Public Health Assessment

Final Release

Evaluation of Exposure to Contamination at the

BLUE LEDGE MINE SUPERFUND SITE

SISKIYOU COUNTY, CALIFORNIA

EPA FACILITY ID: CAN000906063

Prepared by
California Department of Public Health

OCTOBER 18, 2023

Prepared under a Cooperative Agreement with the
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Office of Capacity Development and Applied
Prevention Science
Atlanta, Georgia 30333

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment was prepared by ATSDR's Cooperative Agreement Partner pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6)), and in accordance with our implementing regulations (42 C.F.R. Part 90). In preparing this document, ATSDR's Cooperative Agreement Partner has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate.

In addition, this document has previously been provided to EPA and the affected states in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. The revised document was released for a 45-day public comment period. Subsequent to the public comment period, ATSDR's Cooperative Agreement Partner addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes the public health assessment process for this site, unless additional information is obtained by ATSDR's Cooperative Agreement Partner which, in the agency's opinion, indicates a need to revise or append the conclusions previously issued.

The California Department of Public Health (CDPH) prepared this Public Health Assessment for the Blue Ledge Mine Superfund Site in Siskiyou County, California. This publication was made possible by a cooperative agreement (program number TS20-2001) with the federal Agency for Toxic Substances and Disease Registry (ATSDR). CDPH evaluated data of known quality using approved methods, policies, and procedures existing at the date of publication. ATSDR reviewed this document and concurs with its findings based on the information presented by CDPH.

PUBLIC HEALTH ASSESSMENT

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List of Abbreviated Terms

µg—microgram, or one-millionth of a gram (0.000001 gram)
µg/dL—microgram per deciliter
µg/L— microgram per liter µg/m³—
microgram per cubic meter ALM—
adult lead methodology (USEPA)
AMD—acid mine drainage
ATSDR—Agency for Toxic Substances and Disease Registry
BLL—blood lead level
CalEPA—California Environmental Protection Agency
CDPH—California Department of Public Health
CEM—conceptual exposure model CHHSL—
California Human Health Screening Level COC—
contaminant of concern
CREG—cancer risk evaluation guide for one in a million excess cancer risk (ATSDR) CTE—
central tendency exposure
CV—comparison value (health based) EMEG—
environmental media evaluation guide (ATSDR) FDA—
(United States) Food and Drug Administration g/day—
gram per day
HI—hazard index HQ—
hazard quotient
IEUBK model—integrated exposure uptake biokinetic model (USEPA)
IUR—inhalation unit risk
kg—kilogram, or one thousand grams (1,000 grams) L/day—
liter per day
MCL—maximum contaminant level for drinking water (state and federal)
MDC—maximum detected concentration
mg—milligram, or one-thousandth of a gram (0.001 gram)
mg/kg— milligram per kilogram
mg/kg/day—milligram per kilogram per day MRL—
minimal risk level (ATSDR)
NA—not available
NIH—(United States) National Institutes of Health NPL—
National Priorities List (USEPA)
OEHHA—Office of Environmental Human Hazard Assessment (CalEPA)
PCT—Pacific Crest Trail
PEF—particulate emission factor
PHA—public health assessment
PHAP—public health action plan
PHAST—Public Health Assessment Site Tool (ATSDR)
REL—reference exposure level (CalEPA) RfD—
reference dose (USEPA)

RME—reasonable maximum exposure RMEG—
reference dose media evaluation guide (ATSDR) RSL—
Regional Screening Level (USEPA)
SDWR—Secondary Drinking Water Regulation (state and federal)
U.S.—United States UCL—
upper confidence limit
USEPA—United States Environmental Protection Agency
USFS—United States Forest Service
USGS—United States Geological Survey
WRP—waste rock pile
XRF—X-ray fluorescence

1. Summary

INTRODUCTION

The Blue Ledge Mine site is roughly 500 acres of land on a steep mountainside in the Rogue River-Siskiyou National Forest near the California-Oregon border. No one lives on the 500-acre site, but it is visited for recreational hiking. A small community of five homes, known as Joe Bar, is three miles north of the site.

On September 3, 2011, the U.S. Environmental Protection Agency (USEPA) added the Blue Ledge Mine site to its National Priorities List (NPL). The NPL, part of the USEPA's Superfund Program, is a list of hazardous waste sites eligible for federal funds to carry out site cleanup activities. The NPL listing initiated involvement by the California Department of Public Health (CDPH) in assessing the site.

CDPH, in a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR), wrote this public health assessment (PHA). In writing the PHA, CDPH reviewed available environmental sampling data to determine whether chemicals found at the Blue Ledge Mine site may have harmed people living nearby or visiting the site in the past or present and in the future.

ATSDR and CDPH examined potential exposures from metals in surface soil, sediment, air, surface water, fish, homegrown vegetables, and drinking water. Past exposure statements refer to exposures that occurred before the 2010 clean-up activities. Present exposure statements refer to exposures that took place after the 2010 clean-up activities and exposures from current activities on or near the site. Based on the findings, CDPH recommends actions to reduce or prevent exposures and to protect the community's health. In addition, CDPH examined the site-related public health concerns raised by people who live in the Joe Bar community near the site. Throughout the process, the community and state and federal agencies had an opportunity to provide input.

CDPH released an initial version of this public health assessment for a 45- day public comment period on August 4, 2022. CDPH responded to public comments in Appendix D of this report.

In this PHA, ATSDR and CDPH reached seven conclusions described below.

