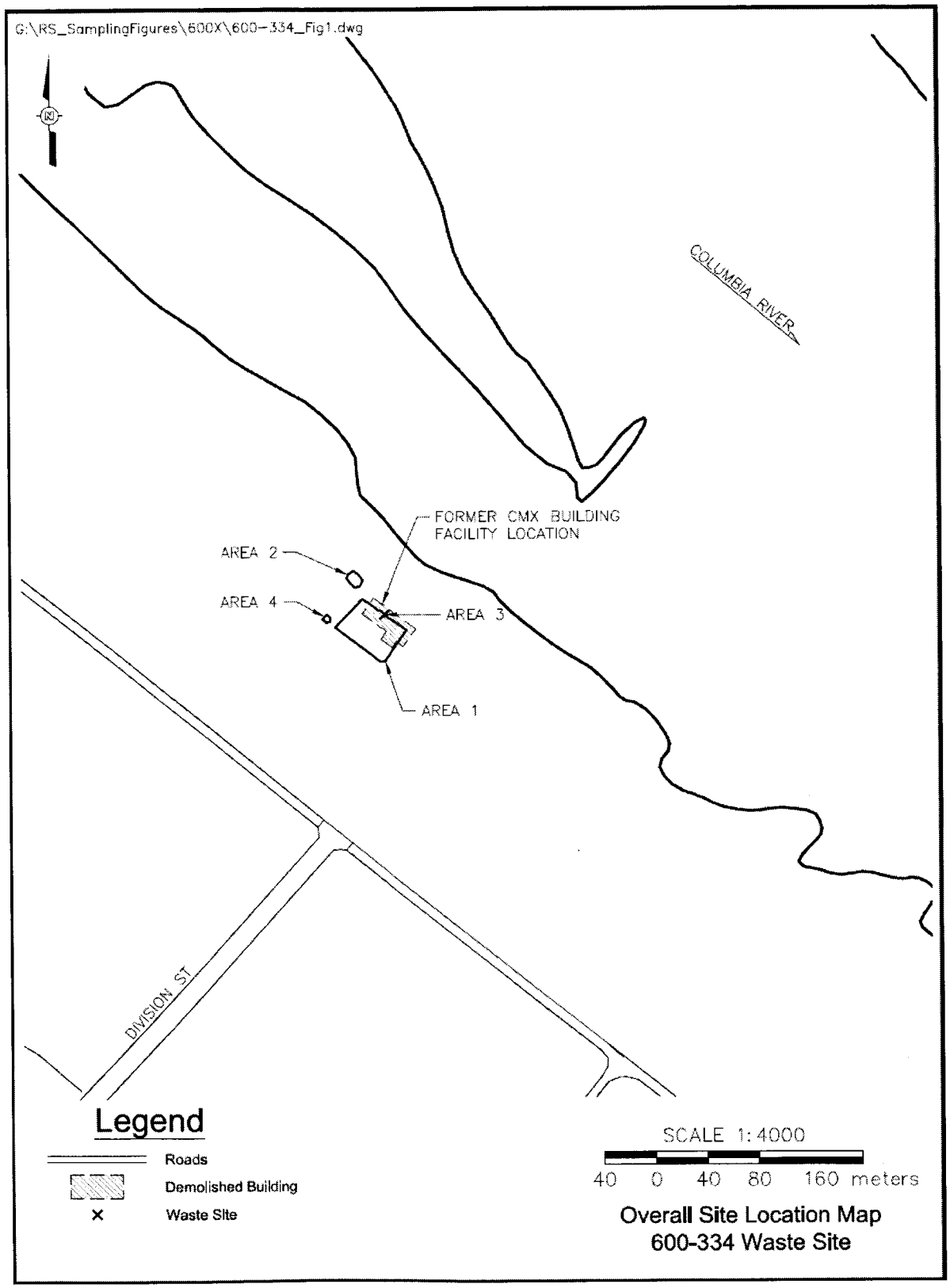

Figure 2. The 600-334:2 Subsite During Sampling (October 28, 2010).

2.2 HISTORY

As reactor operations began in the 100 Area of the Hanford Site, limited information was available on the corrosion of aluminum in water under reactor operation conditions. It was anticipated that corrosion may be accelerated by impurities such as chlorides, copper, heavy metals, oxygen, and hydrogen peroxide. Confounding factors such as pH and temperature were also suspected to contribute to possible corrosion. The CMX Facility was placed along the Columbia River to address these concerns and quantitatively assess the effects and limitations of the available reactor operation design features.

The purpose of the CMX Facility was to determine a satisfactory treatment for the process water to be used in the aluminum process tubes of the Hanford Reactors to guarantee continuous operation was possible without interruption due to failure of either the aluminum canned slugs or corrosion of the aluminum tubes. A secondary purpose was to develop technology to prevent or minimize the formation of film or scale on the slugs or tubes, as well as to develop methods for film and scale removal if formation occurred.

The test equipment included six aluminum tubes, approximately 3 m (10 ft) in length. In early 1944, two of these tubes were replaced with full-length 12-m (40-ft) tubes that would actually be used in the reactor piles. Columbia River water was fed to these tubes and the quality of the water was varied by filtration, demineralization, deaeration, and many combinations of chemicals and chemical additions. Water temperature and velocity were also varied. In June 1944, a flocculator (with agitator) and a 95,600-L (25,000-gal) clearwell were added to the CMX Facility to study the removal of iron and aluminum from the river water.

Over a 2-year period, the optimum concentrations of anti-corrosion and anti-scaling chemicals were tested and perfected. The additives for this testing were primarily sodium dichromate for anti-corrosion and sodium silicate for anti-scaling. Although it is not confirmed, analysis of the relevant photographs indicates that the discharges from the facility likely went directly into the river. The river intake extended into the main channel of the river because the water near the shore was not representative of the 100 Area operations water (HEW 1943).

The secondary purpose of the CMX Facility for film and scale research included the use of settling tanks, sand filters, deaeration, and demineralization water treatment systems. Chemicals used in the process included sulfuric acid, ferric sulfate, oxalic acid, and hydrogen peroxide. It is believed that most of the piping used for the developmental processes were stainless steel or lined with rubber.

An additional feature of the CMX Facility was the use of five discarded steam locomotives located northwest of the 145 Building to provide heat for water temperature experiments and building heating (Appendix A). These locomotives are thought to have been either coal- or fuel oil-fired. A steam-driven compressor provided compressed air for the laboratory.

