UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8
1595 Wynkoop Street
DENVER, CO 80202-1129
Phone 800-227-8917
http://www.epa.gov/region08

DATE: August 20th, 2020

TECHNICAL MEMORANDUM

SUBJECT: Request for Region 8 Superfund Emergency Response Program Assistance for the Carpenter-Snow Creek Superfund Site located in Neihart, Cascade County, Montana.

TO: Roger Hoogerheide, RPM, USEPA R8, Montana — Roger Hoogerheide Digitally signed by Roger Hoogerheide Date: 2020.08.26 15:15:33 -06'00'
Duc Nguyen, OSC, USEPA R8, Montana — DUC NGUYEN Digitally signed by DUC NGUYEN Date: 2020.08.26 15:05:43 -06'00'

FROM: Jason Fritz, Ph.D., Toxicology Team Lead, EPA Region 8 Laboratory Services and Applied Sciences Division, Technical Assistance Branch — JASON FRITZ Digitally signed by JASON FRITZ Date: 2020.08.26 15:23:27 -06'00'
Will Folland, M.Sc., Toxicologist, EPA Region 8 Laboratory Services and Applied Sciences Division, Technical Assistance Branch — Digitally signed by WILLIAM FOLLAND Date: 2020.08.26 15:11:51 -06'00'

RE: Lead Removal Justification

Summary:

As Toxicologists responsible for providing technical assistance to the Region 8 Superfund program, we support your efforts to remove approximately 500 yd^3 of lead-contaminated soils at a residential property immediately down gradient of the Silver Dyke glory hole, in OU3 of the Carpenter Snow Creek (CSC) Mining District Superfund Site, to be replaced with clean fill. The Office of Land and Emergency Management (OLEM) Lead Technical Review Workgroup (TRW) was consulted on July 31st, 2020 and concurs with the methods and conclusions of this memorandum.

The concentrations of lead (Pb) described in the attached memo "Request for Region 8 Superfund Emergency Response Program Assistance for the Carpenter-Snow Creek (CSC) Superfund Site located in Neihart, Cascade County, Montana" are at a level that is sufficient to warrant removal action.

Analysis:

The proposed removal action involves a single, privately-owned residential property, which previously served as the Silver Dyke Mining Company foreman's residence and is situated in a drainage area several hundred feet downgradient from the Silver Dyke Adit. The house is currently used in summer for recreational activity, and children have been observed playing in the yard. While full-time residential use is possible, seasonal occupation by adults with children is the current and most probable future use.

In 2011, soil samples were evaluated for lead and other metals by both laboratory and XRF analysis. Two 5-point composite soil samples were collected from two depths, 0-2" and 6-12", including both yard and driveway areas of the property. Consistent with OSWER 9285.7-50, only the 0-2" surface soil data will be considered for the purposes of evaluating potential human health risk to residents. The soil lead concentrations reported by laboratory analysis from the surface composite samples were 3,930 and 6,280 mg/kg (average = 5,105 mg/kg), which were consistent with reported field XRF results of four samples (range 2,455 – 5,592 mg/kg).

In order to evaluate the potential for human health risk resulting from exposure to lead, Integrated Exposure Uptake Biokinetic (IEUBK) modeling was performed to estimate risk to children residing on this property (EPA, 1994; EPA, 2003). Risks to children evaluated using the IEUBK model are protective of potential risks to the fetus of pregnant women, hence the Adult Lead Methodology was not used to evaluate potential risks to this receptor.

Because the baseline human health risk assessment (HHRA) for CSC has been completed (EPA, 2016), some site-specific parameters were used instead of default IEUBK values. Specifically, from *in-vitro* bioaccessibility (IVBA) testing data, the relative bioavailability (RBA) of lead in CSC soil samples was estimated to be 28%. The RBA-adjusted absorption fraction for soil (AF_s) used in the CSC HHRA IEUBK model was 0.14. In addition, this property was evaluated only for seasonal residential risk in the HHRA, and seasonal occupancy was described as the current and most likely future use scenario. Therefore, the current evaluation adopts the CSC HHRA seasonal exposure frequency (EF) value of 112 days/yr, which was based on exposures 7 days per week over 16 weeks. Time weighted averaging of the soil lead concentration was not necessary because exposure is continuous over the exposure duration as opposed to intermittent, hence 5,105 mg/kg was used as the IEUBK exposure point concentration. All other IEUBK inputs were set to updated default values as directed by the Lead TRW consultation.

<u>Results</u>:

IEUBK modeling suggests that there is a >99.9% probability that children may experience blood lead levels (PbB) >5 µg/dL following seasonal residence at this property.

Sources and Impact of Uncertainty Specific to this Evaluation:

While there was limited laboratory-based soil lead concentration data available, the existing data obtained from two incremental 5-point composite samples were consistent with XRF estimates. Additional data on soil lead concentrations could adjust the resulting risk estimates in either direction but are not likely to impact the overall risk-based decision.

The CSC HHRA IVBA-informed RBA estimate and adjusted AF_s were used herein, instead of default values, to be consistent with the methodology used to evaluate human health risks at this site. However, the soil was not sieved; the IVBA analyses were performed on bulk samples, not fine fractions, and lead concentrations from ≤150 µm sieved samples are not yet available. Therefore, the relative concentration of lead in the bulk versus ≤150 µm soil fraction remains to be determined. As this latter size fraction contributes the majority of incidental soil ingestion exposures, actual lead intake could be greater or lesser than estimates based upon the bulk sample data. In general, if the soil was sieved the risks estimates would likely be greater, which would not alter the overall risk-based decision.

