

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 300-FF-2

Control No.: 2015-081

Waste Site Code(s)/Subsite Code(s):

300-15:2, 300 Area Process Sewer North of Apple Street

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 300-15:2 subsite was previously remediated and reclassified under the *Interim Action Record of Decision for the 300-FF-2 Operable Unit, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

Basis for reclassification:

The 300-15:2 subsite was identified as a waste site requiring remediation in the Hanford Site 300 Area, Record of Decision for 300-FF-2 and 300-FF-5, and Record of Decision Amendment for 300-FF-1, Hanford Site, Benton County, Washington (300 Area ROD), U.S. Environmental Protection Agency, Region 10, Seattle, Washington (EPA 2013). The included subsite was interim reclassified based on remediation, sampling, and evaluation under an interim action ROD, but the post-remediation conditions were not evaluated in development of the 300 Area ROD due to concurrent timing of remediation and ROD development efforts. Final reclassification of these waste sites is performed in accordance with TPA-MP-14 in the *Tri Party Agreement Handbook Management Procedures* (DOE-RL 2011). The basis for reclassification is described in detail in the *Final Action Evaluation of 300-15:2, 300 Area Process Sewer North of Apple Street Subsite* (attached).

Regulator comments:

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 300-FF-2

Control No.: 2015-081

Waste Site Code(s)/Subsite Code(s):

300-15:2, 300 Area Process Sewer North of Apple Street

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:

The 300-15:2 waste subsite and the associated staging pile areas do not meet the RAGs and RAOs for unrestricted land use. Therefore, institutional controls to maintain industrial land use of these areas are required as established in the 300 Area ROD (EPA 2013).

M. French

DOE Federal Project Director (printed)



Signature

9/23/15
Date

N/A

Ecology Project Manager (printed)

Signature

Date

B. Simes

EPA Project Manager (printed)



Signature

10/5/15
Date

FINAL ACTION EVALUATION OF THE 300-15:2 SUBSITE

Attachment to Waste Site Reclassification Form 2015-081

October 2015

FINAL ACTION EVALUATION OF 300-15:2 SUBSITE

INTRODUCTION

This attachment documents evaluation performed to support final reclassification of 300-15:2 subsite identified for remove, treat, and dispose (RTD) in the *Hanford Site 300 Area, Record of Decision for 300-FF-2 and 300-FF-5, and Record of Decision Amendment for 300-FF-1* (300 Area ROD) (EPA 2013). The 300-15:2 subsite was interim reclassified based on remediation, sampling, and evaluation under an interim action ROD but was not evaluated in the *Remedial Design Report/Remedial Action Work Plan for 300-FF-2 Soils* (300-FF-2 RDR/RAWP) (DOE-RL 2015) due to concurrent timing of remediation and 300-FF-2 RDR/RAWP development efforts. Final reclassification of the 300-15:2 subsite is performed in accordance with TPA-MP-14 in the *Tri-Party Agreement Handbook Management Procedures* (DOE-RL 2011).

Based upon evaluation of the previous subsite reclassification data against the 300 Area ROD cleanup levels, no further RTD is required for 300-15:2 subsite. Evaluation for the 300-15:2, 300 Area Process Sewer North of Apple Street subsite is provided to support reclassification to Final Closed Out.

300-15:2 SUBSITE – 300 AREA PROCESS SEWER NORTH OF APPLE STREET

Interim Action Summary

The 300-15:2, 300 Area Process Sewer North of Apple Street subsite was part of the 300-FF-2 Operable Unit. Some segments of the 300-15 pipelines north of Apple Street were not included in the 300-15:2 subsite because they were either retained as active sewer lines or were interfered with by long-term retained facilities and/or utilities and were excluded from the Decision Unit Boundaries. Remedial action at the 300-15:2 subsite was performed from July 17, 2012, to January 4, 2013. The 300-15:2 subsite was excavated to depths of 0.5 m (1.6 ft) to 4.9 m (16.1 ft) below ground surface, resulting in approximately 44,715.8 bank cubic meters (54,488.3 bank cubic yards) of soil and debris disposed at the Environmental Restoration Disposal Facility of the Hanford Site. Verification sampling was performed on July 24 and 25, 2012, December 5, 7, and 10, 2012, and January 2 and 9, 2013, as summarized in Tables 1 through 4. Additional information is available in the *Remaining Sites Verification Package for the 300-15:2, 300 Area Process Sewer North of Apple Street Subsite* (WCH 2013).

Table 1. Verification Sample Summary Table for 300-15:2, Fully Excavated Sections North of Apple Street, Decision Unit 1.

