



SCREENING RISK EVALUATION FOR INDIVIDUALS OBSERVED SWIMMING IN THE TAR CREEK SWIMMING HOLE AREA

AGENDA

- Document Scope
- Exposure Assumptions
- Risk Assessment Methods
 - Focused Field Investigation
 - Exposure Assessment Assumptions
 - Risk Characterization Methods
- Results
 - Sample Analysis
 - Risk Characterization
 - Uncertainty
- Summary and Conclusions
- TASC Comments





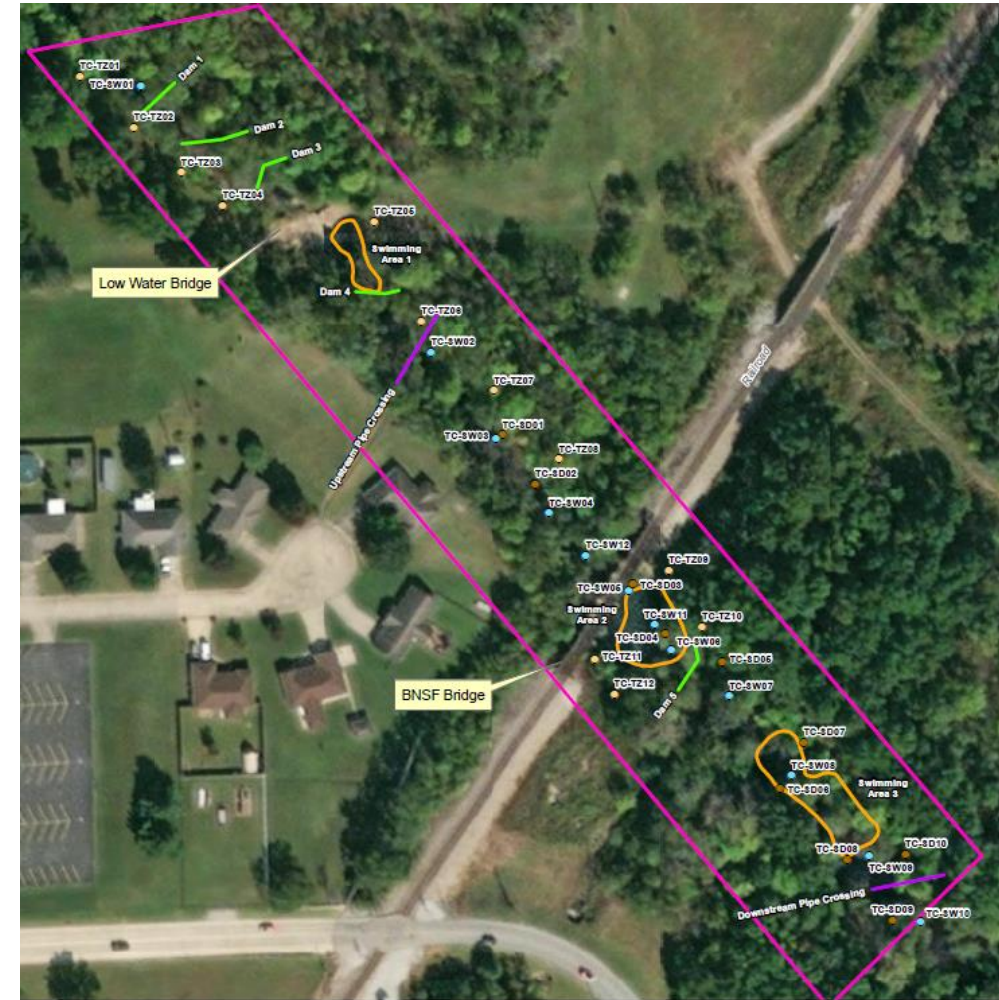
DOCUMENT SCOPE

INTRODUCTION AND BACKGROUND

- In February 2021, a Remedial Investigation/Baseline Human Health Risk Assessment (RI/BHHRA) Report documented a high risk from exposure to several hazardous chemicals in surface water and sediment during recreational and swimming activities
- Community members noted that small dams were placed on part of Tar Creek to allow pooling for swimming activities
- The Oklahoma Department of Environmental Quality (ODEQ) placed several “Swimming Discouraged” signs in and around the swimming areas; the signs were stolen or damaged
- EPA Region 6 repeated its recommendation to avoid recreational activities, including swimming, in any part of Tar Creek until final action is taken to remove the risk of exposure to Tar Creek-contaminated waters