Also consistent with the CSC HHRA, the current evaluation used a seasonal residential exposure frequency of 112 days/yr; shorter exposures frequencies may decrease the probabilities of PbB >5 µg/dL exceedance, while default assumptions of year-round residential exposure would increase this risk significantly.

<u>Conclusions</u>:

Results of IEUBK modeling based upon the available soil lead concentration data and adopting site-informed input parameter values applied in the 2016 CSC baseline HHRA, suggests that there is a >99.9% probability that children may experience >5 µg/dL PbB following seasonal residential exposure. This risk is unacceptable even in a seasonal exposure scenario of 112 days/yr and would only increase if the more health-protective default year-round residential exposure scenario were evaluated. Therefore, the existing soil lead data provides sufficient support for a removal action based upon unacceptable risk to children.

References:

U.S. Environmental Protection Agency (EPA). 1994. Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response: Washington, DC. PB93-963510, OSWER 9285.7-15-1.

U.S. Environmental Protection Agency (EPA). 2003. Recommendations of the Technical Review Workgroup for Lead for an approach to assessing risks associated with adult exposures to lead in soil. EPA-540-R-03-001.

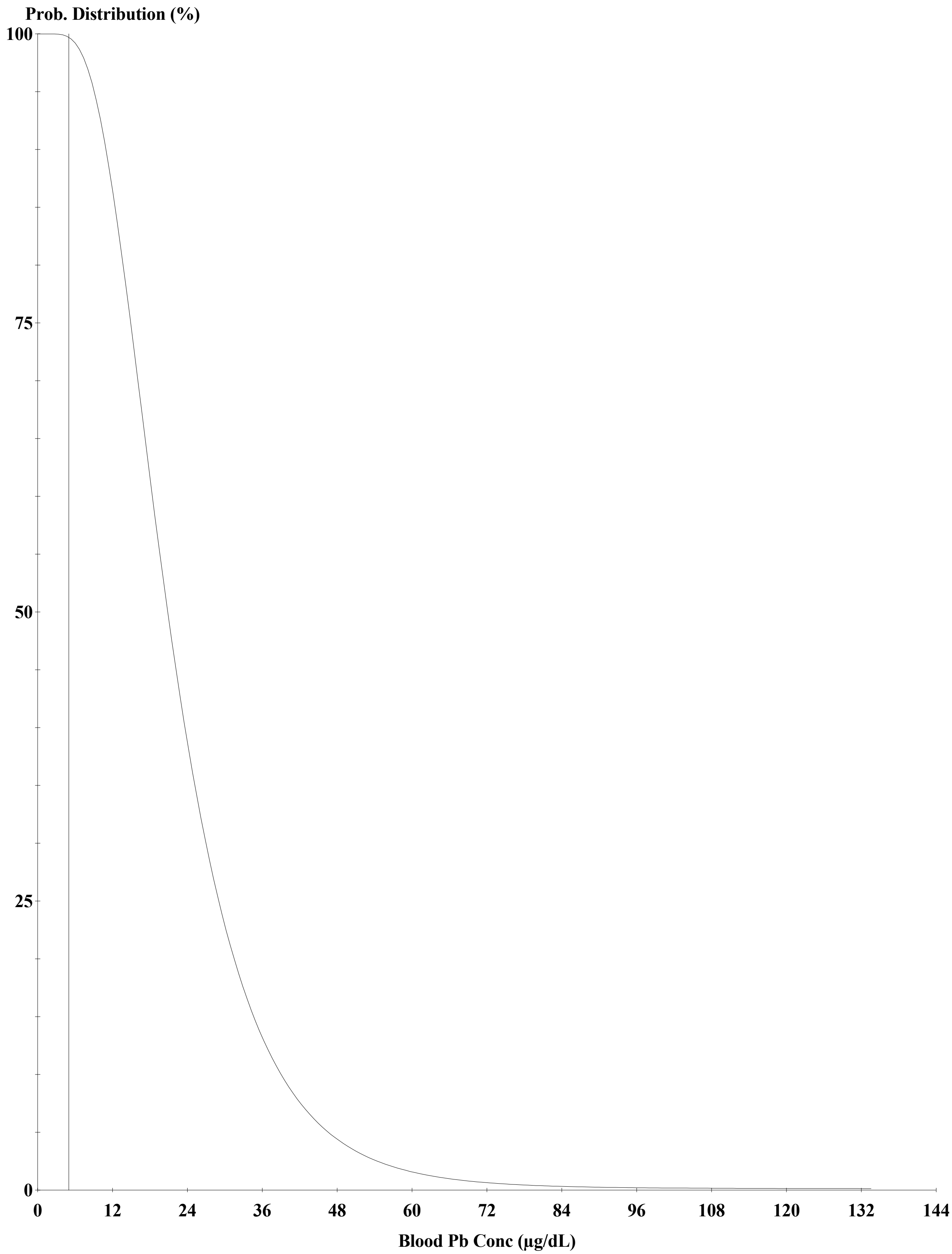
U.S. Environmental Protection Agency (EPA). 2003. Superfund Lead-Contaminated Residential Sites Handbook. OSWER #9285.7-50.

U.S. Environmental Protection Agency (EPA). 2016. Baseline Human Health Risk Assessment for the Carpenter-Snow Creek Mining District Superfund Site Located in Cascade County, Montana.

U.S. Environmental Protection Agency (EPA). 2016. Update of the Adult Lead Methodology's Default Baseline Blood Lead Concentration and Geometric Standard Deviation Parameters and the Integrated Exposure Uptake Biokinetic Model's Default Maternal Blood Lead Concentration at Birth Variable. OLEM Directive 9285.6-55.