3.0 SAMPLING ACTIVITIES

Sampling at the 600-334:2 subsite was performed on October 28, 2010, and consisted of one focused sample. The following subsections provide additional discussion of the information used to develop the sampling design. A more detailed discussion of the

sample design can be found in the *Work Instruction for Confirmatory Sampling of 600-334, CMX Building* (WCH 2010).

3.1 CONTAMINANTS OF CONCERN FOR SAMPLING

The COCs for the 600-334:2 subsite were identified based on the existing historical information for the site. The COCs for the 600-334:2 subsite are mercury, lead, hexavalent chromium, nitrate, sulfate, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAH), semivolatile organic compounds (SVOCs), and total petroleum hydrocarbons (TPH). Due to evidence of burning at the subsite and historical documentation of a large number of chemical additions, both PAH and SVOC analysis were performed.

3.2 SAMPLING DESIGN SELECTION AND BASIS

This section describes the basis for selection of an appropriate sample design and determination of the number of samples that were collected. There was one decision unit identified for the 600-334:2 subsite for sampling.

3.2.1 Focused Sampling Design

Figure 3 presents the focused sample location. Professional judgment and site walkdown observations were used to identify the sample location. A surface sample was collected at the approximate center of the material that showed evidence of previous burning.

A discrete soil sample was collected at the designated sample point (0 to 0.15 m [0 to 6 in.]) below the surface of the excavated waste site) and analyzed using the methods identified in Table 1. The soil sampling location was global positional surveyed and staked prior to sample collection using the coordinate pair provided in Table 2. All sampling was performed in accordance with ENV-1, *Environmental Monitoring & Management*, to fulfill the requirements of the *100 Area Remedial Action Sampling and Analysis Plan* (100 Area SAP) (DOE-RL 2009a).

Contaminants of concern and contaminants of potential concern (COPCs) for the 600-334:2 subsite were identified based on historical information for the site. The COC/COPC list includes mercury, lead, hexavalent chromium, nitrate, sulfate, PCBs, PAH, SVOCs, and TPH. Both PAH and SVOC analysis was performed due to historical documentation of chemical additions at the CMX facility. While not considered COCs, antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc were evaluated by performing analysis of the expanded inductively coupled plasma (ICP) metals analytical list.

Figure 3. Sampling Map for the 600-334:2 Subsite.

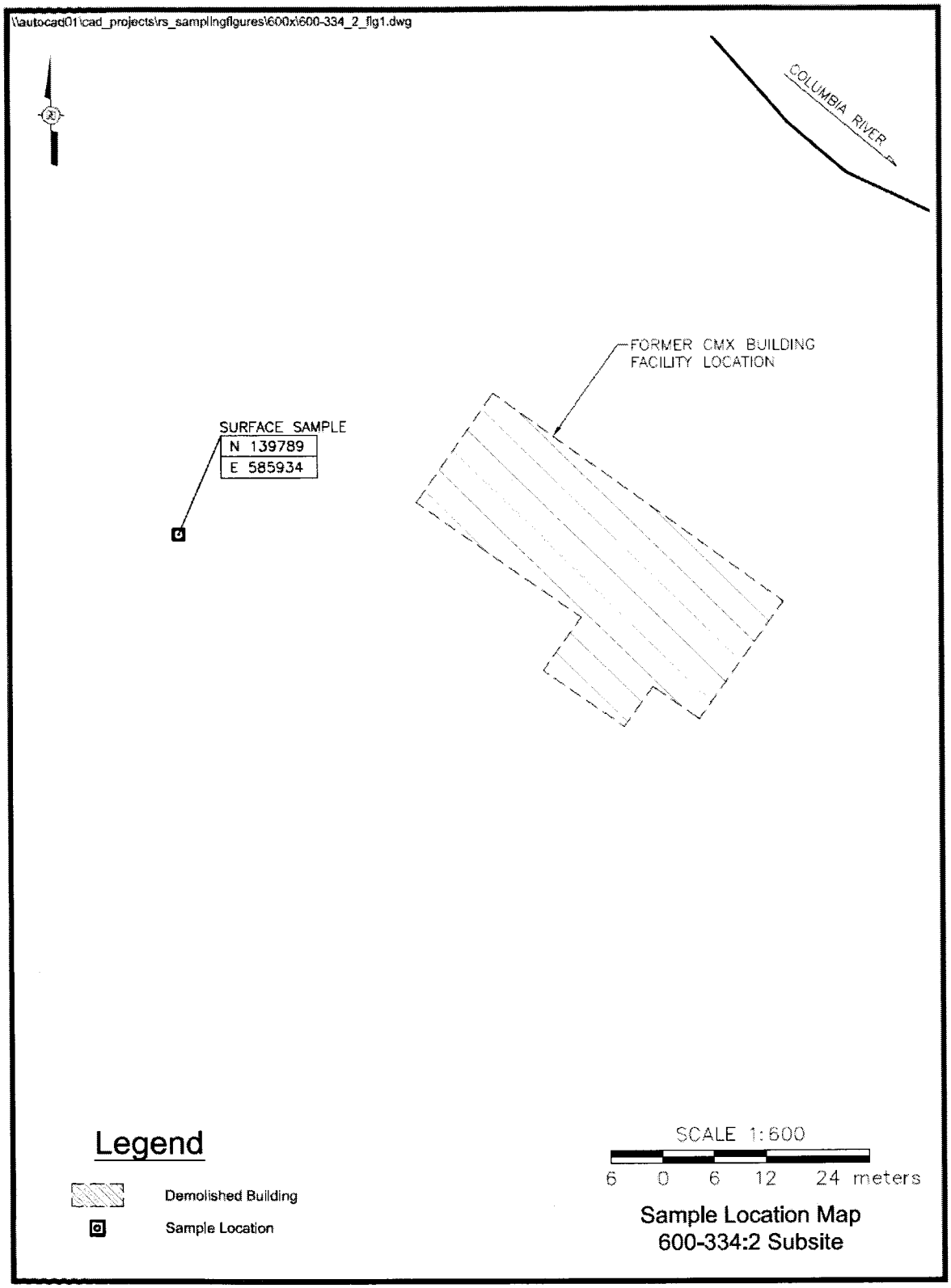

Table 1. Laboratory Analytical Methods.