CONCLUSION 1	**Drinking water from where acid mine runoff empties into Joe Creek at the base of the Blue Ledge Mine site presently or in the past might cause recreational visitors to experience gastrointestinal distress, such as abdominal pain, vomiting, and nausea.**
BASIS FOR CONCLUSION 1	CDPH estimated exposure doses using health-protective assumptions about recreational visits to the Blue Ledge Mine site. Exposure to the elevated level of copper sometimes found in the water where acid mine runoff drains into Joe Creek at the base of the site exceeds amounts in human studies that showed gastrointestinal symptoms.
CONCLUSION 2	**Touching, breathing, or swallowing contaminants at current levels found in on- site treatment pond sediments is not expected to harm the health of recreational visitors. However, future levels of contaminants in the sediment could reach amounts harmful to the health of recreational visitors.**
BASIS FOR CONCLUSION 2	CDPH concludes that currently sediment in the on-site treatment ponds contain heavy metals but are presently not at levels that could harm the health of recreational visitors. However, given that the treatment ponds are designed to capture and treat the site's contaminated acidic surface water runoff and elevated levels of metals were found in surface water samples collected in 2021, heavy metals could accumulate in the sediment and reach unhealthy levels in the future. Exposure to pond sediment could occur in the summer if the treatment ponds dry out and expose the sediment. Recreational visitors that enter a dry pond could touch, breathe, or ingest small amounts of the exposed sediment.
CONCLUSION 3	**Touching, breathing, or incidentally swallowing contaminants in on-site surface soil presently or in the past at the Blue Ledge Mine site is not expected to harm the health of recreational visitors walking on the site.**

BASIS FOR CONLUSION 3	CDPH estimated exposure doses using health-protective assumptions about recreational visits to the Blue Ledge Mine site. The small amounts of contaminants that might be ingested or breathed in from walking on the site presently or in the past are well below health guidelines, thus noncancer health effects are unlikely. Cancer also is not a concern because of the infrequent exposure.
CONCLUSION 4	**Accidentally swallowing water while swimming in Elliott Creek or the Applegate River is not likely to harm or have harmed the health of recreational visitors presently or in the past.**
BASIS FOR CONCLUSION 4	Estimated exposure doses for recreational visitors to Elliott Creek are below health guidelines established for copper and arsenic, and there is no concern for increased cancer risk. The small amount of lead in creek water will not significantly increase blood lead levels in children.
CONCLUSION 5	**Eating fish caught in Elliott Creek is not expected to harm or have harmed the health of recreational anglers or Joe Bar residents presently or in the past.**
BASIS FOR CONCLUSION 5	CDPH evaluated fish samples collected from Elliott Creek. The samples were analyzed for arsenic, cadmium, copper, lead, zinc, and mercury; only copper and zinc were found at amounts that require further evaluation. Estimated exposure doses to copper and zinc found in fish from Elliott Creek were below health guidelines for copper and zinc. Therefore, noncancer harmful effects are not likely.

CONCLUSION 6	**Eating vegetables grown in Joe Bar home gardens irrigated with Elliott Creek water is not expected to harm residents' health.**
BASIS FOR CONLUSION 6	CDPH evaluated sampling data of vegetables grown by Joe Bar residents that used irrigation water from Elliott Creek. Estimated exposure doses to arsenic, cadmium, copper, zinc, and mercuric chloride were below noncancer health guidelines. Therefore, non-cancer harmful effects are unlikely. There is no concern for increased cancer risk from eating home-grown vegetables.
CONCLUSION 7	**Drinking tap water from Joe Bar homes could contain natural levels of arsenic, but the levels are not likely to harm people's health. The levels found in water do not exceed California or USEPA drinking water standards**.
BASIS FOR CONCLUSION 7	Arsenic concentrations found in Joe Bar tap water originate from natural sources and the arsenic concentrations found in samples are below California's and USEPA's allowable level for public water systems of 10 parts per billion, which is protective of public health.

NEXT STEPS

ATSDR and CDPH recommend that USEPA continue monitoring the surface water runoff from the Blue Ledge Mine site for metals.

USEPA and CDPH will provide Joe Bar residents with resources to assist them with evaluating and reducing common exposures to lead such as chipping paint, old water pipes, and plumbing fixtures.

FOR MORE INFORMATION

If you have concerns about exposure or your health as it relates to this PHA, you may contact ATSDR at 1-800-CDC-INFO.

2. Background and Statement of Issues

On March 3, 2011, the U.S. Environmental Protection Agency (USEPA) proposed adding the Blue Ledge Mine site to its National Priorities List (NPL). The NPL, part of the USEPA's Superfund Program, is a list of hazardous waste sites eligible for federal funds to carry out site cleanup activities. USEPA determines whether sites proposed for the NPL pose risks to public health or the environment and works to eliminate those risks whenever possible. On September 3, 2011, the USEPA added the Blue Ledge Mine site to its NPL.[1] The NPL listing initiated involvement by the federal Agency for Toxic Substances and Disease Registry (ATSDR) and the California Department of Public Health (CDPH) under a cooperative agreement between ATSDR and CDPH.

In this public health assessment (PHA), CDPH determined whether health effects are likely to occur or have occurred due to past, present, and future exposure to Blue Ledge Mine site contaminants. CDPH also evaluated the health impacts of drinking water from private wells in a small residential community located near the Blue Ledge Mine known as the Joe Bar community. The conclusions of this PHA for the Blue Ledge Mine site are based on a review of available environmental sampling data, various environmental reports, collected community concerns, information from site visits, and discussions with involved agencies and the public.

CDPH released an initial version of this public health assessment for a 45- day public comment period on August 4, 2022. CDPH responded to public comments in Appendix D of this report.

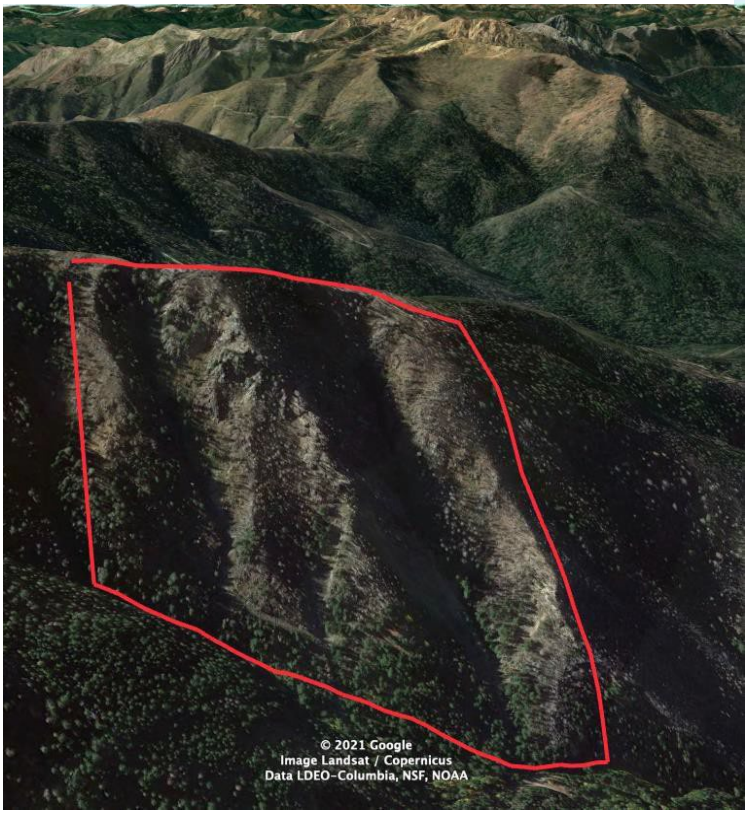
3. Site Description and History

The Blue Ledge Mine site ("the site") is a former copper mine in the Rogue River-Siskiyou National Forest in Siskiyou County, California (Appendix A, Figure 1). The site is approximately three miles south of the California-Oregon border [USFS 2010]. The closest community, called Joe Bar, is three miles north of the site and is located near the intersection of USFS 1050 and 1060 (Appendix A, Figure 2).