INTRODUCTION AND BACKGROUND

- The report addresses the “Tar Creek Swimming Hole Area” of Tar Creek, southeast of the Miami Nursing Home, and includes waters surrounding the Low Water Bridge and the BNSF Bridge
- Potential exposures to chemicals of concern (COCs) in surface water, sediment and riverbank soil through ingestion and contact with skin were evaluated



DOCUMENT SECTIONS

Memorandum: June 30, 2023

"Screening Risk Evaluation for Individuals Observed Swimming in the Tar Creek Swimming Hole Area"

Provides a description of:

- The purpose of the Screening Risk Evaluation (SRE)
- Methods used to complete the SRE
- Conclusions and review of the uncertainty associated with the SRE

Attachment A: pdf pages 15 to 85

Site-specific General Public Recreator, and Tribal Lifeways Recreator; Surface Water, Sediment, Soils Inputs : Risk to General Public and Tribal Lifeways Recreator from Exposure to Surface Water while Swimming/Wading at the Tar Creek Swimming Hole Area

Attachment B: pdf pages 86 to 123

Evaluation of Lead Exposure and Risk Estimation Using Time Weighted Average: Calculations in the EPA IEUBK Lead Model

Attachment C: pdf pages 124 to 160

ProUCL Statistics

RISK ASSESSMENT DOCUMENT OBJECTIVES

- To **identify unacceptable risk to child and adult recreators**, involved in swimming, wading and picnicking activities at the Tar Creek Swimming Hole Area
- To **document possible exposure risks to COCs** in surface water, sediment and surface riverbank soil through ingestion or contact to the skin (dermal contact)
- To **continue recommendations to avoid recreational activities in any section of the Tar Creek** until a final action is taken to alleviate the risk from exposure to Tar Creek-contaminated waters



RISK ASSESSMENT METHODS



- Legend**
- Soil Sample Location
 - Sediment Sample Location
 - Surface Water Sample Location
 - Dam
 - Pipe Crossing
 - Swimming Area
 - Assessment Area

Notes:
 1. Imagery Source (main map): ESRI World Street Map online mapping service
 2. Imagery Source (inset map): ESRI World Imagery online mapping service
 EPA = Environmental Protection Agency
 BNSF = Burlington Northern Santa Fe

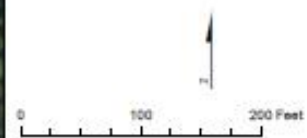


Figure 1.
 Surface Water, Sediment and Soil
 Sample Locations
 Remedial Investigation/Feasibility Study
 and Remedial Design
 Tar Creek Superfund Site
 Ottawa County, Oklahoma

Focused Field Investigation



TC-SW04

TC-SW12

TC-TZ09

TC-SW05

TC-SD03

Swimming Area 2

TC-SW11

TC-TZ10

TC-SD04

TC-SW06

TC-TZ11

TC-SD05

TC-TZ12

TC-SW07

Dam 5

Legend

- Soil Sample Location
- Sediment Sample Location
- Surface Water Sample Location
- Dam
- Pipe Crossing
- Swimming Area
- Assessment Area

BNSF Bridge

TC-SD07

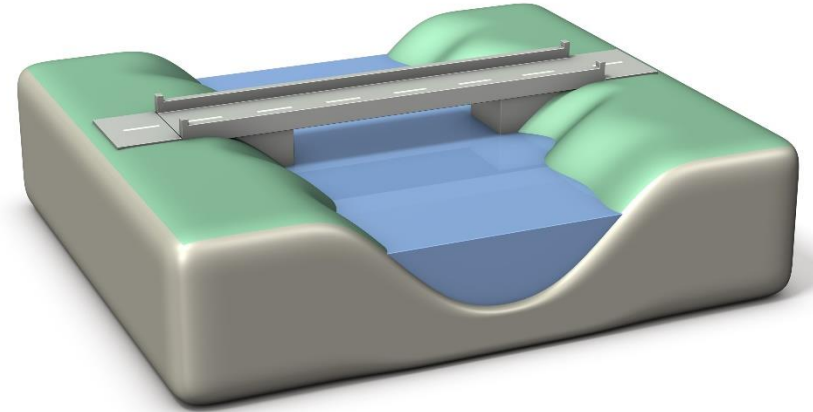
TC-SW08

Swimming Area 3

TC-SD06

FOCUSED FIELD INVESTIGATION

- Sampling event took place in October 2022
- Water level was lower compared to water levels at capacity
- Both fine fraction and unsieved samples of sediment and soil were collected