Sample Location	Deep or Shallow Zone	HEIS Number	Sample Date	Coordinate Locations (WSP, m)	Sample Analysis
DU-1 #1	Shallow	J1PW67	7/24/2012	N 116163 E 593913	ICP metals ^a , mercury, IC anions, nitrite/nitrate, total cyanides/sulfates, VOA, SVOA, PCB, TPH, GEA, gross alpha, gross beta, total uranium
DU-1 #2		J1PW68		N 116140 E 593902	
DU-1 #3		J1PW69		N 116163 E 593890	
DU-1 #4		J1PW70		N 116101 E 594020	
DU-1 #5		J1PW71		N 116103 E 594020	
DU-1 #6		J1PW72		N 116115 E 594020	
DU-1 #7		J1PW73	7/25/2012	N 116124 E 594019	
Duplicate of J1PW73		J1PW74		N 116137 E 594019	
DU-1 #8		J1PW75		N 116140 E 594019	
DU-1 #9		J1PW76		N 116144 E 594019	
Split of J1PW76		J1PWM0		N 116148 E 594018	
DU-1 #10		J1PW77		N 116170 E 594017	
DU-1 #11	J1PW78	NA	ICP metals ^a , mercury		
DU-1 #12	J1PW80	12/5/2012	N 116077 E 594008	ICP metals ^a , mercury, IC anions, nitrite/nitrate, total cyanides/sulfates, VOA, SVOA, PCB, TPH, GEA, gross alpha, gross beta, total uranium	
Equipment blank	J1PW79		N 116089 E 594008		
Zone 6, Segment 1	J1R4C7		N 116077 E 593993		
Duplicate of J1R4C7	J1R4D1		N 116075 E 593983		
Split of J1R4C7	J1R4H1	12/5/2012	NA	VOA	
Zone 6, Segment 2	J1R4C8		ICP metals ^a , mercury		
Zone 6, Segment 3	J1R4C9	12/5/2012	NA	VOA	
Zone 6, Segment 4	J1R4D0		ICP metals ^a , mercury		
Trip blank	NA	J1R4D4	12/5/2012	NA	VOA
Equipment blank	NA	J1R4D3	12/5/2012	NA	ICP metals ^a , mercury

^a Analysis for 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.

GEA = gamma energy analysis

HEIS = Hanford Environmental Information System

IC = ion chromatography

ICP = inductively coupled plasma

NA = not applicable

PCB = polychlorinated biphenyl

SVOA = semivolatile organic analysis

TPH = total petroleum hydrocarbons

VOA = volatile organic analysis

WSP = Washington State Plane

Table 2. Verification Sample Summary Table for 300-15:2, Fully Excavated Sections North of Apple Street, Decision Unit 2.

Sample Location	Deep or Shallow Zone	HEIS Number	Sample Date	Coordinate Locations, (WSP, m)	Sample Analysis		
Zone 2, Segment 19	Shallow	J1R3D8	12/10/2012	N 116266 E 593887	ICP metals ^a , mercury, IC anions, nitrite/nitrate, total cyanides/sulfates, VOA, SVOA, PCB, TPH, GEA, gross alpha, gross beta, total uranium		
Duplicate of J1R3D8		J1R3H2					
Split of J1R3D8		J1R3H7					
Zone 2, Segment 1	Deep	J1R3D9		N 116176 E 594058			
Zone 3, Drum Crushing Area		J1R3F0		N 116168 E 594025			
Zone 3, Segment 7		J1R3F1		N 116167 E 594003			
Zone 3, Segment 4		J1R3F2		N 116173 E 594039			
Zone 3, Segment 4		J1R3F3		N 116173 E 594025			
Zone 2, Segment 3		J1R3F4 ^b		N 116177 E 593995			
		J1R7R2 ^b		1/2/2013		E 593995	PCB
Zone 3, Segment 8		J1R3F5	12/10/2012	N 116172 E 593965	ICP metals ^a , mercury, IC anions, nitrite/nitrate, total cyanides/sulfates, VOA, SVOA, PCB, TPH, GEA, gross alpha, gross beta, total uranium		
Zone 2, Segment 16	Shallow	J1R3F6		N 116296 E 593985			
Zone 2, Segment 15		J1R3F7		N 116295 E 593950			
Zone 2, Segment 10		J1R3F8		N 116272 E 593926			
Zone 2, Segment 10		J1R3F9		N 116251 E 593926			
Zone 2, Segment 5	Deep	J1R3H0		N 116172 E 594017			
Zone 2, Segment 8		J1R3H1		N 116180 E 593924			
Trip blank	NA	J1R3H3		12/10/2012		NA	VOA
Equipment blank		J1R3H4					ICP metals ^a , mercury

^a Analysis for 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.

^b J1R7R2 was collected after further excavation due to the high PCB result for the original sample, J1R3F4. The PCB data for J1R7R2 replaces the PCB data for J1R3F4. The remaining J1R3F4 data is used for verification purposes.

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TPH = total petroleum hydrocarbons

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Table 3. Verification Sample Summary Table for 300-15:2, Fully Excavated Sections North of Apple Street, Decision Unit 3.