The site is on a steep hillside (Figure 1) at an elevation ranging from 4,000 to 4,800 feet above mean sea level and includes 500 acres [URS Corporation 2009, USEPA 2011a]. The site lies along the unpaved United States Forest Service (USFS) Road 1060, which is accessible via unpaved USFS Road 1055.

[1] https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0906063, last accessed in January 2022

Figure 1. Blue Ledge Mine site image looking to the west. Rendered from ©Google Earth



Copper mining occurred intermittently at the site from 1898 to 1930 [URS Corporation 2009, USEPA 2011a, USFS 1998]. Mining operations extracted rock from horizontal tunnels called adits [Environmental International Ltd. 2002]. The mining operation burrowed a total of 10 adits that resulted in an estimated 70,000 tons of waste rock [Engineering/Remediation Resource Group 2013]. The waste rock, containing metals and sulfide, was discarded onto the hillside into four separate waste rock piles (WRPs) [USFS 2010]. Surface water draining from the site is best described as acid mine drainage (AMD) that contains elevated concentrations of metals. The AMD has been observed draining from the site into Joe Creek, which is adjacent to the site. From the site, Joe Creek flows north for roughly three miles until it drains into the larger Elliott Creek. From the Joe Creek-Elliott Creek confluence, Elliott Creek then flows for roughly two miles until emptying into the larger Applegate River. From the Elliott Creek-Applegate River confluence, the Applegate River crosses the Oregon-California border and flows for a short distance until draining into the Applegate Reservoir (Appendix A, Figure 2) [Environment International Ltd. 2002, USEPA 2011a].

The climate at the site is characterized by cool, wet winters and warm, dry summers. According to meteorological data collected near the site, the wet season is from mid-October to mid-April, and the dry season is from mid-April to mid-October [California Climate Data Archive https://calclim.dri.edu/]. During the wet winter months, precipitation falls as a mixture of rain and snow, with mostly snow from December through mid-February.

Since 1981, environmental studies have been conducted to investigate the level and extent of contamination in site soil and AMD resulting from the past mining operations. The studies were conducted or overseen by the USFS and the USEPA. The results of the studies indicate that metals have contaminated on-site soil, surface water, sediment, and groundwater, and that AMD is discharging into Joe Creek [Environment International Ltd. 2002, Ecology and Environment 2005, URS Corporation 2009].

Efforts to remediate and monitor the site include:

- **Summer 2006** – The USEPA constructed channels to reroute the AMD discharge and a pond to capture sediment [URS Corporation 2009]. However, observations by the University of Southern Oregon indicated that by summer 2008 the pond was overwhelmed and no longer passively treating the AMD before discharging into Joe Creek [Elliott et al. 2007].
- **January 2009** – USFS installed a heavy metal swing gate along USFS Road 1050 to control vehicle traffic to the site (USFS provided Joe Bar residents with gate keys). Recreational visitors could check out a gate key from the USFS Star Ranger Station located in Jacksonville, OR.
- **July 2010 to November 2011** – The USFS excavated and hauled 66,521 cubic yards of waste rock from the site to a sealed, off-site repository roughly 1.5 miles north of the site. USFS also:
    - Placed clean topsoil along the site's sloping hillside,
    - Planted 10,000 native shrubs and trees,
    - Covered all disturbed soil with native grass seed,
    - Placed reinforced erosion control fabrics,
    - Constructed 1,800 feet of drainage channels, and
    - Built nine drainage basins (treatment ponds) to passively treat AMD runoff before discharging into Joe Creek [USFS 2010].

  In addition, heavy steel barricades were placed over the uncovered adit entrances to prevent recreational visitors from entering.
- **September 2011** – CDPH toured the site, visited with residents from the Joe Bar community, and explored the surrounding area.
- **2014** - USFS stopped allowing recreational visitors to obtain keys; keys will be offered to the public again at a future date. Joe Bar residents or hikers have access to the site by way of USFS Road 1060 or a hiking trail that branches off the nearby Pacific Crest National Scenic Trail.
- **2012 to 2015** – Off-site post-remediation monitoring of Joe and Elliott Creek surface water and Joe Bar residents' drinking water was conducted twice per year (spring and fall). Fish samples were collected from Elliott Creek annually [Engineering/Remediation Resource Group Inc. 2015]. In addition to monitoring, site inspections were conducted on a monthly basis from April through November in 2012, April through October in 2013 and 2014, and April and May in 2015.
- **2021 to 2022** – USEPA collected on-site treatment pond sediment and water samples in-support of its remedial investigation study efforts.

4. Site Visit and Demographics

On September 21, 2011, CDPH staff toured the site, spoke with residents from the Joe Bar community and explored the surrounding area. CDPH staff observed the final phase of the USFS removal and remediation efforts that began in July 2010 and made the following observations:

- WRPs were removed to bedrock,
- topsoil had been placed over bedrock in areas level enough to receive soil cover,
- several sediment basins and a run-off channel lined with limestone rock had been constructed,

- native revegetation planting had begun,

no remaining buildings or structures related to prior mining activities were observed on the site.

CDPH staff toured Elliott Creek and Joe Creek with Joe Bar community residents. Staff observed that the riparian (creek bank) zones along both Joe and Elliott creeks were covered with dense vegetation, small stones, medium- to large-sized boulders, and steep slopes. Joe Creek was observed to be a shallow creek with a width of roughly three to five feet. Joe Creek did not appear to be a favorable location for swimming or recreational activities. Joe Bar residents conveyed that the more accessible and wider Elliott Creek is used for swimming and the most frequented swimming locations are downstream from the Elliott Creek and Joe Creek confluence (Appendix B, Figure 2). Joe Bar residents also conveyed that rainbow trout fishing is common in Elliott Creek and not Joe Creek.