Analytical Method	COC/COPC
ICP metals – EPA Method 6010	Lead [a]
Mercury – EPA Method 7471	Mercury
Cr^{+6} – EPA Method 7196	Hexavalent chromium
IC anions – EPA Method 300.0	Sulfate [b]
Nitrate/nitrite – EPA Method 353.2	Nitrate
PAH [c] – EPA Method 8310	Polycyclic aromatic hydrocarbons
SVOA – EPA Method 8270	Semivolatile organic compounds [b]
PCB – EPA Method 8082	Polychlorinated biphenyls
TPH – NWTPH-Dx	Petroleum hydrocarbons

[a] Although not considered COCs, the expanded list of ICP metals analysis was performed to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.
[b] Sulfate and SVOCs are not COCs in the Final Action ROD (EPA 2014).
[c] Because Method 8310 is specifically meant to analyze for PAH, data from this method was used preferentially over the Method 8270 data for site evaluation of the PAH analytes.

COC = contaminant of concern
COPC = contaminant of potential concern
EPA = U.S. Environmental Protection Agency
IC = ion chromatography
ICP = inductively coupled plasma
NWTPH-Dx = Northwest total petroleum hydrocarbons
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyl
ROD = record of decision
SVOA = semivolatile organic analysis
SVOC = semivolatile organic compound
TPH = total petroleum hydrocarbons

Table 2. Sample Summary Table for the 600-334:2 Subsite.

Sample Location	HEIS Sample Number	Washington State Plane Coordinate Locations (m)		Sample Analysis [a]
		Northing	Easting	
Surface sample	J1B783	139789	585934	ICP metals [a], mercury, hexavalent chromium, IC anions, nitrate/nitrite, PAH, SVOA, PCB, TPH

[a] The expanded list of ICP metals included antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc in the analytical results package.

HEIS = Hanford Environmental Information System
IC = ion chromatography
ICP = inductively coupled plasma
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyl
SVOA = semivolatile organic analysis
TPH = total petroleum hydrocarbons

Field instrumentation capable of detecting alpha, beta, and gamma radiation was used during sampling. No radiological activity was detected in the field above background levels; therefore, radionuclides were not considered COCs/COPCs and laboratory analysis for radionuclides was not performed. Additionally, an organic vapor monitor was used to field screen all material prior to sample collection. Organics were not detected in the field; therefore laboratory volatile organic analysis was not performed. Finally, suspected asbestos-containing material was not observed during sampling activities; therefore, asbestos analysis was not performed.

4.0 SAMPLING RESULTS

This section presents the evaluation of the 600-334:2 subsite data for comparison with the data quality criteria and CULs. The samples were submitted to offsite laboratories for analysis using approved U.S. Environmental Protection Agency (EPA) analytical methods as required per the 100 Area SAP (DOE-RL 2009a).

4.1 FOCUSED SAMPLE RESULTS

The laboratory-reported data results for all constituents are stored in the Environmental Restoration project-specific database prior to archival in the Hanford Environmental Information System and are presented as Attachment 1 of the Direct Contact Hazard Quotient Calculation (Appendix A).

The 600-334:2 subsite consisted of one decision unit for sampling. The data from the burned area footprint were evaluated using direct comparison for residual concentrations of COCs as specified by the Final Action ROD (EPA 2014). If no detections for a given COC were reported in the data set, then no comparison to CULs were performed for that COC.

Comparisons of the results for COCs against the CULs for the footprint of the 600-334:2 subsite excavation are summarized in Table 3. Contaminants that were not detected by laboratory analysis are excluded from this table, but are reported in Appendix A.

Contaminants of concern for the 100-IU-6 Operable Unit were selected in the Final Action ROD (EPA 2014).

Table 3. Comparison of Contaminant Concentrations to Residential Cleanup Levels for the 600-334:2 Subsite Sampling.

COC	Result [a] (mg/kg)	Nonradionuclide Direct Exposure CULs [b] (mg/kg)	Nonradionuclide Groundwater and River Protection CULs [b] (mg/kg)	Does the Result Exceed CULs?
Lead	2.1 (<BG)	250	--	No
Mercury	0.057	24	--	No
Nitrogen in nitrate	1.1 (<BG)	128,260	11,300	No
TPH – diesel range	520	2,000	2,000	No
TPH – diesel range extended	1,000	2,000	2,000	No

[a] Value from sample results Appendix A.
[b] CULs obtained from Table 5 of the Final Action ROD (EPA 2014).

-- = not applicable
BG = background
COC = contaminant of concern
CUL = cleanup level
TPH = total petroleum hydrocarbons

4.2 DATA QUALITY ASSESSMENT (DQA) PROCESS

A DQA is performed to compare the sampling approach and resulting analytical data with the sampling and data quality requirements specified by the project objectives and performance specifications.

The DQA for the 600-334:2 subsite determined that the data are of the right type, quality, and quantity to support site verification decisions within specified error tolerances. All analytical data were found to be acceptable for decision-making purposes. The evaluation also verified that the sample design was sufficient to support clean site verification. The sample analytical data are stored in the Washington Closure Hanford project-specific database prior to archiving in the Hanford Environmental Information System and are presented as attachments to the direct contract hazard quotient calculation Appendix A. The detailed DQA is presented in Appendix B.

5.0 CLEANUP VERIFICATION DATA EVALUATION

This section demonstrates that sampling at the 600-334:2 subsite has achieved the CULs developed to support residential land use with no further action required, as established in the Final Action ROD (EPA 2014). The cumulative residential hazard quotient calculated for the 600-334:2 subsite meets the cumulative noncarcinogenic risk criteria. The calculations for residential land use demonstrate that the 600-334:2 subsite, identified as requiring RTD in Table 1 of the Final Action ROD (EPA 2014),

meets the requirements for the residential direct contact hazard quotient and excess carcinogenic risk, respectively, as identified in the Final Action ROD (EPA 2014), with no RTD required.

5.1 COMPARISON OF SAMPLE DATA TO CULS

5.1.1 Direct Comparison of Sample Data to the CULs

Evaluation of the results listed in Table 3 from the sampling at the 600-334:2 subsite indicates that all nonradionuclide COCs were undetected and/or quantified below the CULs. It should be noted that other non-COC constituents in the analysis were detected below background and/or CULs, including arsenic, barium, beryllium, cadmium, total chromium, cobalt, copper, manganese, nickel, vanadium, zinc, fluoride, sulfate, acenapthene, benzo(b)fluoranthene, chrysene, and fluorine. Additionally, phenanthrene and pyrene were detected via Method 8270, but were not detected with Method 8310. These results are included in Appendix A.