EXPOSURE ASSESSMENT METHODS

- Exposure media:
 - Surface water (total)
 - Sediment (fine fraction and unsieved)
 - Surface riverbank soil (fine fraction and unsieved)
- COCS:
 - Surface water: arsenic, cadmium, cobalt, iron, lead, manganese, nickel and zinc
 - Sediment and soil: cadmium, lead and zinc
- Receptors:
 - Child (ages 0 to 6) and Adult
 - Tribal Lifeway and General Public exposure scenarios
- Exposure Pathways (swimming vs. picnicking)
 - Incidental ingestion of and dermal exposure to surface water and sediment while swimming, and dermal exposure to surface water and sediment
 - Incidental ingestion of surface riverbank soil and dermal exposure to soil



Table 5. Exposure Input Parameters for Surface Water, Sediment and Bank Soil used in the Regional Screening Level Calculator to evaluate risk from swimming/wading and recreating (picnicking) at the Tar Creek Swimming Hole Area. *

<i>Exposure Parameter</i>	<i>Tribal Lifeway</i>		<i>General Public</i>	
	<i>Child</i>	<i>Adult</i>	<i>Child</i>	<i>Adult</i>
Water ingestion rate (swimming/wading) (liter/hr)	0.12	0.0985	0.12	0.0985
Sediment/Soil ingestion rate (mg/day)	200/400**	200/400	200	100
Exposure time (swimming/wading) (hours/day)	6	6	3	3
Exposure frequency (days/yr)	234	312	90	90
Exposure duration (years)	6	64	6	20
Body Weight (Kg)	15	70	15	80
Averaging time (Non-Cancer) (days)	2190	23,360	2,190	7,300
Event time (hours/event)	6	6	3	3
Skin surface area (swimming/wading) (cm²)	6,365	19,652	6,365	19,652
Skin surface area (soil/sediment) (cm²)	2,373	6,032	2,373	6,032
Event frequency (events/day)	1	1	1	1
Soil to skin adherence factor (mg/cm²-day)	0.1	0.1	0.2	0.07

**All input parameters and references were adopted with some modifications from the RI/BHHRA of Feb. 2021.*

***Additional risk calculations were done to address the uncertainty associated with higher tribal soil/sediment ingestion rate of 400 mg/day.*

EXAMPLE – EXPOSURE ALGORITHM: SURFACE WATER – RECREATIONAL CONTACT FOR A CHILD

Exposure via this pathway would be calculated as follows:

$$LADD_{ABS \text{ surface water dermal}} = \frac{DA_{event} * SA * EV * EF * ED}{BW * AT}$$

where:

$LADD_{ABS \text{ surface water dermal}}$	=	absorbed lifetime average daily dose from dermal contact with contaminated surface water (mg/kg-day);
DA_{event}	=	absorbed dose per event (mg/cm ² /event);
SA	=	surface area of the skin that contacts surface water (cm ²);
EV	=	event frequency (events/day);
EF	=	exposure frequency (days/year);
ED	=	exposure duration (years);
BW	=	body weight of a child (kg); and
AT	=	averaging time (days).

RISK CHARACTERIZATION METHODS

- Data statistically reviewed (ProUCL methods)
- Time-weighted average exposure point concentrations developed that include ingestion of surface water while swimming, and ingestion of drinking water at home
- SRE using EPA's Screening Level (RSL) Calculator under a recreational land use scenario
- Risk from exposure to lead evaluated using EPA's uptake bio-kinetic model, IEUBK model version 2.0



EPA
PB93-963510
OSWER #9285.7-15-1
February 1994

GUIDANCE MANUAL FOR THE IEUBK MODEL FOR LEAD IN CHILDREN

Office of Solid Waste and Emergency Response
U.S. Environmental Protection Agency
Washington, DC 20460



RESULTS

RESULTS – SAMPLE ANALYSIS

- A total of 12 surface water and 20 sediment samples were collected from the swimming hole
- A total of 24 surface riverbank soil samples were collected to evaluate picnicking activity-related exposure
- Table 1 and Table 3 show summary statistics for surface water, riverbank soil and sediment
- Table 2 and Table 4 show statistics for the COCs in Tar Creek surface water and sediment samples from the RI/BHRRR Report

TASK ORDER NO. 079-RICO-06TS

Tar Creek Superfund Site Operable Unit 5
Ottawa County, Oklahoma

Human Health Risk Assessment
Document Control No. 0079-02017

Prepared for

U.S. Environmental Protection Agency

February 2021

ch2m.