Farther downstream from the Joe Bar community, CDPH staff observed level areas used as campgrounds or daytime recreational areas along the banks of Elliott Creek. These areas were characterized by mature trees, small pebbles, and large- to medium-sized boulders. Few fine sands or soils were observed.

The Joe Bar community has roughly nine year-round adult residents with a variable number of multi-aged visitors throughout the year, primarily in the spring, summer, and fall. The Joe Bar community lies along the north shore of Elliott Creek near the Joe Creek-Elliott Creek confluence (Appendix A, Figure 2).

The nearest city to the site is Jacksonville, Oregon. Jacksonville is roughly a one-hour drive from the site. An estimated 3,020 people live in Jacksonville.[2]

Elliott Creek, the Applegate River, and Applegate Reservoir are known recreational areas for people living in the nearby cities. Two medium-sized cities (Ashland and Medford, both in Oregon) and several small cities are within a two-hour drive of the site. In total, according to the 2010 census, the combined population of the medium-sized and small cities within a two-hour driving distance (total population of potential recreational visitors) is approximately 160,000.

5. Discussion

CDPH evaluated past, present, and future exposure to on-site environmental contamination as well as present exposure to off-site environmental contamination to which the Blue Ledge Mine site may have contributed. Past exposure evaluations are based on site conditions before the USFS 2010-2011 remediation efforts, while present and future exposures are based on site conditions after these efforts.

[2] https://data.census.gov/cedsci/all?q=Jacksonville,%20Oregon, last accessed March 2022

The evaluation of potential exposures was based on the five elements of an exposure pathway [ATSDR 2022]: (1) the source of the contaminant release, (2) environmental fate and transport, (3) exposure location and media (soil, sediment, air or water), (4) exposure route (ingestion, inhalation or dermal), and (5) potentially exposed populations. The site's completed exposure pathways are summarized in Appendix B, Table 1.

5.1 Evaluation Process

Exposure pathways were evaluated for health impacts using soil, sediment, surface water, fish, and private well water data, in conjunction with standard exposure equations. Initially, with the exception of food media, such as fish and garden produce, maximum contaminant concentrations detected during environmental sampling were compared to ATSDR's human health comparison values (CVs). The CVs are media-specific concentrations of chemicals in air, soil, and water that are unlikely to cause harmful health effects based on toxicity information and assumptions of high-level, frequent exposure. In the absence of ATSDR CVs, CDPH used screening values from other sources. When the maximum detected amount of a contaminant is less than the media-specific CV, exposure is not expected to result in adverse health effects, and the contaminant is not examined further as part of the PHA. Thus, CVs were used to screen contaminants for further evaluation.

Those contaminants with maximum concentrations that exceed the media-specific CV are designated as a contaminant of concern (COC). Contaminants designated as COCs do not necessarily represent a health hazard [ATSDR 2022, USEPA 2016]. Instead, COCs warrant a more refined evaluation that incorporates site-specific information to determine whether health effects may occur. Contaminants of concern require that an exposure dose be estimated based on site-specific conditions. Exposure dose estimates incorporate an appropriate exposure point concentration of the COC [ATSDR 2019a, Section 2.2], the duration of exposure, the frequency of exposure, and the route of exposure (swallowed, breathed, or touched).

Exposure point concentrations used to derive an exposure dose are either the maximum concentration detected in a media sample or the 95% upper confidence level (UCL) of the mean. The 95% UCL, calculated using USEPA's ProUCL software, provides a health-protective estimate of the mean. A 95% UCL is derived only if at least eight media samples are available; otherwise the maximum detected concentration is used as the exposure point concentration.

Dose estimates incorporate parameters such as body weight and ingestion rate (amount of food, water or soil consumed per day). Many of these values are provided by ATSDR's Public Health Assessment Guidance Manual [ATSDR 2022]. Both a central tendency exposure (CTE), based on more average assumptions, and a reasonable maximum exposure (RME), based on more conservative exposure assumptions, were estimated. To be health protective, the RME estimates were used in this assessment to make decisions about possible health effects.

Given that there are no on-site residents, this assessment only considers recreational exposure scenarios. During the wet season, snow and rain create a substantial barrier to

accessing the site as well as Joe and Elliott Creek [USFS 2011]; therefore, visitation to the site and surrounding area most likely occurred during the 6-month dry season from mid-April to mid- October. CDPH staff assumed that a recreational visitor likely visited no more than twice per month from mid-April through mid-October, or roughly 14 times per year.

Due to the site's remote location and steep terrain, CDPH staff assumed that children younger than 6 years of age are not likely to visit the site. In this assessment, a recreational visitor is defined as: an adult over the age of 21 years, an adolescent between the ages of 11 years and 21 years, and/or a child between the ages of 6 years and 11 years.

Some of the recreational exposure scenarios are different for Joe Bar residents who are closer to the site and access the site and nearby areas more frequently. Based on discussions with community members, Joe Bar residents utilize Elliott Creek frequently.

A COC's exposure dose estimate is compared to health guidelines derived from toxicity studies usually conducted on adult humans (typically worker populations) or laboratory animals. Uncertainty factors are included in deriving the health guideline to be protective of sensitive populations such as children.

As a further step, exposure to chemical combinations that might interact additively are investigated. First, hazard quotients (HQs) for each chemical are calculated for noncancer health effects. A HQ is the estimated dose for a specific chemical divided by the chemical's noncancer health guideline. The various HQs are then summed to give the hazard index (HI) for the mixture of chemicals. An HI of less than 1 indicates that no additive adverse (noncancer) health effects are expected to occur. An HI greater than one indicates that the noncancer health effects of exposures should be evaluated further.

Lead is evaluated as a blood concentration (blood lead level, or BLL), and more specifically how much an exposure will increase the BLL [ATSDR 2019b]. Since no threshold for adverse health effects have been identified for blood lead levels, ATSDR's and CDPH's public health goal is to reduce blood lead levels in children as much as possible. To evaluate children's exposure to lead, CDPH used the USEPA integrated exposure uptake biokinetic (IEUBK) model v2.0 [USEPA 2021]. The model predicts a BLL, expressed in micrograms of lead per deciliter (µg/dL), based on exposure to lead contaminated water, air, dust, and soil for children ages 1 to 7. Additionally, the model will estimate a percentage of children whose BLL could exceed 5 µg/dL.[3]

To evaluate adolescent and adult exposure to lead, CDPH used the USEPA adult lead methodology (ALM) [USEPA 2003a]. The IEUBK and ALM use the arithmetic mean exposure concentrations to give estimates of BLLs. When only a few samples are available, the maximum concentration was used.