The ecological risk evaluations discussed in Section 7.2 of the Final Action ROD (EPA 2014) concluded that 100-IU-6 interim remedial actions that achieved interim action ROD CULs to protect human health were also protective of ecological receptors. No further evaluation or screening of potential ecological risk is necessary to be performed in CVPs or other supporting documents for waste site reclassification.

5.1.2 Nonradionuclide Evaluation of Risk Standards

Table 3 provides a comparison of the nonradioactive sampling results to the direct exposure, groundwater protection, and river protection CULs.

5.1.2.1 Attainment of Nonradionuclide Noncarcinogenic and Carcinogenic Risk Standards. The work instruction identified lead, mercury, hexavalent chromium, sulfate, nitrate, PAH, SVOCs, PCBs, and TPH as the 600-334:2 subsite COCs (WCH 2010). However, the Final Action ROD (EPA 2014) identified a cumulative COC list for the entire 100-IU-6 Operable Unit. All detected constituents in 600-334:2 subsite sampling that are listed as COCs in Table 3 of the Final Action ROD (EPA 2014) were conservatively evaluated as 600-334:2 subsite COCs in the hazard quotient calculations (Appendix A). The direct contact hazard quotient was calculated separately for non-COC constituents that were detected in 600-334:2 subsite samples, but are not listed as COCs in Table 3 of the Final Action ROD (EPA 2014).

For COCs with noncarcinogenic effects, *Washington Administrative Code* (WAC) 173-340 specified the evaluation of the hazard quotient, which is given as daily intake divided by a reference dose (WAC 173-340-200). The solutions and details of the hazard quotient calculations for 600-334:2 subsite are provided in Appendix A.

Nonradionuclide risk requirements for the residential scenario include an individual hazard quotient of less than 1.0, a cumulative hazard quotient of less than 1.0, an individual contaminant carcinogenic risk of less than 1×10^{-6}, and a cumulative carcinogenic risk of less than 1×10^{-5}. Hazard quotient and excess carcinogenic risk calculations were performed for the 600-334:2 subsite using the values from the samples. Risk values were not calculated for constituents that were not detected or were detected at concentrations below Hanford Site or Washington State background values. All individual hazard quotients are below 1.0, and all individual excess carcinogenic risk values are below 1×10^{-6}. The cumulative hazard quotient for the 600-334:2 subsite COCs and non-COCs is 2.38×10^{-3}, satisfying the criteria to be less than 1.0. The individual and cumulative excess cancer risk for COCs is 3.4×10^{-7}, satisfying the criteria to be less than 1×10^{-6} and less than 1×10^{-5}.

5.1.2.2 Attainment of Nonradionuclide Groundwater Cleanup Levels. Evaluation of the results in Table 3 from sampling at the 600-334:2 subsite show that no contaminants exceed groundwater and/or Columbia River CULs. The CULs protective of the groundwater and the Columbia River for the 100-IU-6 Operable Unit are provided in Table 6 of the Final Action ROD (EPA 2014).

6.0 STATEMENT OF PROTECTIVENESS

This CVP demonstrates that sampling at the 600-334:2 subsite achieved the RAOs and corresponding CULs established for the residential land-use scenario in the Final Action ROD (EPA 2014). No remedial action was required, based on sampling results that indicate that the site supports future land uses that can be represented (or bounded) by the residential land-use scenario and poses no threat to groundwater or the Columbia River. Waste site contamination above direct exposure levels was not observed in shallow zone soils and is not believed to extend into the deep zone soils. Therefore, institutional controls are not required to prevent uncontrolled drilling or excavation into the deep zone. The 600-334:2 subsite is confirmed to not require remedial action in accordance with the Final Action ROD (EPA 2014) and may be reclassified to a status of Final Closed Out.

7.0 REFERENCES

40 CFR 141, "National Primary Drinking Water Regulations," *Code of Federal Regulations,* as amended.

BHI, 2001, *Calculation of Total Uranium Activity Corresponding to a Maximum Contaminant Level for Total Uranium of 30 Micrograms per Liter in Groundwater*, 0100X-CA-V0038, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

DOE Order 5400.5, *Radiation Protection of the Public and the Environment*, U.S. Department of Energy, Washington, D.C., as amended.

DOE-RL, 2009a, *100 Area Remedial Action Sampling and Analysis Plan,* DOE/RL-96-22, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2009b, *Remedial Design Report/Remedial Action Work Plan for the 100 Areas,* DOE/RL-96-17, Rev. 6, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2011, *Tri-Party Agreement Handbook Management Procedures*, RL-TPA-90-0001, Guideline Number TPA-MP-14, "Maintenance of the Waste Information Data System (WIDS)," Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order,* 2 vols., as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

ENV-1, *Environmental Monitoring & Management*, Washington Closure Hanford, Richland, Washington.

EPA, 1999, *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

EPA, 2009, *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

HEW, 1943, "CMX Bldg. 145 Weekly Report 10-31-43 to 11-6-43," DUH-11683, E. I. Dupont De Nemours & Company, Hanford Engineer Works, Richland, Washington.

WAC 173-340, 1996, "Model Toxics Control Act – Cleanup" *Washington Administrative Code*.

WCH, 2010, *Work Instruction for Confirmatory Sampling of 600-334, CMX Building*, 0600X-WI-G0034, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2011, *Remaining Sites Verification Package for the 600-334:1, CMX Building and Surface Anomalies*, Rev. 0, WSRF 2011-002.

APPENDIX A

CALCULATIONS

APPENDIX A

CALCULATIONS

The calculations in this appendix are kept in the active Washington Closure Hanford project files and are available upon request. When the project is completed, the files will be stored in a U.S. Department of Energy, Richland Operations Office, repository. These calculations have been prepared in accordance with ENG-1, *Engineering Services*, ENG-1-4.5, "Project Calculations," Washington Closure Hanford, Richland, Washington. The following calculations are provided in this appendix:

600-334:2 Subsite Confirmatory Direct Contact Hazard Quotient and Carcinogenic Risk Calculations, 0600X-CA-V0187, Rev. 0, Washington Closure Hanford, Richland, Washington.....A-2

DISCLAIMER FOR CALCULATIONS

The calculations provided in this appendix have been generated to document compliance with established cleanup levels. These calculations should be used in conjunction with other relevant documents.