Attachments:

03/19/2020 Memorandum: Request for Region 8 Superfund Emergency Response Program Assistance for the Carpenter-Snow Creek (CSC) Superfund Site located in Neihart. Cascade County. Montana
IEUBK Carpenter Removal Probability Distribution
IEUBK Carpenter Removal Text Output



Cutoff = 5.000 µg/dl
Geo Mean = 21.850
GSD = 1.600
% Above = 99.915

Age Range = 0 to 84 months

Run Mode = Research

LEAD MODEL FOR WINDOWS Version 1.1

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Model Version: 1.1 Build11
User Name:
Date:
Site Name:
Operable Unit:
Run Mode: Research

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****** Air ******

Indoor Air Pb Concentration: 30.000 percent of outdoor.
Other Air Parameters:

Age	Time Outdoors (hours)	Ventilation Rate (m^3/day)	Lung Absorption (%)	Outdoor Air Pb Conc (µg Pb/m^3)
.5-1	1.000	3.220	32.000	0.100
1-2	2.000	4.970	32.000	0.100
2-3	3.000	6.090	32.000	0.100
3-4	4.000	6.950	32.000	0.100
4-5	4.000	7.680	32.000	0.100
5-6	4.000	8.320	32.000	0.100
6-7	4.000	8.890	32.000	0.100

****** Diet ******

Age	Diet Intake(µg/day)
.5-1	2.660
1-2	5.030
2-3	5.210
3-4	5.380
4-5	5.640
5-6	6.040
6-7	5.950

****** Drinking Water ******

Water Consumption:

Age	Water (L/day)
.5-1	0.400
1-2	0.430
2-3	0.510
3-4	0.540
4-5	0.570
5-6	0.600
6-7	0.630

Drinking Water Concentration: 0.900 µg Pb/L

****** Soil & Dust ******

Multiple Source Analysis Used
Average multiple source concentration: 3583.500 µg/g

Mass fraction of outdoor soil to indoor dust conversion factor: 0.700
Outdoor airborne lead to indoor household dust lead concentration: 100.000
Use alternate indoor dust Pb sources? No

Age	Soil (µg Pb/g)	House Dust (µg Pb/g)
.5-1	5105.000	3583.500
1-2	5105.000	3583.500
2-3	5105.000	3583.500
3-4	5105.000	3583.500
4-5	5105.000	3583.500
5-6	5105.000	3583.500
6-7	5105.000	3583.500

****** Alternate Intake ******

Age	Alternate (µg Pb/day)
.5-1	0.000
1-2	0.000
2-3	0.000
3-4	0.000
4-5	0.000
5-6	0.000
6-7	0.000

****** Maternal Contribution: Infant Model ******

Maternal Blood Concentration: 0.600 µg Pb/dL

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CALCULATED BLOOD LEAD AND LEAD UPTAKES:
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Year	Air (µg/day)	Diet (µg/day)	Alternate (µg/day)	Water (µg/day)
.5-1	0.034	0.747	0.000	0.101
1-2	0.057	1.483	0.000	0.114
2-3	0.076	1.764	0.000	0.155
3-4	0.093	1.923	0.000	0.174
4-5	0.102	2.057	0.000	0.187
5-6	0.111	2.377	0.000	0.213
6-7	0.119	2.356	0.000	0.225

Year	Soil+Dust (µg/day)	Total (µg/day)	Blood (µg/dL)
.5-1	61.844	62.726	31.0
1-2	70.953	72.607	29.4
2-3	58.099	60.095	22.6
3-4	57.678	59.868	20.3
4-5	62.592	64.939	20.2
5-6	52.408	55.108	17.6
6-7	55.774	58.474	16.0

Environmental exposures associated with blood lead levels above 30 µg/dl are above the range of values that have been used in the calibration and empirical validation of this model. (Zaragoza, L. and Hogan, K. 1998. The Integrated Exposure Uptake Biokinetic Model for Lead In Children: Independent Validation and Verification. Environmental Health Perspectives 106 (supplement 6). p. 1555)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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1595 Wynkoop Street
Denver, CO 80202-1129
Phone 800-227-8917
www.epa.gov/region8

March 19, 2020

Ref: SEMD-C

MEMORANDUM

SUBJECT: Request for Region 8 Superfund Emergency Response Program Assistance for the Carpenter-Snow Creek (CSC) Superfund Site located in Neihart, Cascade County, Montana

FROM: Roger Hoogerheide
Superfund Remedial Project Manager

THRU: Joe Vranka
Unit C Supervisor

TO: Laura Williams, Unit Leader
Emergency Response Program

- Carpenter Snow Creek/Operable Unit 3/NPL Status: Final
- Account Code to Charge Staff Time and Travel: 089XRV0308LTDC6
- Estimated Project Cost: Approx. $250,000 1) Fixing erosion issue on a steep hillside associated with the Silver Dyke tailings impoundment that was addressed under a 2014 Time Critical Removal Action; 2) Placement of adit discharge (Sih-Mem Creek) back into its historic channel to reduce seasonal flooding around a residential property; 3) Excavation and on site disposal of approximately 500 cubic yards lead contaminated soils at another residential property that is impacted by mine waste associated with the Silver Dyke mine.
- Source of Project Funding (including travel) Available: This request is for removal intramural funding and contract capacity. Extramural special account funding is available through the recent Blue Tee settlement account. Montana Department of Environmental Quality's (DEQ) contractor, Tetra Tech EMI, will provide a Basis for Design for this removal action. The removal program can also use common fill located at the MacKay Gulch on-site repository as part of the residential yard cleanup and stream rechannelization to help defer costs
- Authority for Removal Project (Action Memo)/Schedule: Two Action Memos will be required for the response action pending approval of this additional work: one for the Silver Dyke Mine tailings impoundment erosion issues and another to redirect Sih-mem Creek away from a residential property and to conduct a residential yard cleanup at a property contaminated with lead and other

metals. It is anticipated these Action Memos will be issued in 3rd quarter FY2020. Due to contracting issues, removal work is anticipated to commence in early September and is estimated to take 3 weeks to complete.