[3] Currently, 5 µg/dL is the lowest BLL that the IEUBK model can generate a percent probability for exceeding.

Cancer risk is assessed slightly different than noncancer risks. The exposure dose is averaged over the lifetime of a human (78 years) and then multiplied by the COC's cancer slope factor or unit risk factor. These factors are determined through carcinogenicity studies of persons (workers exposed to chemicals occupationally) or laboratory animals. In this evaluation, the estimated possible cancer risks resulting from recreational exposure for a child and adolescent are combined, and the estimated adult cancer risk assumes 33 years of exposure.

What is cancer?

Cancer is the name given to a collection of diseases with multiple causes. Carcinogens are any substance that can cause cancer. For most carcinogens, no level of exposure can be considered safe for carcinogens. The National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) program states that the lifetime risk for men and women of being diagnosed with cancer is about 39.2 cases in 100 people, or 39.2% (for all cancer sites, diagnosis at some point in life, based on 2016-2018 data). This corresponds to 392,000 cases for every 1 million people [SEER, 2021]. This is referred to as the "background cancer risk." The term "excess cancer risk" represents the risk above and beyond the "background cancer risk".

The cancer risks calculated in this PHA are the increased risks of developing cancer over a lifetime.

In general, dermal absorption of COCs contributes much less than other exposures that occur simultaneously, namely incidentally ingesting soil (hand-to-mouth), inhaling dust, and incidentally swallowing water [ATSDR 2005]. In this evaluation, dermal absorption scenarios were not evaluated because the other exposures were not found to be potentially harmful to human health.

6. Evaluation of Past Exposure (Pre-remediation) to On-site Contaminants

CDPH evaluated recreational visitors' past exposure to on-site contaminants in soil (incidental ingestion of soil and inhalation of dust) and past exposure to surface water at the confluence of site acid mine drainage (AMD) and Joe Creek (ingestion from filling drinking water bottles and wading).

Before the USFS 2010-2011 remediation efforts, WRPs 1 and 2 were connected and accessible via USFS Road 1060 while WRPs 3 and 4 located roughly 500 feet from WRPs 1 and 2 were isolated and not accessible by road or by an established foot trail (Appendix A, Figure 3). Accordingly, only WRPs 1 and 2 surface soil data were evaluated, as a combined data set. The samples were collected in July 2005 and prior to WRP excavation in June and July 2010 (Appendix B, Table 2).

Due to the very steep rocky terrain, driving an off-road vehicle on the site is not likely. Therefore, breathing dust caused by off-road vehicles was not considered in this investigation. Instead, CDPH estimated a potential concentration of contaminants in fugitive dust inhaled by

recreational visitors by calculating the site-specific particulate emission factor (PEF). The PEF is a ratio that approximates the concentration of a contaminant in the soil that is released into the air as dust and will be discussed in more detail in the 'Evaluation of Past Onsite Exposures (pre-remediation) to On-site Contaminants' portion of this document [USEPA 1996].

The on-site surface water originating from mine adits and groundwater seeps can be acidic with pH as low as 2.4 and contain metals and sulfur. Eye irritation and redness have been reported from contact to water with a pH below 4. Contact with water below a pH of 2.5 can cause irreversible damage to the outer layer of the eye's cornea (WHO 2012). Photographs and data collected prior to 2010 indicate that the concentrations of metals and sulfur caused the on-site water to have an offensive appearance and likely an unpleasant odor; too offensive for a recreational visitor to consider for drinking water or wading. Therefore, the recreational visitor exposure from drinking or wading in on-site surface water was not evaluated.

However, AMD from the site empties into Joe Creek at a location abutting USFS Road 1060 (Appendix A, Figure 4). In the past, a recreational visitor could have found this easily accessible location suitable for filling a water bottle or wading. To evaluate the past exposure to drinking from and wading where on-site AMD water empties into (Joe Creek and on-site AMD confluence), CDPH used surface water samples collected before the USFS 2010-2011 remediation effort (Appendix B, Table 3).

Unlike other metals, lead exposure is modeled as BLLs, so it is presented separately (see Section 6.4).

6.1 Incidental Ingestion of Soil

The July 2005 surface soil samples were analyzed for metals (arsenic, cadmium, copper, iron, lead, manganese, mercury, and zinc). These soil samples were collected just below the top surface along a randomly selected line across WRPs 1 and 2 and were individual, not composite (combined) samples. Analysis of soil samples from July 2010 included the analysis of additional metals (antimony, total chromium, selenium, silver, thallium, vanadium, potassium, aluminum, barium, beryllium, cobalt, and nickel) in two of the surface soil samples collected, which also were individual, not composite samples. Table 2 (in Appendix B) includes data on soil samples collected.

6.1.1 Exposure to on-site soil

When compared to soil CVs (Appendix B, Table 2), the following compounds were identified as COCs: arsenic, copper, iron, lead, mercury, and silver. Table 6.1.1 below provides the COC exposure point concentrations, comparison values, and natural surface soil background concentrations. Background samples were collected by the US Geological Survey (USGS) from a location with similar terrain roughly 6 miles south from the site (USGS 2013).

Table 6.1.1: Contaminants of concern summary table and US Geological Survey (USGS) soil sampling results on background concentration

Metals Sampled	Exposure Point Concentration *(milligrams per kilogram)*	Comparison Value (Type) *(milligrams per kilogram)*	USGS Background Concentration *(milligrams per kilogram)*
Arsenic	197**	16 (ATSDR: Chronic child 0.26 (ATSDR: CREG)	1.8
Copper	2740*	1,000 (ATSDR Intermediate child)	70.1
Mercury	92.8 *	16 (ATSDR: Chronic child)	0.08
Silver	390 *	260 (ATSDR: Chronic child)	Not Analyzed
Iron	121,000*	55,000 (USEPA: RSL)	5.88
Lead	1,568^{m}	80 (CalEPA) 400 (USEPA: child))	4.8

* Maximum concentration detected
** 95% Upper confidence limit
Abbreviations - ^{m}: mean; CREG: cancer risk evaluation guide; RSL: regional screening level; USEPA: US Environmental Protection Agency; CalEPA: California Environmental Protection Agency
Comparison Values are for residential exposure scenarios

Using the EPC reported in Table 6.1.1, exposure doses were estimated to determine whether exposure to COCs could cause noncancer health risks. Exposure doses were based on the recreational visitor scenario described in section 5.1 above and assumptions obtained from USEPA's Exposure Factor Handbook and compared to health guidelines. No exposures exceeded health guidelines (Appendix B, Table 4.1). Lead (see Section 6.4) and iron (see below) do not have noncancer health guidelines and were evaluated separately.