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CALCULATION COVER SHEET

Project Title: 600 Area Closure Operations **Job No. 14655**

Area: 600 Area

Discipline: Environmental *Calculation No: 0600X-CA-V0187

Subject: 600-334:2 Subsite Confirmatory Direct Contact Hazard Quotient and Carcinogenic Risk Calculations

Computer Program: Excel Program No: Excel 2010

The attached calculations have been generated to document compliance with established cleanup levels. These calculations should be used in conjunction with other relevant documents in the administrative record.

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Summary = 4 Attachment = 2 Total = 7	J. D. Skoglie	S. W. Clark	T. Q. Howell	S. G. Wilkinson	2/23/15

SUMMARY OF REVISION

WCH-DE-018 (05/08/2007) *Obtain Calc. No. from Document Control and Form from Intranet

Washington Closure Hanford CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	2/17/2015	Calc. No.:	0600X-CA-V0187	Rev.:	0
Project:	600 Area Closure Operations	Job No:	14655	Checked:	S. W. Clark	Date:	2/17/2015
Subject:	600-334:2 Subsite Confirmatory Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 1 of 4	

PURPOSE:

Provide documentation to support the calculation of the direct contact hazard quotient (HQ) and excess carcinogenic risk calculations for the 600-334:2 subsite. In accordance with the cleanup levels (CUL) in the Final Action Record of Decision (ROD) for the 100-F/IU Area (EPA 2014), the following criteria must be met:

1) An HQ of <1.0 for all individual noncarcinogens
2) A cumulative HQ of <1.0 for noncarcinogens
3) An excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens
4) A cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.

GIVEN/REFERENCES:

1) DOE-RL, 2009, *100 Area Remedial Action Sampling and Analysis Plan,* DOE/RL-96-22, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

2) Ecology, 2007, WAC 173-340, "Model Toxics Control Act – Cleanup," *Washington Administrative Code,* November 2007 Revision.

3) Ecology, 2014, *Cleanup Levels and Risk Calculations (CLARC) Database,* Washington State Department of Ecology, Olympia, Washington, <https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>.

4) EPA, 2014, *Record of Decision, Hanford 100 Area Superfund Site, 100-FR-1, 100-FR-2, 100-FR-3, 100-IU-2, and 100-IU-6 Operable Units*, September 2014, U. S. Environmental Protection Agency, Region 10, Seattle, Washington.

5) WAC 173-340, "Model Toxics Control Act – Cleanup," *Washington Administrative Code*, 2007.

6) WCH, 2015, *Cleanup Verification Package for the 600-334:2, Burn Area Near CMX Building Waste Site*, CVP-2015-00002, Washington Closure Hanford, Richland, Washington.

SOLUTION:

Values of the cleanup levels in Table 5 of the Final Action ROD for the 100-F/IU Area (EPA 2014) were used for the 600-334:2 subsite contaminants of concern (COCs). For the non-COCs the formula and reference dose (RfD) from WAC 173-340 were used.

1) Generate an HQ for each noncarcinogenic constituent detected above background or required detection limit/practical quantitation limit and compare it to the individual HQ of <1.0 (EPA 2014).

2) Sum the HQs and compare this value to the cumulative HQ of <1.0.

3) Generate an excess cancer risk value for each carcinogenic constituent detected above background or required detection limit/practical quantitation limit and compare it to the excess cancer risk of $<1 \times 10^{-6}$ (EPA 2014).

4) Sum the excess cancer risk value(s) and compare it to the cumulative cancer risk of $<1 \times 10^{-5}$.

BAP TEC Calculations

Per Ecology, 2007, compliance with cleanup levels for mixtures of carcinogenic polycyclic aromatic hydrocarbons (PAHs) is determined by considering mixtures of carcinogenic PAHs as a single hazardous substance and using the cleanup levels established for benzo(a)pyrene (BAP) as the cleanup level for mixtures of carcinogenic PAHs. Statistical values representing the PAH concentrations for each decision unit are determined, or the maximum detected value is selected for focused samples. The selected value for each PAH is multiplied by the corresponding toxicity equivalency concentration (TEC) as shown in Table 1 to obtain the BAP TEC for that carcinogenic PAH. The TECs of all the carcinogenic PAHs are summed to obtain the total BAP TEC for the subject decision unit.

Table 1. Toxic Equivalent Concentrations of Benzo(a)pyrene [a]

Carcinogenic Polyaromatic Hydrocarbons	Maximum or Statistical Result (mg/kg)	Toxic Equivalency Factors (Unitless)	Toxic Equivalency BAP Concentration (mg/kg)
Benzo(b)fluoranthene	0.15	0.1	0.015
Chrysene	3.2	0.01	0.032
Total Toxic Equivalency Concentration of Benzo(a)pyrene			0.047

[a] From WAC 173-340-708(8)(e), Table 708-2 (Ecology 2007)

BAP = benzo(a)pyrene

METHODOLOGY:

The 600-334:2 subsite excavation is comprised of one focused confirmatory sample. The direct contact hazard quotient and carcinogenic risk calculations for the 600-334:2 subsite were conservatively calculated for the entire waste site using the confirmatory soil sample results from Attachment 1. Of the COC's for this site, mercury requires an HQ calculation because this analyte was detected above a Hanford Site background value. Benzo(b)fluoranthene and chrysene were detected and summed as shown in Table 1 to obtain the total BAP TEC. Although total petroleum hydrocarbons (diesel range extended) were detected and no background value is available, the risk associated with total petroleum hydrocarbons does not contribute to the cumulative toxicity calculation. All other site nonradionuclide COCs were not detected or were quantified below background levels. Risk values for non-COCs were calculated but are for information purposes only. An example of the HQ and cancer risk calculations is presented below:

Washington Closure Hanford CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	2/23/2015	Calc. No.:	0600X-CA-V0187	Rev.:	0
Project:	600 Area Closure Operations	Job No:	14655	Checked:	S. W. Clark	Date:	2/23/2015
Subject:	600-334:2 Subsite Confirmatory Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 3 of 4	

1) For example the COC, mercury, was detected above a Hanford Site background value. The HQ for mercury was calculated in Table 2 using the following formula and reference dose (RfD) from the WAC 173-340: HQ = (Concentration) x (Daily Intake Factor) / (RfD). Where the Daily Intake Factor is 1.25E-05 and the concentration and RfD are presented in Table 2. The HQ for mercury is 2.38E-03 and the total cumulative HQ for all COC's is also 2.38E-03 which is less than 1. Therefore, the requirement of <1.0 has been met and the criterion (<1.0) for cumulative HQ is also met.