- Removal Project Duration/Deadline (SCAP or other): 3 weeks – Material, labor and equipment to 1) Redirect Sih-mem Creek back into its historic channel to eliminate future channel migration and contaminated water infiltration near the residential structure; construct an infiltration gallery to inject base flow into the alluvial aquifer as well as construction and armoring of the diversion channel to allow higher discharges to flow into Carpenter Creek; 2) Repair failing erosion control measures and reseeding of the steep hillside that was addressed as part of the 2014 TCRA at the Silver Dyke Tailings impoundment; and 3) Excavation and on-site disposal of approximately 500 cubic yards of lead contaminated soils from a residential yard (Figure 1). The schedule for completing this work is contingent upon a new removal construction contract being awarded in 4th quarter FY2020.
- Is this a mine site? Yes. Mine Site Characterization memo will be written. Since the proposed removal actions are not anywhere in the vicinity of adit, we anticipate the memo will be written that the Region's planned activities are considered a Sub-Category "1N" which will not affect or change the mine's fluid hazard as defined in Attachment 1 – FY17 Hardrock Mining and Mineral Processing Sites Categories and Activities Chart (EPA Headquarters' Memorandum/Woolford and Cheatham - April 4, 2017).
- Is this a lead site? Yes – David Berry, EPA Human Health Toxicologist has agreed to complete a justification memo for excavation and disposal of lead contaminated soils for this residential property if this project is approved.
- EPA consultation with the Montana Department of Environmental Quality (DEQ), the site support agency, has been on-going and the DEQ State Project Officer agrees this concurs with this action. As part of DEQ's comments on this request the DEQ site project officer provided his concurrence with the proposed actions outlined in this memo. Affected property owners are also on board with the proposed action.

Figure 1
Project Location

PROJECT DESCRIPTION/ STATUS:

1. Sih-Mem Creek Channel

The Silver Dyke mine operated from 1921 to 1929 and included a mine and mill. In 1925, a tailings impoundment collapsed, releasing a large volume of tailings into Carpenter Creek. The upper and lower tailings piles (UTP and LTP) were built along Carpenter Creek in 1926 to allow operations to continue. In 1929, operations stopped, and the tailings impoundments were left to degrade. A significant volume of tailings has since eroded from the UTP and LTP and continues to erode during spring runoff and episodic rain events. The periodic flush of mine tailings affects streamside soil past the confluence of Carpenter Creek with Belt Creek to the Town of Monarch, approximately 12 miles downstream. The Silver Dike adit also discharges poor quality water to Sih-mem Creek. Sih-mem Creek discharges into Carpenter Creek, where it degrades water quality so severely that fish are not present in the affected stream reach of Carpenter Creek in OU3. The population density and taxa richness of macroinvertebrates in Sih Mem is non-existent due to the high metal concentrations in the adit discharge and is severely impaired in Carpenter Creek downgradient of the Sih-Mem Creek confluence.

In 2011, an unusually high snowfall was followed by significant spring rainfall. This resulted in Sih-Mem flowing out of its historic stream channel between Pioneer Road and Carpenter Creek. Sih-Mem Creek now flows over the surface to the west of its former channel before it enters Carpenter Creek several hundred feet below its historic confluence. In the past couple of years, this creek has pooled near the home of an adjacent property owner during Spring runoff. Figure 2 shows iron staining of surface soils near the residence property from surface flow of Sih-Mem Creek while Figure 3 shows the existing confluence of Sih-Mem Creek.

Figure 2
Orange staining on the surface near the residential structure

Figure 3
Confluence of Sih-mem Creek (foreground) and Carpenter Creek (background)

2. Silver Dyke Tailings Erosion Control

An action memorandum was issued in August 2014 to address the Silver Dyke tailings impoundment. The objective of this removal action was to prevent continued releases from the estimated 35,000 cubic yards of tailings at the Silver Dyke tailings impoundment within No Name Creek drainage area. The action included the following elements: (a) Removing the tailings from the hillside slopes and staging for disposal; (b) constructing an onsite repository; (c) placing the tailings in an onsite repository; and (d) reclaiming/restoring removal area slopes. The removal action occurred between September and October 2014.

Since the removal action was completed, the upper removal area has experienced significant erosion damage from summer storms. Rill erosion is quite evident and is cutting into previous reclaimed areas (see attached memo). A large gully has cut through the center of the erosion blanket, threatening to discharge sediment into No Name Creek. Rill erosion is also evident in the western removal area, particularly just below the tree line area.

Figure 4
Looking down Silver Dyke Tailings impoundment hillside during 2014 removal action

In 2015 and 2016, Post Removal Site Control measures were implemented by Tetra Tech (Attachment). Activities included:

- Installed waterbars and wattles throughout the removal area.

- Applied seed mix 15-1731 and 17-17-17 nitrogen-phosphorus-potassium (NPK) fertilizer in the lower and upper removal areas.
- Limed the barren area with agricultural lime (94 percent $CaCO_3$)
- At the base of the hill, a reinforced silt fence was installed to prevent sediment from reaching No Name Creek.