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Table 1. Surface Water Descriptive Statistics and Exposure Point Concentration (EPC= 95% UCL of the mean) of Chemicals of Concern found at Tar Creek Swimming Hole Area.								
	<i>Arsenic</i>	<i>Cadmium</i>	<i>Cobalt</i>	<i>Iron</i>	<i>Lead</i>	<i>Manganese</i>	<i>Nickel</i>	<i>Zinc</i>
<i>EPC (µg/L)</i>	0.81	1.83	2.62	812.00	9.75	1252.00	14.60	482.00
<i>Minimum(µg/L)</i>	0.45	0.221	0.411	121	0.635	82.1	8.14	95.9
<i>Maximum(µg/L)</i>	12.6	4.14	5.73	1760	24.8	2850	30.8	953
<i>Arithmetic Mean(µg/L)</i>	0.672	1.32	1.59	509	5.41	414	11.8	320
<i>Total number of samples collected is 12 samples.</i>								

Table 3. Surface Water Descriptive Statistics and Exposure Point Concentration of Chemicals of Concern found at Tar Creek Watershed Reported in the Site Wide OU#5 RI/BHHRA report.								
	<i>Arsenic</i>	<i>Cadmium</i>	<i>Cobalt</i>	<i>Iron</i>	<i>Lead</i>	<i>Manganese</i>	<i>Nickel</i>	<i>Zinc</i>
<i>EPC (µg/L)</i>	34	16	32	51,000	44/37	1,600	330	6,300
<i>Minimum(µg/L)</i>	0.5	0.01	0.35	10	0.2	3.34	1.59	2.87
<i>Maximum(µg/L)</i>	230	360	120	260,000	1300	12,000	1,100	63,000
<i>Arithmetic Mean(µg/L)</i>	42	14	31	43000	37	1,400	320	5,700
<i>Total number of samples collected is 1,396</i>								

SURFACE WATER RESULTS:

Comparison of Swimming Hole Area surface water concentrations to surface water results across operable unit 5 (OU-5) show Swimming Hole Area concentrations at the lower end of the range of OU-5 surface water results

<i>Location</i>	<i>Cadmium (mg/Kg)</i>	<i>Lead (mg/Kg)</i>	<i>Zinc (mg/Kg)</i>
Sediment Exposure Point Conc. (fine fraction)	<i>187.3</i>	<i>1,065</i>	<i>18,307</i>
Minimum	<i>0.66</i>	<i>16.1</i>	<i>282</i>
Mean	<i>84.5</i>	<i>768.9</i>	<i>13,316</i>
Maximum	<i>231</i>	<i>1,800</i>	<i>28,200</i>
Sediment Exposure Point Conc. (Unsieved)	<i>84.14</i>	<i>964.1</i>	<i>16,806</i>
Minimum	<i>0.95</i>	<i>8.83</i>	<i>682</i>
Mean	<i>62.1</i>	<i>709.3</i>	<i>12,223</i>
Max	<i>141</i>	<i>1,480</i>	<i>31,300</i>

<i>Location</i>	<i>Cadmium (mg/Kg)</i>	<i>Lead (mg/Kg)</i>	<i>Zinc (mg/Kg)</i>
Sediment Exposure Point Conc. (fine fraction)	<i>357</i>	<i>1100</i>	<i>21,400</i>
Minimum (mg/Kg)	<i>0.3</i>	<i>6</i>	<i>21</i>
Mean	<i>150</i>	<i>1100</i>	<i>15,000</i>
Maximum	<i>4,200</i>	<i>7,300</i>	<i>64,000</i>
Sediment Exposure Point Conc. (Unsieved)	<i>74.6</i>	<i>532</i>	<i>12,300</i>
Minimum	<i>0.3</i>	<i>6</i>	<i>21</i>
Mean	<i>47</i>	<i>530</i>	<i>8,200</i>
Maximum	<i>240</i>	<i>800</i>	<i>43,000</i>
<i>*Total number of samples collected is 199</i>			

SEDIMENT RESULTS:

Comparison of Swimming Hole Area sediment concentrations to OU-5-wide sediment results show they are comparable

RESULTS – RISK CHARACTERIZATION

- Two different exposure scenarios (Tribal Lifeway and General Public) were used to determine how individuals could be exposed to COCs by recreating in the Swimming Hole Area
- Three types of risk were evaluated:
 - Cancer risk = probability of observing cancer following exposure to cancer-causing contaminants; generally, EPA does not require any actions if the cancer risk is less than 1×10^{-4}
 - Noncancer hazard = exposure is higher than an acceptable dose; generally, EPA does not require any actions if the noncancer hazard index (HI) is less than 1 because that means exposure is below the acceptable dose

$$\frac{\text{Exposure Dose}}{\text{Acceptable Dose}} = \text{HI}$$

- Exposure to lead is evaluated differently using site data and a lead model to predict an exceedance of acceptable blood lead levels in greater than 5% of the exposed group of children

> 5% of exposed child population exceed a target
blood lead level of 5 micrograms per deciliter ($\mu\text{g/dL}$)

