

This human health risk screening evaluation focusses on the data obtained to characterize the sediment in the sump located outside of 607-1F Sewage Treatment Plant for the Deactivation and Decommissioning Model. The characterization effort was originally scheduled as a onetime sampling event that included the collection of one composite sample originating from five biased locations within the concrete primary sedimentation tank. Details are described in the *Sample and Analysis Plan for the 607-1F Sewage Treatment Plant* (SRNS 2018). The samples were analyzed for Target Analyte List (TAL) inorganics, Target Compound List (TCL) organics and radiological indicators.

Data Evaluation Method

The 607-1F Sewage Treatment Plant is in an area designated for industrial land use. That said, the exposure assumptions for an industrial worker scenario (25 years, 250 days/year, 8 hours/day) are overly conservative for the configuration of this facility (i.e., below ground sedimentation tank).

The concentration of each analyte is compared to the default industrial worker soil values from the *USEPA Regional Screening Levels (RSLs)* website, dated November 2018. Constituents that exceed the RSL thresholds are also compared to SRS background maximum concentrations for soil media (WSRC 2006). Constituents that have concentrations less than the RSL thresholds are dropped from further evaluation (no risk).

For noncarcinogens, hazard estimates, called hazard quotients (HQs), are calculated using the following equation:

$$\text{HQ} = \text{concentration} / \text{RSL}$$

For carcinogens, risk estimates are calculated using the following equation:

$$\text{Risk estimate} = (\text{concentration} / \text{RSL}) \times 1\text{E-}06$$

Data Evaluation Results

Table 1 presents the initial data screening for the 607-1F Sewage Treatment Plant.

The following constituents exceed the industrial RSL: arsenic, chromium (assuming hexavalent chromium), cobalt, and thallium. Industrial hazard/risk estimates are provided in Table 2. A summary of the results for an industrial scenario is provided below.

Arsenic: concentration = 2,820 mg/kg, risk = 9.4E-04, SRS background max = 22.9 mg/kg

Chromium: concentration = 1,550 mg/kg, risk = 2.5E-04 (assuming hexavalent chromium), SRS background max (total chromium) = 54.3 mg/kg

Cobalt: concentration = 485 mg/kg, HQ = 1.4, SRS background max = 5.04 mg/kg

Thallium: concentration = 23.6 mg/kg (J-qualified), HQ = 2.0, SRS background max = 8.13 mg/kg

Discussion/Conclusion

The sediment in the sump located outside of 607-1F Sewage Treatment Plant has high concentrations of metals, with some (e.g., arsenic and cobalt) approaching 100 times the SRS background maximum soil concentration. The industrial risk estimate for arsenic ($9.4E-04$) is very close to the principal threat source material (PTSM) risk threshold of $1E-03$. The risk estimate for chromium is based on the hexavalent chromium RSL, but the analytical result is for total chromium, so the estimate is likely biased high. The HQs for cobalt and thallium are relatively low (insignificant).

References

SRNS 2018. *Sample and Analysis Plan for the 607-1F Sewage Treatment Plant*, ERD-EN-2018, Savannah River Nuclear Solutions, April.

USEPA 2018. *USEPA Regional Screening Levels (RSLs) website*, U.S Environmental Protection Agency, November 2018.

WSRC 2006. *Background Soils Statistical Summary Report for the Savannah River Site*, ERD-EN-2005-0223, Rev.1, Washington Savannah River Company, Savannah River Site

Table 1. Risk Screening for the 607-1F Sewage Treatment Plant

Analyte ¹	Result (mg/kg)	Qualifier	Industrial RSL ² (mg/kg)	Result > Ind RSL?	SRS Soil Bkgd Max ³ (mg/kg)	Result > Bkgd?
<u>Metals</u>						
Aluminum	32800		1.1E+06	no		
Antimony	19.4		4.7E+02	no		
Arsenic	2820		3.0E+00	YES	22.9	YES
Barium	161		2.2E+05	no		
Beryllium	27.6		2.3E+03	no		
Cadmium	13.2		9.8E+02	no		
Calcium	3310		EN ⁵	no		
Chromium (+3 RSL) ⁴	1550		1.8E+06	no		
Chromium (+6 RSL) ⁴	1550		6.3E+00	YES	54.3	YES
Cobalt	485		3.5E+02	YES	5.04	YES
Copper	4170		4.7E+04	no		
Iron	139000		8.2E+05	no		
Lead	381		8.0E+02	no		
Magnesium	1390		EN ⁵	no		
Manganese	1460		2.6E+04	no		
Mercury	2.16		4.6E+01	no		
Nickel	393		2.2E+04	no		
Potassium	624		EN ⁵	no		
Selenium	6.41	J	5.8E+03	no		
Sodium	59.3	J	EN ⁵	no		
Thallium	23.6	J	1.2E+01	YES	8.13	YES
Vanadium	175		5.8E+03	no		
Zinc	7610		3.5E+05	no		
<u>PCBs</u>						
Aroclor-1260	0.331		9.9E-01	no		
<u>Organics</u>						
1,2-Dichloroethane	0.126	J	2.0E+00	no		
Benzo(a)anthracene	0.346		2.1E+01	no		
Benzo(a)pyrene	0.377		2.1E+00	no		
Benzo(b)fluoranthene	0.651		2.1E+01	no		
Benzo(ghi)perylene	0.192		NA ⁶	no		
Benzo(k)fluoranthene	0.28		2.1E+02	no		
Bis(2-ethylhexyl)phthalate	9.63		1.6E+02	no		
Butylbenzylphthalate	0.0915	J	1.2E+03	no		
Chrysene	0.488		2.1E+03	no		
Dibenzo(a,h)anthracene	0.0597	J	2.1E+00	no		
Di-n-butylphthalate	0.0982	J	8.2E+04	no		
Fluoranthene	0.695		3.0E+04	no		
Indeno(1,2,3-cd)pyrene	0.24		2.1E+01	no		
Phenanthrene	0.198		NA ⁶	no		
Pyrene	0.508		2.3E+04	no		

1 - Detected analytes from Samples W-18052-00001 and W-18052-RS-01.

2 - Industrial RSL = Regional Screening Level (soil media) for industrial worker scenario from USEPA Regional Screening Levels website (November 2018).

3 - SRS background concentrations obtained from the Background Soils Statistical Summary Report for the Savannah River Site, Table B-2 (WSRC 2006).

4 - Analytical result is for total chromium; data screened against USEPA trivalent and hexavalent chromium RSL concentrations.

5 - EN = essential nutrient, RSL not available

6 - NA = not available

Table 2. Industrial Hazard/Risk Estimate				
Analyte	Concentration (mg/kg)	Industrial RSL²	Industrial Hazard Estimate (HQ)³	Industrial Risk Estimate⁴
<i>Noncarcinogenic Hazard Estimate</i>				
Cobalt	485	350	1.4	NA
Thallium	23.6	12	2.0	NA
<i>Carcinogenic Risk Estimate</i>				
Arsenic	2820	3.0	NA	9.4E-04
Chromium (+6)	1550	6.3	NA	2.5E-04
1 - Analytes from Table 1 that exceed RSL (residential/industrial) 2 - Industrial RSL = Regional Screening Level (soil media) for industrial worker scenario from USEPA Regional Screening Levels website (November 2018) 3 - Hazard Estimate (HQ) = Concentration/RSL 4 - Risk Estimate = (Concentration/RSL) x 1E-06				