These activities were designed and implemented to temporarily mitigate erosion potential and are not a permanent solution to erosion in the upper removal area. Removal support is requested to implement engineering control measures to prevent further erosion on the hillside. The proposed measures consist of erosion matting, terracing and 6 inches of top soil with seed mix.

3. Foreman's Property

The former Silver Dyke Mining Company foreman's house is located in a drainage several hundred feet below the Silver Dyke Adit. There are several waste piles surrounding this property. The house is currently heavily used in summer for recreational activity and children have been observed playing in the yard. The house is currently for sale with a potential purchaser who plans to close on it this Spring. He plans to continue using the property the same way and has children that will be playing on the property when they visit.

In 2011, this property was investigated as part of the remedial investigation and soil samples were collected and analyzed. Four samples were analyzed using XRF from the residential property. The XRF concentrations were:

- Arsenic was not detected above the LOD.
- Cadmium was not detected above the LOD.
- Copper concentrations (1,023 mg/kg to 2,369 mg/kg)
- Lead concentrations (2,455 mg/kg to 5,592 mg/kg)
- Zinc concentrations (1,071 mg/kg to 1,817 mg/kg)

Two five-point composite samples were also collected from a depth of 0 to 2 inches and another two were collected from 6 to 12 inches and submitted to a laboratory for analysis of heavy metals and arsenic. Analytical results and a figure showing sample locations are included as an attachment to this memo with some key metals highlighted below:

- Aluminum concentrations (9,490 mg/kg to 14,300 mg/kg)
- Arsenic concentrations (35.4 mg/kg to 82.4 mg/kg)
- Cadmium concentrations (5.9 mg/kg to 12.7 mg/kg)
- Copper concentrations (1,130 mg/kg to 2,450 mg/kg)
- Iron concentrations (23,100 mg/kg to 30,800 mg/kg)
- Lead concentrations (2,960 mg/kg to 6,280 mg/kg)
- Manganese concentrations (1,260 mg/kg to 2,520 mg/kg)
- Thallium concentrations (2.5 mg/kg to 2.6 mg/kg)
- Zinc concentrations (1,220 mg/kg to 2,190 mg/kg)

It is estimated that 500 cubic yards of soils will need to be excavated to 18 inches and transported to the MacKay Gulch Repository, which is located within the CSC NPL Site.

2020 Proposed Action

All three proposed actions discussed below will be conducted together to reduce cost of mobilization, demobilization and equipment rentals.

1. Sih-Mem Creek Channel

Redirect Sih-mem Creek back into its historic channel to eliminate future channel migration to the west and infiltration of contaminated water near the residential structure. Activities contemplated include construction of an infiltration gallery just below the Pioneer Road culvert to inject base flow into the alluvial aquifer and construction and armoring of the diversion channel to allow higher discharges to flow into Carpenter Creek. Since the area is already heavily impacted by tailings, all material excavated will be hauled to the repository and restored with borrow soil. A Record of Decision is anticipated to be issued in 2022 that will identify a remedy to address the tailings within the Carpenter Creek floodplain. Rip rap will need to be brought to the site to armor the diversion channel. It is estimated that activities will require about 5 days to implement and will cost approximately $70,000.

2. Silver Dyke tailings Upper Removal Area Erosion Control

Corrective action activities will be implemented to ensure that future erosion of the upper removal area is limited and vegetative cover is established and maintained. Activities include but are not limited to providing corrective action measures including, but not limited to: reseeding, fence building, installation of erosion controls such as waddles, woody debris, terraces, rip rap and straw bales or mats. It is estimated that activities will require about 7 days to implement and will cost $100,000.

3. Former Forman Residential Yard Cleanup

Approximately 500 cubic yards of soils will need to be excavated to a depth of 18 inches and hauled to the MacKay Gulch Repository (1 mile roundtrip). Soils will be temporarily staged until a repository cell is opened during remedial action to allow for permanent placement in the repository. Sufficient common fill is available at the repository to allow for 12 inches of replacement soil while six inches of top soil (growth media) will be brought in from offsite. If excavation is done on the gravel based driveway, an appropriate amount of road base will be transported to the site and placed as backfill in these areas. Earthern Berms anchored with rocks will be placed around the cleaned up portions of the property to ensure that mine waste located on the hillsides around the property does not re-contaminate the property. Discussions will be held with property owner as to appropriate type of seeding to use. It is estimated that activities will require about 5 days to implement and will cost approximately $80,000.

Attachments
Figure showing residential yard sample locations
Residential Yard sample Results
2016 Site Control at the Silver Dyke Tailings Impoundment

Hoogerheide, Roger

From: Mark Reichelt <mreichelt@itstriangle.com>
Sent: Friday, September 27, 2019 1:05 PM
To: Hoogerheide, Roger
Subject: Carpenter Creek

Hey Roger, just touching base with you to get the results of my well sampling from last summer. I was at the cabin yesterday and I am having more groundwater and surface water intrusion from Sih-mem creek because of the tailings that have settled at the mouth of the creek not allowing it to drain directly to Carpenter Creek. You had asked me to send a letter requesting the routing or channeling of that creek directly to Carpenter creek and I did. If you could get back to me on that subject and my water sample I would appreciate it. Thanks Mark Reichelt 406 390 3910.

Hoogerheide, Roger

From: Large, Keith <klarge@mt.gov>
Sent: Tuesday, March 17, 2020 10:52 AM
To: Hoogerheide, Roger
Cc: Vranka, Joe
Subject: RE: Request for removal assistance Carpenter Snow Creek
Attachments: Request for Removal Assistance CSCMDOU3 Draft Final1.docx

Roger,

Find attached DEQ edits to the draft letter to be send to the removal program. Also, DEQ concurs with EPA about this purposed action.