Sample Location	Deep or Shallow Zone	HEIS Number	Sample Date	Coordinate Locations (WSP, m)	Sample Analysis			
Zone 4, Segment 3	Shallow	J1R4J5	12/7/2012	N 116035 E 593648	ICP metals ^a , mercury, IC anions, nitrite/nitrate, total cyanides/sulfates, VOA, SVOA, PCB, TPH, GEA, gross alpha, gross beta, total uranium			
Duplicate of J1R4J5		J1R4L0						
Split of J1R4J5		J1R4F8						
Zone 4, Segment 1		J1R4J6		N 116054 E 593648				
Zone 4, Segment 3		J1R4J7		N 116015 E 593648				
Zone 4, Segment 1		J1R4J8		N 116073 E 593678				
Zone 1, Segment 12		J1R4J9		N 116131 E 593712				
Zone 1, Segment 19		J1R4K0		N 116093 E 593773				
Zone 1, Segment 19		J1R4K1		N 116094 E 593805				
Zone 5, Segment 1		J1R4K2		N 116084 E 593808				
Zone 5, Segment 4		J1R4K3		N 116066 E 593765				
Zone 5, Segment 5		J1R4K4		N 116051 E 593808				
Zone 1, Segment 13		J1R4K5		N 116170 E 593806				
Zone 1, Segment 13		J1R4K6		N 116180 E 593806				
Zone 1, Segment 13		J1R4K7		N 116128 E 593806				
Zone 5, Segment 6		J1R4K8		N 116052 E 593828				
Zone 5, Segment 7		J1R4K9		N 116052 E 593824				
Trip blank		NA		J1R4L1		12/7/2012	NA	VOA
Equipment blank				J1R4L2				ICP metals ^a , mercury

^a Analysis for 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.

GEA = gamma energy analysis

HEIS = Hanford Environmental Information System

IC = ion chromatography

ICP = inductively coupled plasma

NA = not applicable

PCB = polychlorinated biphenyl

SVOA = semivolatitc organic analysis

TPH = total petroleum hydrocarbons

VOA = volatile organic analysis

WSP = Washington State Plane

Table 4. Verification Sample Summary Table for 300-15:2, Fully Excavated Sections North of Apple Street, Staging Pile Areas.

Sample Location	Deep or Shallow Zone	HEIS Number	Sample Date	Coordinate Locations (WSP, m)	Sample Analysis
FS-1	Shallow	J1R876	1/9/2013	N 116119.1 E 593874.3	PCB
FS-2		J1R877		N 116108.5 E 593875.8	
FS-3		J1R878		N 116117.8 E 593890.4	
FS-4		J1R879		N 116103.9 E 593891.2	
FS-5		J1R880		N 116108.9 E 593946.6	
FS-6		J1R881		N 116110.4 E 593958.1	
Composite for ramp area		J1R882		NA	
Duplicate of FS-1		J1R883		N 116119.1 E 593874.3	
Split of FS-1		J1R884			
Equipment blank		NA		J1R8T5	

HEIS = Hanford Environmental Information System
NA = not applicable

PCB = polychlorinated biphenyl
WSP = Washington State Plane

Final Action Data Evaluation

This section demonstrates that residual contaminant concentrations at the 300-15:2 subsite achieve the applicable cleanup levels (CULs) developed to support industrial land use for the 300 Area as established in the 300 Area ROD (EPA 2013). Comparisons of the results for each contaminant of concern (COC) detected at the 300-15:2 against the CULs are shown in Table 5 for the focused sample results. Analytes that were detected in the samples where no background value is available and are not considered COCs are reported in Table 6. Additionally, molybdenum was detected above the background level, but is not considered a COC for the 300 Area, and was not present above cleanup levels based on the current oral reference dose. The additional potential risk contributions associated with the residual concentrations of these non-COC analytes are not significant.

Table 5. Comparison of Maximum Contaminant Concentrations to Industrial Cleanup Levels for the 300-15:2, Fully Excavated Sections North of Apple Street, Decision Unit 1, Decision Unit 2, and Decision Unit 3, Verification Sampling Data.

COC	Maximum Result ^{a, b} (pCi/g)	Radionuclide Shallow Zone CULs ^c (pCi/g)	Radionuclide Groundwater and River Protection CULs (pCi/g) ^c	Does the Result Exceed CULs?
Uranium-235	1.43	16	NA	No
Uranium-238	21.2	167	NA	No
COC	Maximum Result (mg/kg)	Nonradionuclide Direct Exposure CULs ^c (mg/kg)	Nonradionuclide Groundwater and River Protection CULs ^c (mg/kg)	Does the Result Exceed CULs?
Arsenic	3.97 (<BG)	20	NA	No
Barium	89.7 (<BG)	700,000	NA	No
Beryllium	0.389 (<BG)	7,000	NA	No
Cadmium	0.291 (<BG)	3,500	NA	No
Chromium (total)	15.4 (<BG)	>1,000,000	NA	No
Cobalt	9.09 (<BG)	1,050	NA	No
Copper	105	140,000	NA	No
Lead	10.8	1,000	NA	No
Lithium	11.3 (<BG)	7,000	NA	No
Manganese	435 (<BG)	490,000	NA	No
Mercury	1.05	1,050	NA	No
Nickel	14.7 (<BG)	70,000	NA	No
Silver	2.20	17,500	NA	No
Uranium (total)	47.1	505	157	No
Vanadium	83.2 (<BG)	17,500	NA	No
Zinc	106	>1,000,000	NA	No
Nitrogen in nitrate	1.7 (<BG)	>1,000,000 ^d	4,773 ^d	No
TPH-diesel+motor oil	89.2	2,000	2,000	No
Aroclor-1242	0.0562	66	NA	No
Aroclor-1248	0.559	66	NA	No
Aroclor-1254	6.80	66	NA	No
Aroclor-1260	1.43	66	NA	No
Xylene	0.00414	227	11,090	No
				No