Iron is an essential nutrient in the human diet. However, ingesting excessive amounts of iron can cause gastrointestinal distress. The potential amount of iron a recreational visitor may have ingested (from one site visit) was compared to U.S. National Institutes of Health (NIH) Tolerable Intake Levels, which are maximum daily intake amounts of iron unlikely to cause gastrointestinal distress in children (40 mg/day) or adults (45 mg/day) [U.S. Department of Health and Human Services 2011]. The maximum concentration of iron detected in soil was 121,000 mg/kg. A recreational visitor who incidentally swallows 200 mg/day of soil would be exposed to 24 mg iron/day (121,000 mg/kg x 200 mg/day x 10^{-6} kg/mg), which is well below the child or adult NIH daily Tolerable Intake Level of iron.

6.1.2 Noncancer evaluation of individual and combined exposure

All of the estimated doses to individual pollutants are below health guidelines like MRLs and RfDs. This results in a hazard quotient less than 1 for each chemical. Therefore, exposure to individual chemicals is not expected to cause noncancer health effects.

To investigate whether additive effects might occur from a combined exposure to site-related contaminants, the HQ for each metal reported was summed to give an HI for the mixture. The calculated HQs are based on the child exposure and were as follows: arsenic (HQ=0.01), copper (HQ=0.13), mercury (HQ=0.07) and silver (HQ=0.02). The summed HI is 0.20, which is less than 1 and indicates that exposure interactions are not likely to cause noncancer adverse health effects. Table 6.1.2 below shows the specific HQs and the HI for soil ingestion-only exposure.

Table 6.1.2: Hazard Quotient (HQ) and Hazard Index (HI) Summary

Contaminant	**Exposure Dose (child)** (mg/kg/day**)	**MRL** (mg/kg/day**)	**Child HQ*** **
Arsenic	0.000029	0.0003	0.01
Copper	0.0025	0.02	0.13
Mercury	0.000022	0.0003*	0.07
Silver	0.000094	0.005	0.02
-	-	HI (sum of HQs)	0.20

* This value is the USEPA reference dose (RfD) for mercuric chloride. ATSDR does not have a chronic MRL for inorganic mercury.
**milligrams chemical per kilogram body weight per day
***HQ = child dose/MRL or RfD

6.1.3 Cancer evaluation of on-site soil

Cancer is a common disease, and no level of exposure can be considered safe for most carcinogens. Among the site-related soil pollutants identified, arsenic was the only carcinogen with an exposure point concentration (196 mg/kg) that exceeded its CREG (0.26 mg/kg) [ATSDR 2007]. Because this CREG assumes daily exposure, we conducted a site-specific evaluation.

We used the visitor scenario to estimate the cancer risk from coming into contact with contaminated soil 14 times a year. The cancer risk calculations were based on 60% bioavailability (the amount that can potentially enter the body) of arsenic [USEPA 2012]. The combined child and adolescent cancer risk and the adult cancer risk were both estimated at 4 extra cancer cases should 1 million people be exposed for up to 33 years (Appendix B, Table 4.2). This is not considered an elevated cancer risk.

6.2 Inhalation of Fugitive Dust

Prior to the completion of site remediation efforts, roughly half the site, specifically the waste

rock piles, were free of vegetative cover. Wind-generated fugitive dust was a likely occurrence. CDPH estimated a potential concentration of contaminants in fugitive dust by calculating the site-specific particulate emission factor (PEF). The PEF is a ratio that approximates the concentration of a contaminant in the soil that is released into the air as dust. The PEF accounts for local climate, windspeed, vegetation cover, and total site area.

Potential concentrations of fugitive dust to a recreational visitor at the site were estimated by dividing the maximum detected concentration or the 95% UCL of the mean concentration of each metal measured in the surface soil samples collected in 2005 and 2010 by the site-specific PEF (Appendix B, Table 5).

None of the estimated fugitive dust concentrations exceeded the noncancer CVs for any of the metals (Appendix B, Table 5). Silver and zinc, however, could not be evaluated due to their lack of air CVs.

Of the site-related fugitive dust pollutants identified, only cadmium and arsenic are carcinogens. Cadmium did not exceed its cancer CV (Appendix B, Table 5). Arsenic, however, exceeded its cancer CV (Appendix B, Table 5), so CDPH estimated the possible increased cancer risk to a recreational visitor from breathing arsenic in fugitive dust (Appendix B, Table 6). The estimated cancer risk for a child, adolescent, and adult was 1 in 10 million, which does not present an increased cancer risk.

6.3 Ingestion of Joe Creek Water by Drinking and Wading

Before the USFS 2010-2011 remediation efforts, five surface water samples were collected in spring, summer, and fall near the confluence of site AMD and Joe Creek between September 2000 and June 2008 (Appendix B, Table 3). All five surface water samples were analyzed for cadmium, copper, iron, lead, and zinc. Two of the samples were also analyzed for arsenic, three samples for pH, and two samples were analyzed for sulfates.

6.3.1 Exposure to surface water where on-site AMD empties into Joe Creek

The measured pH (6.6 to 7.5) and sulfate concentrations (2.3 mg/L and 2.8 mg/L) found were similar to levels found in public drinking water. The maximum concentration detected for arsenic (0.07 micrograms per liter [µg/L]) and zinc (774 µg/L) does not exceed child or adult chronic noncancer CVs for drinking water. The maximum detected copper concentration (790 µg/L) exceeds the child (140 µg/L) and adult (520 µg/L) intermediate CVs. The maximum cadmium concentration detected (4.1 µg/L) exceeds the child (0.7 µg/L) and adult (2.6 µg/L) chronic CVs (Appendix B, Table 3). The maximum concentration of iron was 998 µg/L. A recreational visitor who collected and drank two liters of water from where on-site AMD empties into Joe Creek would ingest 1,996 µg iron/day (998 µg/L x 2 L/day), which does not exceed the NIH level of iron known to cause gastrointestinal distress in children (40,000 µg/day) or adults (45,000 µg/day) [U.S. Department of Health and Human Services 2011]. Lead is evaluated separately (see Section 6.4).