RESULTS – RISK CHARACTERIZATION FOR TRIBAL LIFEWAY

- Surface water risks (Table 6)
 - All cancer risks below 1×10^{-4}
 - Noncancer HI >1 for child (HI = 5.37) and adults (HI = 3.11) due to manganese and cadmium
- Sediment risks based on two ingestion rates for an adult and child of 200 milligrams per day [mg/day] and 400 mg/day (Table 7 and Table 7a, respectively)
 - All cancer risks below 1×10^{-4}
 - Noncancer HI >1 for child (HI = 17.3) and adults (HI = 5.28) due to cadmium (based on 200 mg/day)
 - Noncancer HI >1 for child (HI = 33.8) and adults (HI = 10) due to cadmium and zinc (based on 400 mg/day)
- Surface riverbank soil risks based on two ingestion rates for an adult and child of 200 mg/kg and 400 mg/day (Table 8 and Table 8a, respectively)
 - All cancer risks below 1×10^{-4}
 - Noncancer HI >1 for child (HI = 2.8) due to cadmium, adults HI < 1
 - Noncancer HI >1 for child (HI = 5.49) and adults (HI = 1.62) due to cadmium

Table 6. Risk to Tribal Lifeway from Exposure to Surface Water during Swimming/Wading at Tar Creek Swimming Hole Area.

Chemical	Concentration (ug/L)	Ingestion Risk	Dermal Risk	Carcinogenic Risk	Ingestion Child HQ	Dermal Child HQ	Noncarcinogenic Child HQ	Ingestion Adult HQ	Dermal Adult HQ	Noncarcinogenic Adult HQ
Arsenic	0.81	1.22E-05	1.77E-06	1.39E-05	8.31E-02	4.41E-03	8.75E-02	2.18E-02	3.89E-03	2.56E-02
Cadmium (Water)	1.83	-	-	-	5.63E-01	5.97E-01	1.16E+00	1.47E-01	5.27E-01	6.74E-01
Cobalt	2.62	-	-	-	2.69E-01	5.70E-03	2.74E-01	7.04E-02	5.03E-03	7.54E-02
Iron	812	-	-	-	3.57E-02	1.89E-03	3.76E-02	9.35E-03	1.67E-03	1.10E-02
Lead	9.75	-	-	-	-	-	-	-	-	-
Manganese	1252	-	-	-	1.61E+00	2.13E+00	3.73E+00	4.20E-01	1.88E+00	2.30E+00
Nickel	14.6	-	-	-	2.25E-02	5.96E-03	2.84E-02	5.88E-03	5.26E-03	1.11E-02
Zinc	482	-	-	-	4.94E-02	1.57E-03	5.10E-02	1.29E-02	1.39E-03	1.43E-02
<i>Risk/HI</i>	-	<i>1.22E-05</i>	<i>1.77E-06</i>	<i>1.39E-05</i>	<i>2.63E+00</i>	<i>2.75E+00</i>	<i>5.37E+00</i>	<i>6.88E-01</i>	<i>2.42E+00</i>	<i>3.11E+00</i>

Table 7. Risk to Tribal Lifeway from Exposure to Sediment during Swimming/Wading at Tar Creek Swimming Hole Area.

Chemical	Concentration (mg/kg)	Ingestion Risk	Dermal Risk	Inhalation Risk	Carcer Risk	Ingestion Child HQ	Dermal Child HQ	Inhal. Child HQ	Noncarc inogenic Child HI	Ingestion Adult HQ	Dermal Adult HQ	Inhalation Adult HQ	Noncarc inogenic Adult HI
Cadmium (Diet)	1.87E+02	-	-	5.19E-08	5.19E-08	1.60E+01	7.60E-01	2.21E-03	1.68E+01	4.57E+00	5.52E-01	2.94E-03	5.13E+00
Lead	1.07E+03	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	1.83E+04	-	-	-	-	5.22E-01	-	-	5.22E-01	1.49E-01	-	-	1.49E-01
<i>*Total Risk/HI</i>	-	-	-	5.19E-08	5.19E-08	1.65E+01	7.60E-01	2.21E-03	1.73E+01	4.72E+00	5.52E-01	2.94E-03	5.28E+00

Table 7a. Risk to Tribal Lifeway from Exposure to Sediment during Swimming/Wading at Tar Creek Swimming Hole Area using ingestion rate of 400 mg/day.