^a Maximum value from verification sample results (WCH 2013).

^b Background values from DOE-RL (1996, 2001, and 2014d).

^c CULs obtained from 300 Area ROD (EPA 2013).

^d The CULs presented in 300 Area ROD (EPA 2013), are expressed in terms of nitrate, to make the reported results and CULs comparable, the CULs were converted to nitrate as nitrogen by dividing the CULs by 4.4.

BG = background

COC = contaminant of concern

CUL = cleanup level

NA = not applicable

ROD = record of decision

TPH = total petroleum hydrocarbons

Table 6. Detected Analytes that are Not Identified as Contaminants of Concern.

Acetone	Butylbenzylphthalate	Chloride
Methylene chloride	Molybdenum	

Assessment of the residual risk for the 300-15:2 subsite is determined by calculation of the hazard quotient and excess carcinogenic risk values for direct contact (Appendix A). Nonradionuclide risk requirements for the industrial 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^{-5} , and a cumulative carcinogenic risk of less than 1×10^{-5} . Hazard quotient and excess carcinogenic risk calculations were performed for the 300-15:2 subsite using the maximum results from the cleanup verification 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^{-5} . The cumulative hazard quotient for the 300-15:2 subsite is 1.04×10^{-1} , satisfying the criteria of less than 1.0. The cumulative excess cancer risk for the 300-15:2 subsite is 1.34×10^{-6} , satisfying the criteria of less than 1×10^{-5} .

The sum of fractions were conservatively calculated for the 300-15:2 subsite data set using the maximum value for each COC detected above background. The calculations were performed using the soil concentrations corresponding to a 1×10^{-4} risk and a 15 mrem/yr dose for industrial land use from Table 8-3 of the Remedial Investigation/Feasibility Study for the 300-FF-1, 300-FF-2, and 300-FF-5 Operable Units (300 Area RI/FS) (DOE-RL 2014).

The sum of fractions shown in the 300-15:2 Subsite Final Closeout Evaluation - Radionuclide Sum of Fractions Calculation in Appendix A determined that the cumulative excess cancer risk value for radionuclides is 9.27×10^{-6} and the total radiological dose is 3.04 mrem/yr. Comparing these values to the risk and dose limits of $<1 \times 10^{-4}$ and <15 mrem/yr, the risk and dose requirements are met.

Summary for Final Closure

The 300-15:2 subsite was remediated and has been evaluated against the criteria established for the industrial land-use scenario in the 300 Area ROD (EPA 2013) and meets the requirements of the 300-FF-2 RDR/RAWP (DOE-RL 2015). Results indicate that the site supports future land uses that can be represented (or bounded) by the industrial land-use scenario and poses no threat to groundwater or the Columbia River. Because the subsite was remediated to achieve CULs for industrial land use, institutional controls to maintain industrial land use are required. The 300-15:2 subsite are verified to be remediated in accordance with the 300 Area ROD (EPA 2013) and have been reclassified to a status of Final Closed Out.

REFERENCES

- DOE-RL, 2011, *Tri-Party Agreement Handbook Management Procedures*, RL-TPA-90-0001, Rev. 2, Guideline Number TPA-MP-14, "Maintenance of the Waste Information Data System (WIDS)," U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- DOE-RL, 2014, *Remedial Investigation/Feasibility Study for the 300-FF-1, 300-FF-2, and 300-FF-5 Operable Units*, DOE/RL-2010-99, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- DOE-RL, 2015, *Remedial Design Report/Remedial Action Work Plan for 300-FF-2 Soils*, DOE/RL-2014-13-ADD1, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order*, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.
- EPA, 2013, *Hanford Site 300 Area, Record of Decision for 300-FF-2 and 300-FF-5, and Record of Decision Amendment for 300-FF-1, Hanford Site, Benton County, Washington*, November 2013, U.S. Environmental Protection Agency, Region 10, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- WCH, 2013, *300-15:2, 300 Area Process Sewer North of Apple Street Subsite*, Attachment to Waste Site Reclassification Form 2012-120, Rev. 0, Washington Closure Hanford, Richland, Washington.