Thanks, Keith

received approximately 1.5 inches of rain during the period (Tetra Tech 2017), most of it falling during a 3-hour window on the afternoon August 7, 2016. Visits to the site by Tetra Tech field personnel on August 9, 2016, indicated substantial erosion and initiation of gully and rill erosion at locations throughout OU3, including the Silver Dyke removal area and the Mackay Gulch Repository. At the direction of DEQ and EPA, additional control measures were undertaken to mitigate erosion at the Silver Dyke removal area, Mackay Gulch Repository, and along Pioneer Lane (**Figure 1**). These additional actions are discussed in Sections 2 through 4. No Record of Modification to the FSP is presented for these additional controls because no sampling or analysis was involved in the field efforts.

2.0 SITE CONTROL AT THE SILVER DYKE REMOVAL AREA

Site control at the Silver Dyke removal area started on June 13, 2016. Originally, Tetra Tech scheduled field activities for May 11 and 12, 2016, but had to cancel deployment because of a late season snowstorm. Subsequent site control measures were performed on August 25, 2016, October 22, 2016, and November 10, 2016. Site control measures are discussed sequentially in this section.

Three areas of the Silver Dyke removal area are discussed in this section and are shown in Figure 2. These areas include:

- **Lower removal area:** located to the east of No Name Creek
- **Upper removal area:** located to the west and north of No Name Creek
- **Western removal area:** located to the west of No Name Creek and south of the upper removal area.

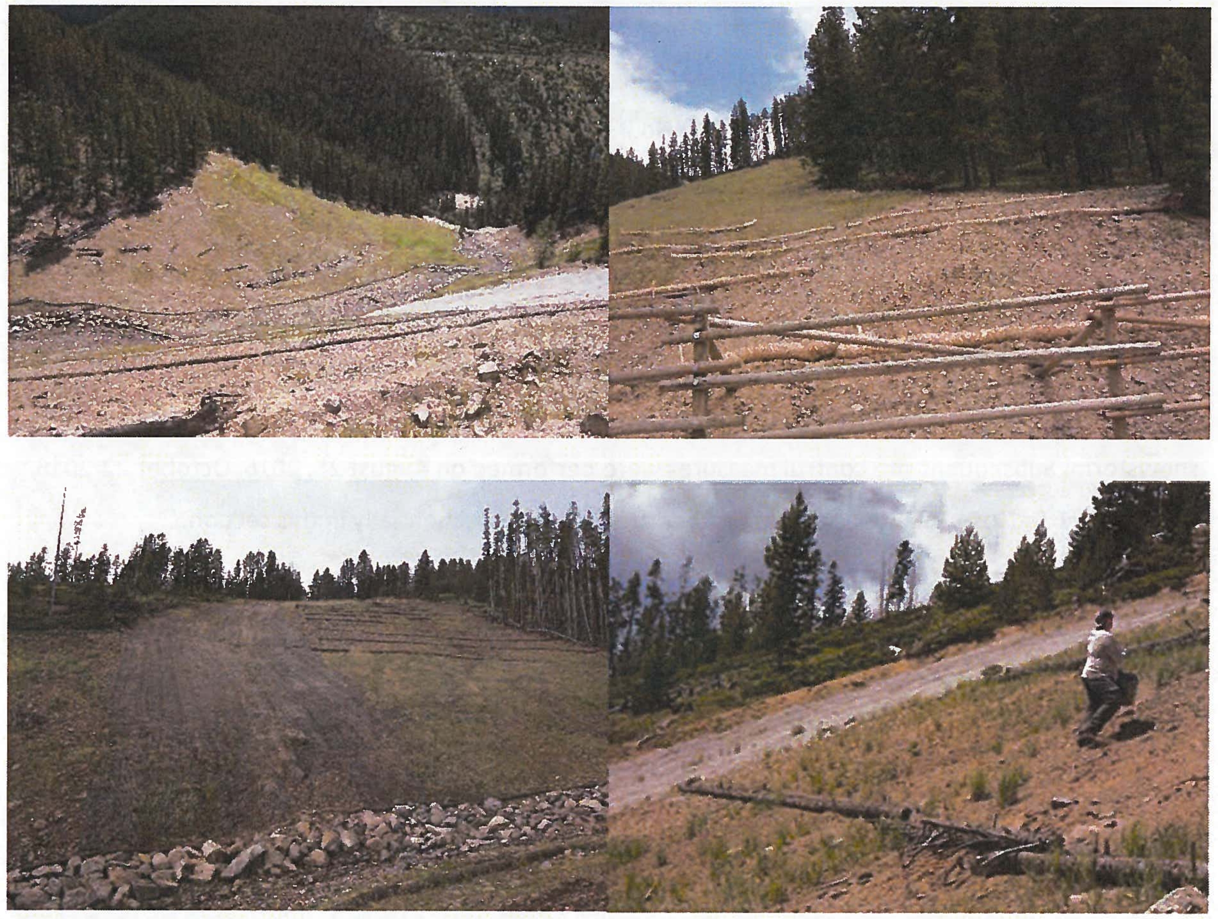
Both the upper (west) removal area and lower removal (east) area are each approximately 1.5 acres.