Chemical	Concentration (mg/kg)	Ingestion Risk	Dermal Risk	Inhalation Risk	Carcinogenic Risk	Ingestion Child HQ	Dermal Child HQ	Inhalation Child HQ	Noncarc inogenic Child HI	Ingestion Adult HQ	Dermal Adult HQ	Inhalation Adult HQ	Noncarc inogenic Adult HI
Cadmium (Diet)	1.87E+02	-	-	5.19E-08	5.19E-08	3.20E+01	7.60E-01	2.21E-03	3.28E+01	9.15E+00	5.52E-01	2.94E-03	9.70E+00
Lead	1.07E+03	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	1.83E+04	-	-	-	-	1.04E+00	-	-	1.04E+00	2.98E-01	-	-	2.98E-01
<i>*Total Risk/HI</i>	-	-	-	5.19E-08	5.19E-08	3.31E+01	7.60E-01	2.21E-03	3.38E+01	9.45E+00	5.52E-01	2.94E-03	1.00E+01

Table 8. Risk to Tribal Lifeway from Exposure to Bank Soil during Picnicking Activities at Banks of the Tar Creek Swimming Hole Area.

Chemical	Concentration (mg/kg)	Ingestion Risk	Dermal Risk	Inhalation Risk	Carcinogenic Risk	Ingestion Child HQ	Dermal Child HQ	Inhalation Child HQ	Noncarcinogenic Child HI	Ingestion Adult HQ	Dermal Adult HQ	Inhalation Adult HQ	Noncarcinogenic Adult HI
Cadmium (Diet)	2.94E+01	-	-	8.14E-09	8.14E-09	2.51E+00	1.19E-01	3.47E-04	2.63E+00	7.18E-01	8.66E-02	4.62E-04	8.05E-01
Lead	3.07E+02	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	5.98E+03	-	-	-	-	1.70E-01	-	-	1.70E-01	4.87E-02	-	-	4.87E-02
<i>*Total Risk/HI</i>	-	-	-	8.14E-09	8.14E-09	2.68E+00	1.19E-01	3.47E-04	2.80E+00	7.67E-01	8.66E-02	4.62E-04	8.54E-01

Table 8 a. Risk to Tribal Lifeway from Exposure to Bank Soil during Picnicking Activities at Banks of the Tar Creek Swimming Hole Area Using ingestion rate of 400 mg/day.

Chemical	Concentration (mg/kg)	Ingestion Risk	Dermal Risk	Inhalation Risk	Carcinogenic Risk	Ingestion Child HQ	Dermal Child HQ	Inhalation Child HQ	Noncarcinogenic Child HI	Ingestion Adult HQ	Dermal Adult HQ	Inhalation Adult HQ	Noncarcinogenic Adult HI
Cadmium (Diet)	2.94E+01	-	-	8.14E-09	8.14E-09	5.03E+00	1.19E-01	3.47E-04	5.15E+00	1.44E+00	8.66E-02	4.62E-04	1.52E+00
Lead	3.07E+02	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	5.98E+03	-	-	-	-	3.41E-01	-	-	3.41E-01	9.73E-02	-	-	9.73E-02
<i>*Total Risk/HI</i>	-	-	-	8.14E-09	8.14E-09	5.37E+00	1.19E-01	3.47E-04	5.49E+00	1.53E+00	8.66E-02	4.62E-04	1.62E+00

RESULTS – RISK CHARACTERIZATION FOR GENERAL PUBLIC

- Surface water risks (Table 9)
 - All cancer risks below 1×10^{-4}
 - Noncancer HI >1 for child (HI = 1.03) due to cadmium and manganese , adult HI <1
- Sediment risks (Table 10)
 - All cancer risks below 1×10^{-4}
 - Noncancer HI >1 for child (HI = 6.94) due to cadmium, adult HI <1
- Riverbank soil risks (Table 11)
 - All cancer risks below 1×10^{-4}
 - Noncancer HI >1 for child (HI = 1.12) due to cadmium, adults HI <1

GENERAL PUBLIC RISK CALCULATIONS

Table 9. Risk to General Public Exposure to Surface Water While Swimming/Wading at Tar Creek Swimming Hole area.