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:

300-15:2 Subsite Final Closeout Evaluations - Direct Contact Hazard Quotient and Carcinogenic Risk Calculations, 0300X-CA-V0241, Rev. 0, Washington Closure Hanford, Richland, Washington A-2

300-15:2 Subsite Final Closeout Evaluation - Radionuclide Sum of Fractions Calculations, 0300X-CA-V0242, Rev. 0, Washington Closure Hanford, Richland, Washington A-6

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.

CALCULATION COVER SHEET

Project Title: 300 Area Closure Operations Job No. **14655**

Area: 300 Area

Discipline: Environmental *Calculation No: 0300X-CA-V0241

Subject: 300-15:2 Subsite Final Closeout Evaluation - 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 = 3 Total = 4	I. B. Berezovskiy <i>I. B. Berezovskiy</i>	R. J. Nielson <i>R. J. Nielson</i>	T. Q. Howell <i>T. Q. Howell</i>	S. G. Wilkins <i>S. G. Wilkins</i>	10/15/15

SUMMARY OF REVISION

Washington Closure Hanford		CALCULATION SHEET					
Originator:	I. B. Berezovskiy	Date:	9/15/2015	Calc. No.:	0300X-CA-V0241	Rev.:	0
Project:	300 Area Closure Operations	Job No:	14655	Checked:	R. J. Nielson	Date:	9/15/2015
Subject:	300-15:2 Subsite Final Closeout Evaluations - Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 1 of 3	

1 **PURPOSE:**

2
3 Provide documentation to support the evaluation for the 300-15:2 subsite as requiring remediation in the
4 *Hanford Site 300 Area, Record of Decision for 300-FF-2 and 300-FF-5, and Record of Decision*
5 *Amendment for 300-FF-1* (300 Area ROD) (EPA 2013) where remediation was completed under interim
6 action decisions. The calculation brief provides calculations for direct contact hazard quotients (HQs),
7 and excess carcinogenic risk values.

8
9 Nonradionuclide risk standards include the following criteria:

- 10
11 1) An HQ of <1.0 for all individual noncarcinogens
12 2) A cumulative HQ of <1.0 for noncarcinogens
13 3) An excess cancer risk of <1 x 10⁻⁵ for individual industrial carcinogens
14 4) A cumulative excess cancer risk of <1 x 10⁻⁵ for carcinogens.

15
16
17 **GIVEN/REFERENCES:**

- 18
19 1) DOE-RL, 2015, *Remedial Design Report/Remedial Action Work Plan for 300-FF-2 Soils*,
20 DOE/RL-2014-13-ADD1, Rev. 0, U.S. Department of Energy, Richland Operations Office,
21 Richland, Washington.
22
23 2) EPA, 2013, *Record of Decision for the 300-FF-2 Operable Unit and 300-FF-5, and Record of*
24 *Decision Amendment for 300-FF-1, Hanford Site, Benton County, Washington*, U.S. Environmental
25 Protection Agency, Region 10, Seattle, Washington.
26
27 3) WCH, 2013, 300-15:2, *300 Area Process Sewer North of Apple Street Subsite*, Attachment to Waste
28 Site Reclassification Form 2012-120, Rev. 0, Washington Closure Hanford, Richland, Washington.

29
30
31 **SOLUTION:**

- 32
33 1) Generate an HQ for each noncarcinogenic constituent detected above background or required
34 detection limit/practical quantitation limit and compare it to the individual HQ of <1.0
35 (DOE-RL 2015).
36
37 2) Sum the HQs and compare this value to the cumulative HQ of <1.0.
38
39 3) Generate an excess cancer risk value for each carcinogenic constituent detected above background or
40 required detection limit/practical quantitation limit and compare it to the excess cancer risk of
41 <1 x 10⁻⁵ (DOE-RL 2015).
42
43 4) Sum the excess cancer risk value(s) and compare it to the cumulative cancer risk of <1 x 10⁻⁵.

Washington Closure Hanford		CALCULATION SHEET					
Originator:	I. B. Berezovskiy	Date:	9/15/2015	Calc. No.:	0300X-CA-V0241	Rev.:	0
Project:	300 Area Closure Operations	Job No:	14655	Checked:	R. J. Nielson	Date:	9/15/2015
Subject:	300-15:2 Subsite Final Closeout Evaluations - Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 2 of 3	

METHODOLOGY:

The 300-15:2 subsite underwent verification sampling at four decision units. Samples collected included sixteen focused samples from Decision Unit 1, fourteen from Decision Unit 2, fifteen from Decision Units 3, and 6 focused and one composite sample from the staging pile area. Four pairs of duplicate and split samples and five equipment blanks were also collected. A total of forty five focused samples were collected for the 300-15:2 subsite, as established in the previously approved interim reclassification documentation for 300-15:2 subsite (WCH 2013). The appropriate representative values for each constituent (i.e., maximum value from all decision units) were obtained from WCH (2013) without further calculation. Only those constituents quantified above background are considered in the HQ and excess carcinogenic risk calculations. The background values were obtained from the 300-FF-2 RDR/RAWP (DOE-RL 2015). An example of the HQ and risk calculations is presented below:

- 1) To calculate the HQ, the maximum value for copper is 105 mg/kg, multiplied by the industrial daily intake factor (2.86×10^{-7}) as explained in Section D4 of the 300-FF-2 RDR/RAWP (DOE-RL 2015) and divided by the reference dose (RfD) of 0.04 mg/kg-day, resulting in a HQ of 7.51×10^{-4} . Comparing this value, and all other individual values for the 300-15:2 subsite calculation, to the requirement of <1.0, this criterion is met.
- 2) After the HQ calculation is completed for the appropriate COCs, the cumulative HQ is obtained by summing the individual values. To avoid errors due to intermediate rounding, the individual HQ values prior to rounding are used for this calculation. The sum of the HQ values is 1.04×10^{-1} for the 300-15:2 subsite COCs only calculation. Comparing this value to the requirement of <1.0, this criterion is met.
- 3) To calculate the excess cancer risk, the maximum value for aroclor-1242, 0.0562 mg/kg, is multiplied by the industrial daily intake factor (7.62×10^{-8}) as explained in Section D4 of the 300-FF-2 RDR/RAWP (DOE-RL 2015) and the cancer potency factor of 2.0 mg/kg-day, with a resulting value of 8.56×10^{-9} . Comparing this value, and all other individual values for the 300-15:2 subsite calculations, to the threshold of $<1 \times 10^{-5}$, this criterion is met.
- 4) After these calculations are completed for the carcinogenic analytes, the cumulative excess cancer risk is obtained by summing the individual values. The sum of the cumulative cancer risk values is 1.35×10^{-6} for the 300-15:2 subsite calculation. Comparing this value to the requirement of $<1 \times 10^{-5}$, this criterion is met.

RESULTS:

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

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Originator:	I. B. Berezovskiy	Date:	9/15/2015	Calc. No.:	0300X-CA-V0241	Rev.:	0
Project:	300 Area Closure Operations	Job No.:	14655	Checked:	R. J. Nielson	Date:	9/15/2015
Subject:	300-15:2 Subsite Final Closeout Evaluations - Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 3 of 3	

Table 1 shows the results of the industrial direct contact calculations.

Table 1. Industrial Direct Contact Hazard Quotient and Excess Cancer Risk Results for the 300-15:2 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
Metals					
Copper	105	4.00E-02	7.51E-04	--	--
Lead ^c	10.8	NA	--	NA	--
Mercury	1.05	3.00E-04	1.00E-03	--	--
Molybdenum	0.659	5.00E-03	3.77E-05	--	--
Silver	2.2	5.00E-03	1.26E-04	--	--
Uranium	47.1	3.00E-03	4.49E-03	--	--
Zinc	106	3.00E-01	1.01E-04	--	--
Total Petroleum Hydrocarbons (TPH)					
TPH - Motor Oil (high boiling) + Diesel Range ^d	89.2	NA	--	NA	--
Volatile Organic Compounds (VOCs)					
Acetone	0.0170	9.00E-01	5.40E-09	--	--
Methylene chloride	0.0100	6.00E-02	4.77E-08	7.50E-03	5.72E-12
Xylene	0.00414	2.00E-01	5.92E-09	--	--
Semivolatile Organic Compounds (SVOCs)					
Butylbenzylphthalate	0.307	2.00E-01	4.39E-07	1.90E-03	4.44E-11
Polychlorinated Biphenyls (PCB)					
PCB Aroclor 1242	0.0562	--	--	2.00E+00	8.56E-09
PCB Aroclor 1248	0.559	--	--	2.00E+00	8.52E-08
PCB Aroclor 1254	6.80	2.00E-05	9.72E-02	2.00E+00	1.04E-06
PCB Aroclor 1260	1.43	--	--	2.00E+00	2.18E-07
COCs Cumulative Hazard Quotient:			1.04E-01		
COCs Cumulative Excess Cancer Risk:					1.35E-06

^a = From (WCH 2013).

^b = Value obtained from the 300-FF-2 RDR/RAWP (DOE-RL 2015).

^c = Value for the noncarcinogenic RAG calculated using Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children, EPA/540/R 93/081, Publication No. 9285.7, U.S. Environmental Protection Agency, Washington, D.C.

^d = The risk associated with total petroleum hydrocarbons do not contribute to the cumulative toxicity calculation.

-- = not applicable

COC = contaminant of concern

NA = not applicable

CONCLUSION:

The calculations in Table 1 demonstrate that the 300-15:2 subsite met the requirements for the industrial direct contact hazard quotient and carcinogenic (excess cancer) risk, as identified in the 300-FF-2 RDR/RAWP (DOE-RL 2015). The hazard quotients and carcinogenic (excess cancer) risk calculations are for use in the final closeout documentation for the 300-15:2 subsite.