June: Tetra Tech seeded and fertilized the reclamation areas, outside the riparian area, (see photographs in Exhibit 1) with left-over native seed mix (Appendix A) from the 2015 field season and installed erosion control devices. June operations included the following activities and are also shown on **Figure 2**:

- Installed waterbars approximately every 20 feet along the lower removal area trail (14 total) using downed, small-diameter pine logs from the area.
- Applied 50 pounds of seed mix 15-1731 and 40 pounds of 17-17-17 nitrogen-phosphorus-potassium (NPK) fertilizer in the lower removal area.
- Installed 300 feet of wattle in the lower removal area near the jack fence on Carpenter Creek Road.
- Limed the barren area in the lower removal area with 20 pounds of agricultural lime (94 percent $CaCO_3$)

- Applied 45 pounds of seed mix 15-1731 and 30 pounds of 17-17-17 NPK fertilizer to the upper removal area.
- Applied 80 pounds of lime (94 percent $CaCO_3$) to the upper removal area.

Exhibit 1 : Photographs from Silver Dyke Tailings Removal Area on June 13 and 14, 2016



[Upper left]: Looking down toward the lower removal area (looking southeast). Vegetation reestablishment is good in the southern half of the area, but vegetation is more sparse on hillsides to the north (left side of picture). **[Upper right]:** Barren area directly adjacent to Carpenter Creek Road (looking north). **[Lower left]:** Upper removal area showing poor vegetation recruitment under erosion control blanket and in areas where hydroseeder did not reach (looking west). **[Lower right]:** Barren areas in the upper removal area where mine waste persists. Erosion control blanket in background (looking south).

Lime was applied to barren areas where residual mine waste was suspected to be present. Lime was added to increase base-cation concentrations in soil solution as a means to limit metal toxicity to plant roots. Previous investigations indicated that the mine tailings associated with the Silver Dyke Mill are not acidic (Tetra Tech 2013). Lime was applied to 0.06 acre in the lower removal area and 0.17 acre in the upper removal area (Figure 2).

The composition of seed mix 15-1731 is included in Appendix A. Fertilizer was not applied within 20 feet of No Name Creek.

Hydroseeding in the lower removal area was generally successful at establishing perennial grasses and forbs. Vegetation was denser near No Name Creek and sparser on the eastern hillside, particularly in the northern quadrant. Only two areas in the lower removal area were barren. The first area was directly adjacent to Carpenter Creek Road behind the jack fence (see Exhibit 1). The lack of vegetation in this area may be attributed to soil compaction of a decommissioned haul road used during the 2014 removal action. The second area is on the eastern hillslope and based on XRF data collected after the removal action, had some residual mine waste.

Revegetation of the upper removal area was less successful than in the lower removal area. Little to no plant recruitment was observed on the south side of the area where the erosion control blanket was installed. Patches of intact vegetation were observed on the north side, but were punctuated with barren areas. The poor recruitment in this area is likely attributable to both poor hydroseeding and the remnant mine waste.

The western removal area was not addressed during June field operations.

<u>**August:**</u> EPA provided Tetra Tech with lupine harvested from the Block P Mine repository at the Barker Hughesville NPL site on August 25, 2016. Field personnel spread approximately 40 pounds of seed heads across the southern section of the lower removal area (within 150 feet of Carpenter Creek Road).

Storm damage to the Silver Dyke removal area was assessed during the August visit. Many erosion control wattles had been displaced and rilling was observed at multiple locations. Additionally, a large gully had begun to form at the base of the erosion control blanket in the upper removal area. The lower removal area did not appear to be as significantly damaged.

Field personnel replaced the displaced wattles on August 6, 2016(Exhibit 2).

Exhibit 2- Photos from the Silver Dyke Removal Area on August 25, 2016

[Left]: August 7 storm damage in upper removal area. Displaced wattles and initiation of rills (looking southwest). [Right]: Initiation of gully erosion at the base of the erosion control blanket (looking northwest).

<u>October:</u> Tetra Tech performed fall seeding and fertilizing at the Silver Dyke removal area on October 22, 2016. Seeding targeted areas in the upper, lower, and western removal areas where vegetation was poorly established. Seeding locations are shown in **Figure 3.** The application included 50 pounds of seed mix 15-1560 (60 pure live seeds per square foot) applied over an area of 2.5 acres. The seed mix information is included in Appendix A. Two pounds of sheep fescue (*Festuca ovina*) was spread over 0.1 acre directly behind the jack fence on Carpenter Creek Road to promote revegetation. Additionally, field personnel applied 352 pounds of 20-10-50 NPK fertilizer. Fertilizer was not applied within 20 feet of No Name Creek. Certified fertilizer analysis is provided in **Appendix A.**

Erosion control measures implemented in the lower removal area in June 2016 were generally effective at minimizing sediment transport and limiting the establishment of rills and gullies. No additional work was required to address erosion control structures within the lower removal area.

In contrast, erosion damage from summer storms to the upper removal area was marked. Rill erosion is quite evident and is cutting into mine waste in some areas (see Exhibit 3 below). A large gully had cut through the center of the erosion blanket, threatening to discharge sediment into No Name Creek. Rill erosion was also evident in the western removal area, particularly just below the tree line among areas that still contained small waste piles. However, the extent of the rill erosion was substantially less in the western removal area versus the upper removal area.

Visual assessment indicated that the spring 2016 seeding did not appear to produce meaningful recruitment through the summer at the site. Vegetation establishment should be reassessed in 2017 to evaluate whether additional measures (such as mulch application, soil tests, and additional hydroseeding) is necessary.

<u>November:</u> Tetra Tech performed its final site control at the removal area on November 10, 2016. Activities included erosion control in the upper removal area to reduce further incising of the gully developing in the erosion control blanket. In total, 72 feet of wattles were installed at three locations within the incipient gully to slow water movement and to catch sediment (**Figure 3**). At the base of the hill, a reinforced silt fence was installed to prevent sediment from reaching No Name Creek. These activities were designed and implemented to mitigate erosion potential from spring runoff in 2017 and are not a permanent solution to erosion in the upper removal area. Pictures of the erosion control measures are shown in Exhibit 3.