Chemical	Concentration (ug/L)	Ingestion Risk	Dermal Risk	Carcinogenic Risk	Ingestion Child HQ	Dermal Child HQ	Noncarcinogenic Child HQ	Ingestion Adult HQ	Dermal Adult HQ	Noncarcinogenic Adult HQ
Arsenic, Inorganic	0.81	9.69E-07	9.58E-08	1.07E-06	1.60E-02	8.48E-04	1.68E-02	2.75E-03	4.91E-04	3.24E-03
Cadmium (Water)	1.83	-	-	-	1.08E-01	1.15E-01	2.23E-01	1.86E-02	6.65E-02	8.51E-02
Cobalt	2.62	-	-	-	5.17E-02	1.10E-03	5.28E-02	8.88E-03	6.35E-04	9.52E-03
Iron	812	-	-	-	6.86E-03	3.64E-04	7.23E-03	1.18E-03	2.11E-04	1.39E-03
Lead and Compounds	9.75	-	-	-	-	-	-	-	-	-
Manganese (Non-diet)	1252	-	-	-	3.09E-01	4.09E-01	7.18E-01	5.31E-02	2.37E-01	2.90E-01
Nickel Soluble Salts	14.6	-	-	-	4.32E-03	1.15E-03	5.47E-03	7.43E-04	6.63E-04	1.41E-03
Zinc and Compounds	482	-	-	-	9.51E-03	3.03E-04	9.81E-03	1.63E-03	1.75E-04	1.81E-03
<i>*Total Risk/HI</i>	-	<i>9.69E-07</i>	<i>9.58E-08</i>	<i>1.07E-06</i>	<i>5.05E-01</i>	<i>5.28E-01</i>	<i>1.03E+00</i>	<i>8.69E-02</i>	<i>3.06E-01</i>	<i>3.93E-01</i>

Table 10. Risk to the General Public from Exposure to Sediment While Swimming/Wading at Tar Creek Swimming Hole Area.

Chemical	Concentration (mg/kg)	Ingestion Risk	Dermal Risk	Inhalation Risk	Carcinogenic Risk	Ingestion Child HQ	Dermal Child HQ	Inhalation Child HQ	Noncarcinogenic Child HI	Ingestion Adult HQ	Dermal Adult HQ	Inhalation Adult HQ	Noncarcinogenic Adult HI
Cadmium (Diet)	1.87E+02	-	-	2.84E-09	2.84E-09	6.16E+00	5.84E-01	4.25E-04	6.74E+00	5.77E-01	9.75E-02	4.25E-04	6.75E-01
Lead and Compounds	1.07E+03	-	-	-	-	-	-	-	-	-	-	-	-
Zinc and Compounds	1.83E+04	-	-	-	-	2.01E-01	-	-	2.01E-01	1.88E-02	-	-	1.88E-02
<i>*Total Risk/HI</i>	-	-	-	2.84E-09	2.84E-09	6.36E+00	5.84E-01	4.25E-04	6.94E+00	5.96E-01	9.75E-02	4.25E-04	6.94E-01

11. Risk to the General Public from Exposure to Bank Soil While Picnicking at the Banks of Tar Creek Swimming Hole Area.

Chemical	Concentration (mg/kg)	Ingestion Risk	Dermal Risk	Inhalation Risk	Carcinogenic Risk	Ingestion Child HQ	Dermal Child HQ	Inhalation Child HQ	Noncarcinogenic Child HI	Ingestion Adult HQ	Dermal Adult HQ	Inhalation Adult HQ	Noncarcinogenic Adult HI
Cadmium (Diet)	2.94E+01	-	-	4.46E-10	4.46E-10	9.67E-01	9.17E-02	6.67E-05	1.06E+00	9.06E-02	1.53E-02	6.67E-05	1.06E-01
Lead and Compounds	3.07E+02	-	-	-	-	-	-	-	-	-	-	-	-
Zinc and Compounds	5.98E+03	-	-	-	-	6.55E-02	-	-	6.55E-02	6.14E-03	-	-	6.14E-03
<i>*Total Risk/HI</i>	-	-	-	4.46E-10	4.46E-10	1.03E+00	9.17E-02	6.67E-05	1.12E+00	9.68E-02	1.53E-02	6.67E-05	1.12E-01

RESULTS – RISK CHARACTERIZATION – HI SUMMARY

Comparison of Noncancer Hazard Indices (HIs)

Exposure Media	Tribal Lifeway		General Public	
	Adult	Child	Adult	Child
Surface Water	3	5	<1	1
Sediment 200 mg/day	5	17	<1	7
Sediment 400 mg/day	10	34	-	-
Bank Soil 200 mg/day	3	<1	<1	1
Bank Soil 400 mg/day	5	2	-	-

RESULTS – RISK CHARACTERIZATION – LEAD

- Exposure to lead is evaluated differently from cancer and noncancer risks using site data and a lead model to predict if acceptable blood lead levels are exceeded in more than 5% of the exposed group of children

Lead Exposure Concern = > 5% of exposed child population exceed a target blood lead level of 5 µg/dL