CALCULATION COVER SHEET

Project Title: 300 Area Closure Operations Job No. 14655

Area: 300 Area

Discipline: Environmental *Calculation No: 0300X-CA-V0242

Subject: 300-15:2 Subsite Final Closeout Evaluation - Radionuclide Sum of Fractions 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 Sheets = 3 Total = 4	I. B. Berezovskiy <i>I. B. Berezovskiy</i>	R. J. Nielson <i>R. J. Nielson</i>	T. Q. Howell <i>T. Q. Howell</i>	S. G. Wilkinson <i>S. G. Wilkinson</i>	10/15/15

SUMMARY OF REVISION

Washington Closure Hanford		CALCULATION SHEET					
Originator:	I. B. Berezovskiy	Date:	09/10/15	Calc. No.:	0300X-CA-V0242	Rev.:	0
Project:	300 Area Closure Operations	Job No.:	14655	Checked:	R. J. Nielson	Date:	09/10/15
Subject:	300-15:2 Subsite Final Closeout Evaluation - Radionuclide Sum of Fractions Calculations					Sheet No.	1 of 3

1 **PURPOSE:**

2
3 Provide documentation to support the calculation of the sum of fractions evaluation for radionuclide
4 direct exposure excess cancer risk and radiological dose for the 300-15:2 subsite identified as requiring
5 remediation in Table 1 of the 300 Area Final Action ROD (EPA 2013). This calculation is prepared for
6 the subsite data set with applicable radiological contaminants of concern (COCs) in accordance with
7 Section B4 of the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2015).

8
9
10 **GIVEN/REFERENCES:**

- 11
12 1) DOE-RL, 1996, *Hanford Site Background: Part 2, Soil Background for Radioactive Analytes*,
13 DOE/RL-96-12, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland,
14 Washington.
15 2) DOE-RL, 2013, *Remedial Investigation/Feasibility Study for the 300-FF-1, 300-FF-2, and 300-FF-5*
16 *Operable Units*, DOE/RL-2010-99, Rev. 0, U.S. Department of Energy, Richland Operations Office,
17 Richland, Washington.
18 3) DOE-RL, 2015, *Remedial Design Report/Remedial Action Work Plan for 300-FF-2 Soils*,
19 DOE/RL-2014-13-ADD1, Rev. 0, U.S. Department of Energy, Richland Operations Office,
20 Richland, Washington.
21 4) EPA, 2013, *Record of Decision for the 300-FF-2 Operable Unit and 300-FF-5, and Record of*
22 *Decision Amendment for 300-FF-1, Hanford Site, Benton County, Washington*, U.S. Environmental
23 Protection Agency, Region 10, Seattle, Washington.
24 5) WCH, 2013, *300-15:2, 300 Area Process Sewer North of Apple Street Subsite*, Attachment to Waste
25 Site Reclassification Form 2012-120, Rev. 0, Washington Closure Hanford, Richland, Washington.

26
27
28 **SOLUTION:**

29
30 As discussed in section B4 of the RDR/RAWP (DOE-RL 2015), the cleanup levels (CULs) for soil
31 radionuclide COCs in the 300 Area Final Action ROD (EPA 2013) were set at a 1×10^{-4} risk limit or 15
32 mrem/yr dose limit for isotopes, whichever is more conservative. Soil radionuclide CULs must also
33 meet the multi-contaminant total cancer risk limit of 1×10^{-4} and the total dose limit of 15 mrem/yr.
34 These soil risk limits are applied to both the industrial and residential scenarios.

35
36 For waste sites with few radionuclide COCs at concentrations well below the individual radionuclide
37 cleanup levels (CULs) provided in the 300 Area Final Action ROD (EPA 2013), a sum of fractions
38 evaluation is performed for direct exposure single radionuclide 1×10^{-4} cancer risk and 15 mrem/yr dose
39 values as shown in Table 1. The first column of Table 1 presents the COCs and the second column
40 presents the maximum values. Where applicable, background values (DOE-RL 1996) are presented in
41 the third column. Uranium background is subtracted from the analyses for all soil samples; however,
42 background for other radionuclides is only subtracted from the overburden soil analysis. This accounts
43 for anthropogenic and naturally occurring radionuclide background in surface soils. Only uranium
44 background concentrations are accounted for in shallow and deep zone soils by subtracting uranium
45 isotope concentrations from the maximum values. The fourth column presents the background
46 subtracted value. The fifth column presents the single radionuclide 1×10^{-4} cancer risk equivalence

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Project:	300 Area Closure Operations	Job No:	14655	Checked:	R. J. Nielson <i>RJN</i>	Date:	09/10/15
Subject:	300-15:2 Subsite Final Closeout Evaluation - Radionuclide Sum of Fractions Calculations						Sheet No. 2 of 3

1 activity, and the sixth column presents the maximum value divided by the cancer risk equivalence
2 activity.