Exhibit 3 : Photographs from Silver Dyke Removal Area on November 10, 2016

[Left]: Reinforced silt fencing used to prevent sediment from reaching No Name Creek. Silt fencing was anchored by trench excavation, steel fence posts, and straw bales secured with wooden posts (looking northeast). **[Right]** Silt fence below with additional erosion control wattles above to slow down water and sediment movement into the gully. Riprap at the bottom of photo is just above the No Name Creek Channel (looking west-northwest).

that still contained small waste piles. However, the extent of the rill erosion was substantially less in the western removal area versus the upper removal area.

Visual assessment indicated that the spring 2016 seeding did not appear to produce meaningful recruitment through the summer at the site. Vegetation establishment should be reassessed in 2017 to evaluate whether additional measures [illegible] mulch application, soil [illegible] and additional hydroseeding is necessary.

[illegible] Tech performed [illegible] site [illegible] at the removal area on November 16, 2016 [illegible] erosion [illegible] in the upper removal area to reduce further [illegible] of the [illegible] in the erosion control blanket [illegible] were installed [illegible] the [illegible] was installed to prevent sediment from reaching Nr Mine Creek. These [illegible] implemented to [illegible] erosion potential [illegible] spring runoff in 2017 [illegible] to erosion [illegible] Pictures [illegible] in Exhibit 3.

[illegible] 2016

CARPENTER-SNOW CREEK MINING DISTRICT
NATIONAL PRIORITIES LIST SITE

FIGURE 4.5-2A

2011
SUPPLEMENTAL RESIDENTIAL INVESTIGATION
RESIDENCE 1 - SOIL SAMPLE LOCATIONS

TETRA TECH

Figure_4.5-2A_2011_Residential_Investigation_Residence-1.mxd - DWH - 06/08/2016

2011 RESIDENTIAL LABORATORY ANALYTICAL RESULTS

Sample Name	Analysis	Aluminum mg/kg	Antimony mg/kg	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Cadmium mg/kg	Calcium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg
RSL - Residential		7,700	3.1	0.7	1,500	16	7.0	NA	12,000	2.3	310
RSL - Industrial		110,000	47.0	3.0	22,000	230	98.0	NA	180,000	35.0	4,700
Background Mean		19,700	0.69	25	186	NC	1.20	NC	33	15	57
Background 95% UCL		21,400	0.89	31	247	NC	1.66	NC	41	18	84
Neihart Cleanup Levels		NA	NA	100	NA	NA	NA	NA	NA	NA	NA
RS01-SS-1 0-2"'	Laboratory	14,200 J	1.3 J-	49.6	264 J	0.07	5.9 J-	3,060 J	22.3 J	14.0	1,460 J
RS01-SS-1 6-12"	Laboratory	14,300 J	1.3 J-	35.4	180 J	0.51	6.0 J-	2,860 J	20.9 J	13.2	1,130 J
RS01-SS-2 0-2"	Laboratory	9,490 J	1.9 J-	82.4	263 J	0.33	12.7 J-	15,700 J	16.6 J	15.8	2,450 J
RS01-SS-2 6-12"	Laboratory	13,200 J	1.0 J-	44.5	244 J	0.51	8.0 J-	11,200 J	22.2 J	13.6	1,330 J

Sample Name	Iron mg/kg	Lead mg/kg	Magnesium mg/kg	Manganese mg/kg	Mercury mg/kg	Nickel mg/kg	Potassium mg/kg	Selenium mg/kg	Silver mg/kg	Sodium mg/kg	Thallium mg/kg	Vanadium mg/kg	Zinc mg/kg
RSL - Residential	5,500	400	NA	180	2.3	150	NA	39	39	NA	0.078	39	2,300
RSL - Industrial	82,000	800	NA	2,600	35.0	2,200	NA	580	580	NA	1.20	580	35,000
Background Mean	26,500	445	NC	1,530	0.033	25	NC	1.2	0.9	NC	NC	52	407
Background 95% UCL	31,400	672	NC	2,140	0.043	34	NC	1.5	1.2	NC	NC	65	580
Neihart Cleanup Levels	NA	400	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
RS01-SS-1 0-2"'	25,900 J	3,930	4,000 J	1,600 J	0.05 J-	24.2	2,250 J	3.6 UJ	26.0 J	510 U	2.6	38 J	1,220
RS01-SS-1 6-12"	23,100 J	3,070	3,960 J	1,260 J	0.06 J-	21.0	1,950 J	3.6 UJ	20.4 J	510 U	2.5	36 J	1,320
RS01-SS-2 0-2"	30,800 J	6,280	4,310 J	2,520 J	0.06 J-	17.8	2,420 J	3.6 UJ	46.2 J	509 U	2.5	34 J	2,190
RS01-SS-2 6-12"	25,300 J	2,960	4,700 J	1,540 J	0.05 J-	18.8	2,100 J	3.6 UJ	34.9 J	510 U	2.5	37 J	1,580

Notes:

NC	Not calculated	95% UCL	95 percent upper confidence limit for background sample concentrations
NA	Not available	RSL	EPA Regional Screening Level
U	Not detected at reported concentration		Concentration exceeds mean background
D	Sample diluted		Concentration exceeds background 95% UCL
J	Estiimated concentration		Concentration exceeds residential RSL
J-	Estimated value with potential negative bias		Concentration exceeds industrial RSL
R	Rejected analytical result		