- Risk from exposure to lead in **sediment** and also **surface riverbank soil** in **children**
 - Assumes Tribal Lifeway Child and General Public Child spend their time in picnicking activities on the riverbank and swimming in contact with sediment all day while they are at the Tar Creek Swimming Hole Area
 - The Tribal Lifeway Child takes into account higher ingestion rates of 200 mg/day and 400 mg/day
- All model runs **exceeded** the probability of no more than 5% of a typical child or group of similarly exposed children to exceed a blood lead level of 5 µg/dL
 - The Tribal Lifeway Child had a probability exceedance ranging from 64.5% to 99.7%, based on surface riverbank soil and sediment ingestion, respectively
 - The General Public Child had a probability exceedance ranging from 12.5% to 25.9%, based on surface riverbank soil and sediment ingestion, respectively

RESULTS – RISK CHARACTERIZATION – LEAD SUMMARY

Comparison of the Chance of Blood Lead Level Exceedances in More than 5% of Exposed Children

Exposure Medium	Acceptable Percentage	Tribal Lifeway Children	General Public Children
Sediment – 200 mg/day	5%	96.4%	25.9%
Sediment – 400 mg/day	5%	99.7%	Not applicable
Soil – 200 mg/day	5%	64.5%	12.8%
Soil = 400 mg/day	5%	92.9%	Not applicable

RESULTS – UNCERTAINTY

- The focused screening risk assessment generally tends to overestimate the risk
 - EPA risk assessment guidance uses the upper end of an average to address the differences among differences in a population
 - Use of a higher average is intentional to ensure decisions are made to ensure the protection of all individuals
- Tribal Lifeway is not representative of the general population since there is more exposure due to the use of Tar Creek on a more frequent basis
 - Use of default exposure assumptions were used with also estimates of higher exposure rates for the Tribal Lifeway, which is intended to overestimate risk
 - The potential exists if these exposure rates are not high enough, depending on actual Tribal Lifeway activities

RESULTS – UNCERTAINTY – LEAD

- The IEUBK model assumes constant exposures during each age-year; it can provide only an approximation of lead concentrations during non-continuous exposure scenarios of less than a year
- The SRE assumes a child is exposed to lead in surface riverbank soil for 234 days per year with 60% of the time as it was also assumed the child spends time at home 40% of this time; this may or may not overestimate the risk if these exposure times are not high enough
- The exposure point concentration is calculated using conservative methods that may overestimate the true exposure conditions by using an upper-end average of the data
- This screening risk assessment uses a more conservative blood lead level of 5 $\mu\text{g}/\text{dL}$ in anticipation of a new EPA lead policy that will lower the acceptable blood lead level in the near future



CONCLUSIONS

CONCLUSIONS

- October sediment results were within the same range of the 2021 sediment results for the watershed (OU-5)
- The cancer risks for both the Tribal Lifeway and the General Public were below 1×10^{-4} for surface water, sediment and riverbank soil exposures
- The noncancer HI was equal to or exceeded the threshold of 1 for the Tribal Lifeway and General Public Child; the Tribal Lifeway exceedances were about three times higher than the noncancer hazard exceedances for the General Public Child

Swimming/wading and picnicking activities at the Tar Creek Swimming Hole Area pose a risk exceeding EPA's acceptable noncancer hazard levels and lead exposure levels; as such, refraining from such activities until the site is remediated is recommended

- The noncancer HI was exceeded for the Tribal Lifeway adult exposure pathways but not for the General Public adult exposure pathways
- All noncancer hazard exceedances were due primarily due to ingestion exposure, with a secondary contribution from skin contact



TASC COMMENTS

TASC COMMENTS – FOR LEAD CONSIDERATION

- Community members understand that many of the exposure assumptions were obtained from the 2021 BHHRA; however, according to Table 5, some assumptions were modified but it is unclear which ones were modified and why they were modified

Community members may want to ask EPA for clarification about which exposure assumptions were modified and the reasons for modifying them

TASC COMMENTS – FOR LEAD CONSIDERATION

- The conclusions indicated that swimming/wading and picnicking activities at the Tar Creek Swimming Hole Area pose a risk exceeding EPA's accepted risk levels; refraining from such activities until the site is remediated is recommended

The community may want to ask EPA for clarification about how ongoing and known exposures to swimming hole areas will be discouraged or prevented since site remediation will take time and has not been completed

TASC COMMENTS – FOR LEAD CONSIDERATION

- While the 2023 SRE results in conclusions similar to those in the 2021 BHHRA, the actions taken to discourage swimming and recreational activities in these areas have not been entirely successful
- For example, EPA and ODEQ placed several “Swimming Discouraged” signs in and around the swimming areas; the signs have since been stolen or damaged

Community members may want to ask EPA if increased monitoring of these areas can be conducted to ensure signage remains posted and that artificial dams can be removed



QUESTIONS?

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