3
4 The values in the sixth column are summed and presented as the sum of fractions. This value is
5 multiplied by 0.0001 to determine the 1×10^{-4} cancer risk value of 9.27×10^{-6} . A cancer risk value of
6 more than 1×10^{-4} indicates additional evaluation is required.

7
8 The seventh column presents the single radionuclide 15 mrem/yr dose equivalence activity, and the last
9 column presents the maximum value divided by the dose equivalence activity. The values in the last
10 column are summed and presented as the sum of fractions. This value is multiplied by 15 mrem/yr to
11 determine the total radiological dose of 3.04 mrem/yr. A total dose of more than 15 mrem/yr indicates
12 additional evaluation is required.

13
14

15 **METHODOLOGY:**

16

17 The 300-15:2 subsite underwent focused verification sampling at four decision units. The sum of
18 fractions were conservatively calculated for the 300-15:2 subsite data set, using the greatest of the
19 maximum values for each COC detected above background from amongst all applicable decision units,
20 as described in the previously approved interim reclassification documentation for the 300-15:2 subsite
21 (WCH 2013).

22

23 Calculations for the 300-15:2 subsite were performed using CULs for industrial land use. The sum of
24 fractions calculation of COCs for industrial land use using data from the 300-15:2 subsite is presented
25 below.

26

27 1) To calculate the fraction for uranium-235, the background value of 0.11 pCi/g is subtracted from the
28 maximum value from the data set of 1.43 pCi/g, resulting in a corrected maximum value of
29 1.32 pCi/g for uranium-235. The background corrected value is divided by the activity equivalent to
30 1×10^{-4} cancer risk of 61 pCi/g, resulting in a fraction of 0.0216 for uranium-235.

31

32 2) The fractions for the remaining COCs are determined and summed. The sum of these fractions
33 equals 0.093. The sum of fractions is then multiplied by 1×10^{-4} to determine the final cancer risk
34 value of 9.27×10^{-6} for the 300-15:2 subsite. Comparing this value to the cancer risk limit of
35 $<1 \times 10^{-4}$, the requirement is met.

36

37 3) To calculate the radiological dose fraction for uranium-238, the background corrected maximum
38 value of 20.1 pCi/g is divided by the activity equivalent to a 15 mrem/yr dose of 167 pCi/g, resulting
39 in a fraction of 0.120 for uranium-238.

40

41 4) The radiological dose fractions for the remaining COCs are determined and summed. The sum of
42 these fractions equals 0.203. The sum of fractions is then multiplied by 15 mrem/yr to determine the
43 total radiological dose of 3.04 mrem/yr for the subsite. Comparing this value to the radiological
44 dose limit of 15 mrem/yr, the requirement is met.

45

46

Washington Closure Hanford

CALCULATION SHEET

Originator:	I. B. Berezovskiy	Date:	09/10/15	Calc. No.:	0300X-CA-V0242	Rev.:	0	
Project:	300 Area Closure Operations	Job No:	14655	Checked:	R. J. Nielson	Date:	09/10/15	
Subject:	300-15:2 Subsite Final Closeout Evaluation - Radionuclide Sum of Fractions Calculations						Sheet No.	3 of 3

RESULTS:

Table 1 presents the results of the direct contact sum of fractions calculations for 300-15:2 subsite for industrial land use.

Table 1. 300-15:2 Subsite Industrial Sum of Fractions Evaluation of Radionuclide Direct Exposure Excess Cancer Risk and Dose.

COC	Maximum Activity ^a (pCi/g)	Background (pCi/g)	Background Corrected Activity ^b (pCi/g)	Activity Equivalent to Industrial 10 ⁻⁴ Cancer Risk ^c (pCi/g)	Fraction for 10 ⁻⁴ Cancer Risk ^b	Activity Equivalent to Industrial 15 mrem/yr Dose ^d (pCi/g)	Fraction for 15 mrem/yr Dose ^b
Uranium-235	1.43	0.11	1.32	61	0.0216	16	0.0825
Uranium-238	21.2	1.1	20.1	283	0.0710	167	0.120
Sum of Fractions					0.093	Sum of Fractions	0.203
Residential Excess Cancer Risk					9.27E-06	Dose, mrem/yr	3.04

^a From (WCH 2013).

^b Correct decimal places and correct all negative values to be zero. Except for uranium isotopes background subtraction only applies to overburden.

^c From Table 6-12 of the 300 Area RLFS, DOE/RL-2010-99, Rev. 0 (DOE-RL 2013).

^d From Table C-1 of the RDR/RAWP for the 300-FF-2 Soils, DOE/RL-2014-13-ADD1, Rev. 0 (DOE-RL 2015).

COC = Contaminant of Concern.

CONCLUSION:

The calculations summarized in Table 1 provide the sum of fraction calculations for the 300-15:2 subsite with industrial land use radionuclide COCs that were identified as requiring remove, treat, and dispose in Table 1 of the 300 Area Final Action ROD (EPA 2013). The direct contact sum of fractions calculations are for use in the final closeout documentation for the 300-15:2 subsite.