2) To calculate the excess cancer risk in Table 2, the following formula and cancer potency factor (CPF) from WAC 173-340 are used: Excess Cancer Risk = (Concentration) x (Daily Intake Factor) x (CPF). The excess cancer risk for the total BAP TEC is the total BAP TEC of 0.047 from Table 1, times the Daily Intake Factor of 1.0E-06, times the CPF of 7.30E+00 presented in Table 2. For the 600-334:2 subsite, the excess cancer risk for the total BAP TEC is 3.43×10^{-7}, which is $<1 \times 10^{-6}$. Therefore, the criterion for excess cancer risk is met. Consequently, because the total BAP TEC is the only carcinogenic concentration, the criterion for cumulative excess cancer risk (1.0×10^{-5}) for carcinogens is also met.

RESULTS:

1) List individual noncarcinogens and corresponding HQs for COC's >1.0: None
2) List the cumulative noncarcinogenic HQ for COC's >1.0: None
3) List individual carcinogens and corresponding excess cancer risk for COC's $>1 \times 10^{-6}$: None
4) List the cumulative excess cancer risk for carcinogens for COC's $>1 \times 10^{-5}$: None

Table 2 shows the results of the hazard quotient and excess cancer risk calculations.

Washington Closure Hanford CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	2/23/2015	Calc. No.:	0600X-CA-V0187	Rev.:	0
Project:	600 Area Closure Operations	Job No:	14655	Checked:	S. W. Clark	Date:	2/23/2015
Subject:	600-334:2 Subsite Confirmatory Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 4 of 4	

Table 2. Direct Contact Hazard Quotient and Excess Cancer Risk Results for the 600-334:2 Subsite.

COCs	Maximum Value [a] (mg/kg)	Oral Reference Dose (RfD) [b] (mg/kg-day)	Hazard Quotient	Cancer Potency (Slope) Factor [b] (mg/kg-day) -1	Cancer Risk	Source of COC
Metals (mg/kg)						
Mercury	0.057	3.00E-04	2.38E-03	NA	--	Final ROD
Total Petroleum Hydrocarbons (TPH) (mg/kg)						
TPH - Diesel Range EXT [c]	1,000	NA	--	NA	--	Final ROD
Polycyclic Aromatic Hydrocarbons (mg/kg)						
BAP equivalence concentration [d]	0.047	--	--	7.30E+00	3.43E-07	Final ROD
COCs Cumulative Hazard Quotient:			**2.38E-03**			
COCs Cumulative Excess Cancer Risk:					**3.43E-07**	

Non-COCs	Maximum Value [a] (mg/kg)	Oral Reference Dose (RfD) [b] (mg/kg-day)	Hazard Quotient	Cancer Potency (Slope) Factor [b] (mg/kg-day) -1	Cancer Risk	Source of Non-COC
Metals (mg/kg)						
Boron	2.1	2.00E-01	1.31E-04	--	--	RI/FS
Polycyclic Aromatic Hydrocarbons (mg/kg)						
Acenaphthene (Method 8310)	0.390	6.00E-02	8.13E-05	--	--	RI/FS
Fluorene (Method 8310)	0.230	4.00E-02	7.19E-05	--	--	RI/FS
Non-COCs Cumulative Hazard Quotient:			**2.84E-04**			
Non-COCs Cumulative Excess Cancer Risk:					**0.00E+00**	

Total Cumulative Hazard Quotient:	**2.66E-03**	
Total Cumulative Excess Cancer Risk:		**3.43E-07**

[a] = From WCH (2015)
[b] = Values obtained from Ecology (2014).
[c] = The risk associated with total petroleum hydrocarbons does not contribute to the cumulative toxicity calculation.
[d] = Evaluation of the compliance of benzo(b)pyrene with cleanup levels include the toxic equivalency concentrations of the carcinogenic PAHs.
-- = not calculated
COC = contaminant of concern
NA = not applicable

CONCLUSION:

The calculations in Table 2 demonstrate that the 600-334:2 subsite COC's meet the requirements for the hazard quotient and carcinogenic (excess cancer) risk as identified in the ROD (EPA 2014) and SAP (DOE-RL 2009). The non-COC individual hazard quotient values and the cumulative hazard quotient are presented for information. The hazard quotient and carcinogenic (excess cancer) risk calculations are for use in the CVP for this site.

ATTACHMENTS

1. 600-334:2 Subsite Confirmatory Sample Results (2 pages)

Attachment 1. 600-334:2 Subsite Confirmatory Sample Results (Metals, Anions, TPH, and Physical).

Sample Location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-334:2	J1B783	10/28/10	1090	J	1.6	0.38	U	0.38	0.79	B	0.67	83.4		0.077	0.083	B	0.033	2.1		0.99

Sample Location	HEIS Number	Sample Date	Cadmium			Calcium			Chromium			Cobalt			Copper			Iron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-334:2	J1B783	10/28/10	0.061	B	0.04	3070		14.2	1.4		0.06	0.87	B	0.1	3.7		0.22	4150	X	4.1

Sample Location	HEIS Number	Sample Date	Lead			Magnesium			Manganese			Mercury			Molybdenum			Nickel		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-334:2	J1B783	10/28/10	2.1		0.27	1500	XY	4	117	X	0.11	0.057		0.006	0.26	U	0.26	1.8	B	0.12

Sample Location	HEIS Number	Sample Date	Potassium			Selenium			Silicon			Silver			Sodium			Vanadium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-334:2	J1B783	10/28/10	454		41.3	0.87	U	0.87	152	J	2.3	0.16	U	0.16	67.1	B	63.8	10.9	X	0.1

Sample Location	HEIS Number	Sample Date	Zinc			Bromide			Chloride			Fluoride			Nitrogen in Nitrate			Nitrogen in Nitrate and Nitrite		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-334:2	J1B783	10/28/10	10.4	J	0.4	0.44	U	0.44	2.2	U	2.2	2.3	B	0.93	1.1	JB	0.36	0.99		0.41