Using the recreational visitor scenario previously described and assuming adults and adolescents drink 2 liters per day, and children drink 1.4 liters/day, CDPH estimated exposure doses for copper and cadmium from both intentional (filling water bottles then drinking from them) and accidental (wading) ingestion (Appendix B, Table 7). None of the estimated doses exceeded the noncancer health guidelines.

6.3.2 Noncancer evaluation of combined exposure

To investigate whether potential additive effects occurred from a combined exposure to cadmium and copper, the HI was determined from HQs based on the highest child doses for cadmium (HQ=0.08, 0.07 from drinking plus 0.006 from wading) and copper (HQ=0.27, 0.25 from drinking plus 0.02 from wading) and summing these HQs. The HI sum for cadmium and copper is 0.4, which is below 1 and indicates that a health hazard from the mixture is unlikely.

6.3.3 Cancer evaluation

The maximum concentration of arsenic measured in water exceeded the cancer CV (Appendix B, Table 3). To evaluate the potential increased cancer risk from drinking and incidentally swallowing arsenic in water from the confluence of site AMD and Joe Creek, CDPH estimated the possible cancer risk using the maximum detected arsenic concentration (only two samples were analyzed). Cancer risks were based on recreational scenarios described previously. The estimated cancer risk was 5 in 100 million for children exposed from 15 years (from ages 6 to 21) (Appendix B, Table 8), which does not present an elevated cancer risk.

6.4 Exposure to Lead

CDPH evaluated exposure to lead based on a hypothetical recreational visitor who participated in all of the above exposures combined: incidental soil ingestion, dust inhalation, and drinking water from the confluence of site AMD and Joe Creek. Dermal absorption of lead was not evaluated because only lead in the organic form is readily absorbed through the skin [ATSDR 2019b], and lead at the site is in the inorganic form.

To estimate a child's BLL, USEPA's IEUBK model v2.0 [USEPA 2021] was used. The model requires mean concentrations, so the mean concentration of lead in surface soil (1,568 mg/kg) was the starting point. Due to fewer samples having been collected, the maximum surface water lead concentration (10.7 µg/L) was used. The estimated fugitive dust concentration (0.011 µg/m³) was also used. Because exposure would be infrequent, a time-weighted factor was applied to these concentrations [USEPA 2003b]. As stated above, the recreational visitor scenario assumes two site visits per month from mid-April through mid-October. This yields a time weighted factor based on 1 visit every 14 days[1]. However, to ensure the IEUBK's model

[1] CDPH derived the soil, surface water, and fugitive dust values by multiplying the media lead concentrations by the time weighted factor of 0.14 (1/7 = 0.14). The media lead concentration calculations used in the model are: 166 mg lead/kg of soil X 0.14 = 23.24 mg lead/kg of soil; 0.0008 µg of lead/ m3of air X 0.14 = 0.0001 µg of lead/ m3of air; 1.47 µg lead/L of water X 0.14 = 0.2 µg lead/L of water.

predictions are valid, a more conservative scenario was used, 1 visit every 7 days, which yields a factor of 0.14 (1 visit/7 days = 0.14). Applying the time-weighted factor yielded the following concentrations that were used in the IEUBK model: 224 mg/kg lead in soil, 1.5 µg/L lead in surface water, and 0.0015 µg/m³ lead in fugitive dust (Appendix B, Table 9).

The predicted BLL for a child aged 6 to 7 years is 1.8 µg/dL (Appendix B, Table 9), which is well below the Centers for Disease Control and Prevention (CDC) Blood Lead Reference value of 3.5 ug/dL [CDC 2021]. The percent of children aged 6 to 7 years that might be expected to have a BLL that exceeds 5 ug/dL is 1.6%, which is less than 5%. Because of infrequent exposure based on 24 visits during a 6- month period, lead was likely not a concern for children.

The BLLs for an adolescent or adult recreational visitor were predicted using the USEPA ALM [USEPA 2003a] (Appendix B, Table 9). Similar to the child BLL estimate, an exposure frequency of once per week is assumed to ensure the ALM predictions are valid. A lead intake of 100 mg/day was assumed as a reasonable maximum exposure for an adult and for an adolescent. The predicted BLL for an adult and adolescent was 1.5 µg/dL with a 1.3% chance of exceeding 5 µg/dL. Exposure to lead in on-site soils for recreational visitors was not a concern in the past. More information about BLL in adults is available at: Lead: Adult Blood Lead Epidemiology and Surveillance (ABLES) | NIOSH | CDC (last accessed September 2023).

The ALM, unlike the IEUBK model, only includes incidental soil ingestion and breathing fugitive dust. However, because the predicted BLL in children (which includes swallowing water) was <3.5 µg/dL, it is expected that predicted adult or adolescent BLLs would also be <3.5 µg /dL, the CDC reference value for children.

7. Evaluation of Present Exposure (Post-remediation) to On-site Contaminants

CDPH evaluated recreational visitors' present exposure to on-site contaminants in sediment, soil (incidental ingestion of soil and inhalation of dust) and present exposure to surface water at the confluence of site AMD and Joe Creek (ingestion after filling drinking water bottles and wading). In general, future exposures are expected to be similar to present exposures since the site has been remediated. Additionally, future site remediation efforts may reduce levels of contamination and therefore, potential exposure risks.

To evaluate the present (and potential future) exposure to on-site surface soil, CDPH analyzed confirmatory surface soil samples collected just after the USFS's 2010-2011 remediation effort (Appendix B, Table 2). The remediation dug a road between WRPs 1, 2, and 4 (see Appendix A, Figure 5), so CDPH evaluated WRPs 1, 2, and 4 (WRP 124) as one pile and WRP 3, roughly 250 feet from the other piles, separately. The higher value from either WRP 124 or WRP 3 was used to evaluate potential exposures.