Sample Location	HEIS Number	Sample Date	Nitrogen in Nitrite			Phosphorous in phosphate			Sulfate			TPH - Diesel Range EXT			TPH - Diesel Range			Percent moisture (wet sample)		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	%	Q	PQL
600-334:2	J1B783	10/28/10	0.38	UR	0.38	4.1	BXCUR	1.4	13.2		2	1000000	J	1100	520000	J	780	15.2		0

Sample Location	HEIS Number	Sample Date	pH Measurement		
			pH	Q	PQL
600-334:2	J1B783	10/28/10	4.64	J	0.01

Note: Gray cells indicate not applicable.
* = duplicate analysis not within control limits.
B = estimated result; result is less than the RL but greater than the
C = sample concentration <= 5x blank concentration
D = results are reported from a diluted aliquot of sample.
EXT = extended
HEIS = Hanford Environmental Information System
J = estimated result
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyls
PQL = practical quantitation limit
Q = qualifier
R = rejected
SVOA = semivolatile organics analysis
TPH = total petroleum hydrocarbons
U = undetected
X (metals) = serial dilution in the analytical batch indicates that physical and chemical interferences are present.
X (organics) = more than 40% difference between the primary and the confirmation detector results. The lower of the two results is reported.

Attachment	1	Sheet No.	1 of 2
Originator	J. D. Skoglie	Date	2/18/15
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Attachment 1. 600-334:2 Confirmatory Sample Results (Organics).

CONSTITUENT	CLASS	600-334:2 - J1B783		
		10/28/10		
		ug/kg	Q	PQL
1,2,4-Trichlorobenzene	SVOA	130	UD	130
1,2-Dichlorobenzene	SVOA	100	UD	100
1,3-Dichlorobenzene	SVOA	55	UD	55
1,4-Dichlorobenzene	SVOA	62	UD	62
2,4,5-Trichlorophenol	SVOA	46	UD	46
2,4,6-Trichlorophenol	SVOA	46	UD	46
2,4-Dichlorophenol	SVOA	46	UD	46
2,4-Dimethylphenol	SVOA	300	UD	300
2,4-Dinitrophenol	SVOA	1500	UD	1500
2,4-Dinitrotoluene	SVOA	300	UD	300
2,6-Dinitrotoluene	SVOA	130	UD	130
2-Chloronaphthalene	SVOA	46	UD	46
2-Chlorophenol	SVOA	96	UD	96
2-Methylnaphthalene	SVOA	87	UD	87
2-Methylphenol (cresol, o-)	SVOA	60	UD	60
2-Nitroaniline	SVOA	230	UD	230
2-Nitrophenol	SVOA	46	UD	46
3,3'-Dichlorobenzidine	SVOA	410	UD	410
3+4 Methylphenol (cresol, m+p)	SVOA	150	UD	150
3-Nitroaniline	SVOA	340	UD	340
4,6-Dinitro-2-methylphenol	SVOA	1500	UD	1500
4-Bromophenylphenyl ether	SVOA	87	UD	87
4-Chloro-3-methylphenol	SVOA	300	UD	300
4-Chloroaniline	SVOA	380	UD	380
4-Chlorophenylphenyl ether	SVOA	96	UD	96
4-Nitroaniline	SVOA	330	UD	330
4-Nitrophenol	SVOA	450	UD	450
Acenaphthene	SVOA	47	UD	47
Acenaphthylene	SVOA	78	UD	78
Anthracene	SVOA	78	UD	78
Benzo(a)anthracene	SVOA	92	UD	92
Benzo(a)pyrene	SVOA	92	UD	92
Benzo(b)fluoranthene	SVOA	120	UD	120
Benzo(ghi)perylene	SVOA	74	UD	74
Benzo(k)fluoranthene	SVOA	180	UD	180
Bis(2-chloro-1-methylethyl)ether	SVOA	110	UD	110
Bis(2-Chloroethoxy)methane	SVOA	110	UD	110
Bis(2-chloroethyl) ether	SVOA	76	UD	76
Bis(2-ethylhexyl) phthalate	SVOA	210	UD	210
Butylbenzylphthalate	SVOA	200	UD	200
Carbazole	SVOA	170	UD	170
Chrysene	SVOA	120	UD	120
Dibenz[a,h]anthracene	SVOA	87	UD	87
Dibenzofuran	SVOA	92	UD	92
Diethyl phthalate	SVOA	120	UD	120
Dimethyl phthalate	SVOA	110	UD	110
Di-n-butylphthalate	SVOA	130	UD	130
Di-n-octylphthalate	SVOA	66	UD	66
Fluoranthene	SVOA	170	UD	170
Fluorene	SVOA	83	UD	83
Hexachlorobenzene	SVOA	130	UD	130
Hexachlorobutadiene	SVOA	46	UD	46
Hexachlorocyclopentadiene	SVOA	230	UD	230
Hexachloroethane	SVOA	98	UD	98
Indeno(1,2,3-cd)pyrene	SVOA	100	UD	100
Isophorone	SVOA	78	UD	78
Naphthalene	SVOA	140	UD	140
Nitrobenzene	SVOA	100	UD	100
N-Nitroso-di-n-dipropylamine	SVOA	140	UD	140
N-Nitrosodiphenylamine	SVOA	96	UD	96
Pentachlorophenol	SVOA	1500	UD	1500
Phenanthrene	SVOA	190	JD	78
Phenol	SVOA	83	UD	83
Pyrene	SVOA	110	JD	56

CONSTITUENT	CLASS	600-334:2 - J1B783		
		10/28/10		
		ug/kg	Q	PQL
Acenaphthene	PAH	390	JX	11
Acenaphthylene	PAH	10	U	10
Anthracene	PAH	3.4	U	3.4
Benzo(a)anthracene	PAH	3.6	U	3.6
Benzo(a)pyrene	PAH	7.2	U	7.2
Benzo(b)fluoranthene	PAH	150	J	4.7
Benzo(ghi)perylene	PAH	8.1	U	8.1
Benzo(k)fluoranthene	PAH	4.4	U	4.4
Chrysene	PAH	3200	J	5.4
Dibenz[a,h]anthracene	PAH	12	U	12
Fluoranthene	PAH	15	U	15
Fluorene	PAH	230	J	5.9
Indeno(1,2,3-cd)pyrene	PAH	13	U	13
Naphthalene	PAH	13	U	13
Phenanthrene	PAH	13	U	13
Pyrene	PAH	13	U	13
Aroclor-1016	PCB	3.2	UJ	3.2
Aroclor-1221	PCB	9.2	UJ	9.2
Aroclor-1232	PCB	2.3	UJ	2.3
Aroclor-1242	PCB	5.4	UJ	5.4
Aroclor-1248	PCB	5.4	UJ	5.4
Aroclor-1254	PCB	3.0	UJ	3.0
Aroclor-1260	PCB	3.0	UJ	3.0

Attachment	1	Sheet No.	2 of 2
Originator	J. D. Skoglie	Date	2/18/15
Checked	S. W. Clark	Date	2/18/15
Calc. No.	0600X-CA-V0187	Rev. No.	0
		Job No.	14655

APPENDIX B

DATA QUALITY ASSESSMENT

APPENDIX B

DATA QUALITY ASSESSMENT

A data quality assessment (DQA) was performed to compare the sampling approach and resulting analytical data with the sampling and data requirements specified in the site-specific sample design (WCH 2010b). This DQA was performed in accordance with site-specific data quality objectives found in the *100 Area Remedial Action Sampling and Analysis Plan* (100 Area SAP) (DOE-RL 2009).

A review of the sample design (WCH 2010b), the field logbook (WCH 2010a), and applicable analytical data packages has been performed as part of this DQA. All samples were collected and analyzed per the sample design. To ensure quality data, the 100 Area SAP data assurance requirements and the data validation procedures for chemical analysis (BHI 2000) are used as appropriate. This review involves evaluation of the data to determine if they are of the right type, quality, and quantity to support the intended use (i.e., closeout decisions). The DQA completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objectives process (EPA 2006).

sample data collected at the 600-334:2 subsite were provided by the laboratory in one sample delivery group (SDG): J00903. The SDG J00903 was submitted for third-party validation. Major and minor deficiencies are discussed for the 600-334:2 data set, as follows below. If no comments are made about a specific analysis, it should be assumed that no deficiencies affecting the quality of the data were found.

Major Deficiencies

SDG J00903

This SDG includes one focused soil sample (J1B783) collected from the 600-334:2 subsite. This sample was analyzed for inductively coupled plasma (ICP) metals, mercury, ion chromatography (IC) anions, nitrate/nitrite, polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCBs), petroleum hydrocarbons (TPH), semivolatile organic analysis (SVOAs), and pH. Major deficiencies are as follows.

Due to the holding time being exceeded by more than twice the limit, all undetected nitrate, nitrite and orthophosphate results were qualified as rejected and flagged "UR".

Minor Deficiencies

In the IC metals analysis, due to matrix spike recovery outside quality control (QC) limits, all aluminum (253%) and silicon (27%) results were qualified as estimates and flagged "J". Due to an LCS recovery outside QC limits (20%), all silicon results were qualified as estimates and flagged "J". Due to relative percent differences (RPDs)

outside QC limits, all aluminum (35%) and zinc (87%) results were qualified as estimates and flagged "J". The data are usable for decision-making purposes.

In the IC anions analysis, the detected nitrate result was qualified as an estimate and flagged "J" due to a holding time being exceeded. pH was flagged as "J" due to a holding time being exceeded. The data are usable for decision-making purposes.

In the TPH analysis, due to a surrogate recovery outside QC limits (305%), all diesel range organic results were qualified as estimates and flagged "J". Estimated data are usable for decision-making purposes.

In the PAH analysis, due to surrogate recovery outside QC limits (284%), all detected results were qualified as estimates and flagged "J". The data are usable for decision-making purposes.

In the PCB analysis, due to surrogate recovery outside QC limits (43%), all PCB results were qualified as estimates and flagged "J". The data are usable for decision-making purposes.

The formal evaluation of the field quality samples is also presented in the next section.

FIELD QUALITY ASSURANCE/QUALITY CONTROL

Relative percent difference evaluations of main sample(s) versus the laboratory duplicate(s) are routinely performed and reported by the laboratory. Any deficiencies in those calculations are reported by SDG in the previous sections.

Field quality assurance (QA)/QC measures are used to assess potential sources of error and cross contamination of samples that could bias results. Field duplicate samples are typically collected to provide a relative measure of the degree of local heterogeneity in the sampling medium, unlike laboratory duplicates that are used to evaluate precision in the analytical process. The field duplicates are evaluated by computing the RPD of the sample/duplicate pair(s) for each contaminant of potential concern. Relative percent differences are not calculated for analytes that are not detected in both the main and duplicate sample at more than five times the target detection limit (TDL). A field duplicate sample was not taken at the 600-334:2 subsite. But, there is no indication that the analytical system was operating out of control. The data are usable for decision-making purposes.

Summary

Limited, random, or sample matrix-specific influenced batch QC issues, such as those discussed above, are a potential for any analysis. The number and types seen in these data sets are within expectations for the matrix types and analyses performed.
The DQA review of the 600-334:2 subsite sampling data found that the analytical results

are accurate within the standard errors associated with the analytical methods, sampling, and sample handling. The DQA review for 600-334:2 subsite concludes that the reviewed data are of the right type, quality, and quantity to support the intended use. The analytical data were found acceptable for decision-making purposes. The sample analytical data are stored in the Environmental Restoration project-specific database prior to being submitted for inclusion in the Hanford Environmental Information System database. The sample analytical data are also summarized in Appendix A.

REFERENCES

BHI, 2000, *Data Validation Procedure for Chemical Analysis*, BHI-01435, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

DOE-RL, 2009, *100 Area Remedial Action Sampling and Analysis Plan,* DOE/RL-96-22, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

EPA, 2006, *Guidance on Systematic Planning Using the Data Quality Objectives Process*, EPA QA/G-4, EPA/240/B-06/001, U.S. Environmental Protection Agency, Office of Environmental Information, Washington, D.C.

WCH, 2010a, 100 Area Confirmatory Sampling, Logbook EL-1649, pp. 74-75, Washington Closure Hanford, Richland, Washington.

WCH, 2010b, *Work Instruction for Confirmatory Sampling of the 600-334, CMX Building, 0600X-WI-G0034*, Rev. 0, Washington Closure Hanford, Richland, Washington.

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