Surface soil samples were collected immediately after waste rock material was removed. Each soil sample was a combination of nine surface soil samples obtained from pre-selected 900-square-foot areas of each (former) WRP [Engineering/Remediation Resource Group Inc. 2012].

After the nine samples were mixed, the mixed (composite) sample was dried and analyzed at the on-site field laboratory for arsenic, cadmium, lead, copper, and zinc using an X-ray fluorescence (XRF) device. XRF reported concentrations could be under or overestimated depending on the pollutant being reported. Certain pollutants can interfere with or alter the results for another pollutant if both are present in a sample, such as lead and arsenic. To validate the XRF results, 20% of the composite samples were analyzed at an off-site laboratory for arsenic, cadmium, lead, copper, and zinc. The laboratory results were statistically consistent with the XRF results; therefore, CDPH used the XRF results as well as the off-site laboratory results to evaluate potential exposure.

To evaluate the present (and future) exposure to drinking from and wading in the confluence of AMD and Joe Creek, CDPH used surface water samples collected post the removal-action (from years 2012 – 2015, and in 2021). Surface water samples were collected at the confluence of site AMD and Joe Creek, and all were analyzed for arsenic, cadmium, copper, lead, and zinc (see Appendix B, Table 3).

The 2010 – 2011 site remediation included the construction of nine on-site basins (ponds) designed to capture and treat AMD and sediment before discharging into Joe Creek. Typically, these ponds are filled with acidic AMD runoff and likely discolored with an offensive appearance that would dissuade visitors from drinking (wading). Surface water samples collected from the ponds by the USEPA in 2021 and analyzed for metals reported water discoloration, acidic conditions, and foul orders. Metals were found that exceed both child and adult drinking water CVs, such as copper (2,600 µg/L) and cadmium (18 µg/L) in addition to detecting other metals at levels that exceed child CVs like aluminum (8,500 µg/L) and zinc (5,300 µg/L) [Eric Canteenwala, USEPA Project Manager, personal communication, March 2022]. Additionally, the USEPA has reported that the ponds dry out in the summer. Based on the surface water samples, the exposed sediment in the dry ponds could contain elevated amounts of metals [Eric Canteenwala, USEPA Project Manager, personal communication, July 2021]. Recreational visitors could enter the dry ponds and touch, breathe, or incidentally swallow the exposed sediment.

Acting on CDPH's recommendation listed in the August 2022, Public Health Assessment Initial-Public comment release to collect sediment samples from the dry on-site basins, the USEPA collected sediment samples from the dry on-site treatment ponds in September 2022.

7.1 Incidental Ingestion of Soil

CDPH compared the maximum detected soil sample concentrations for arsenic, cadmium, lead, copper, and zinc to media-specific child and adult health CVs (Appendix B, Table 2). The maximum concentration (in either WRP 124 or WRP 3) of arsenic and copper are above the respective noncancer CVs, so they were screened further. Lead was evaluated separately (see Section 7.4).

Arsenic and copper were screened further (Appendix B, Table 4.1). The estimated exposure

doses of arsenic and copper did not exceed the noncancer health guidelines.

To investigate potential additive effects from combined exposure to arsenic and copper, the HI was determined using HQs based on the most conservative child doses for arsenic (HQ=0.03) and copper (HQ=0.03) and summing these ratios. The HI sum is 0.06, which is less than 1 and therefore not likely to cause an additive noncancer health effect.

CDPH estimated the possible increased cancer risk from incidentally ingesting arsenic in soil for child, adolescent, and adult recreational visitors. The estimated combined cancer risk from arsenic was 3 in 1 million for children and adolescents and 1 in 1 million for adults (Appendix B, Table 4.1), which do not present cancer risks of concern.

7.2 Inhalation of Fugitive Dust

CDPH estimated the potential concentrations of contaminants in fugitive dust by applying the site-specific PEF to the maximum detected concentrations of arsenic, cadmium, lead, copper, and zinc in post-remediation soil samples (Appendix B, Table 5). With the exception of lead, which is analyzed separately (see Section 7.4), no estimated fugitive dust concentrations exceeded noncancer CVs (Appendix B, Table 5).

CDPH estimated the possible increased cancer risk from breathing arsenic in fugitive dust (Appendix B, Table 6). CDPH assumed that fugitive dust could originate from either WRP 124 or WRP 3 and used the higher value among the two. When this concentration is adjusted for infrequent exposure (multiplied by 14 days/365 days) and then multiplied by the inhalation Unit Risk Factor for arsenic (4.3E-03 $[\mu g/m^3]^{-1}$), the estimated cancer risk representative for child, adolescent, and adult is 5 in 100 million, which does not present a cancer risk of concern.

7.3 Ingestion of Joe Creek Water by Drinking and Wading

CDPH evaluated infrequent exposure to contaminants from drinking water and wading in the confluence of site AMD and Joe Creek. (Appendix B, Table 3). Lead was evaluated separately (see Section 7.4).

The maximum concentration of iron detected in the surface water where the site AMD drains into Joe Creek was 237 µg/L. A recreational visitor that drinks 2 liters of water with an iron concentration of 237 µg/L would ingest 474 µg/day (237 µg/L x 2 L/day), which does not exceed the NIH daily level of iron that could cause gastrointestinal distress in children (40,000 µg/day) or adults (45,000 µg/day) [U.S. Department of Health and Human Services 2011].

CDPH further assessed exposure to cadmium, copper, and zinc by estimating exposure doses from drinking surface water and wading (Appendix B, Table 7). The estimated exposure doses were based on the maximum concentration of each COC detected. The estimated exposure doses for cadmium and zinc did not exceed the health guidelines; however, the exposure dose for drinking copper nearly exceeded its health guideline (HQ = 1). This exposure was examined

further.

The maximum concentration of copper detected at the confluence measured in May 2014 (3,150 µg/L) is much greater than the amount of copper measured in the other confluence samples collected between 2012 and 2015, which ranged from 3.13 µg/L to 6.61 µg/L (refer to Appendix A, Figure 2 for sample location). However, in April 2021, a sample USEPA collected at the confluence found copper at 2,600 µg/L indicating that copper levels vary and can be highly elevated. Therefore, given the possibility that a recreational visitor could be exposed to a one-time high amount of copper, CDPH estimated a one-time (acute) exposure dose for an adult drinking 2 liters of water and a child drinking 1 liter from where on-site AMD empties into Joe Creek containing 3,150 µg/L of copper.

The estimated doses for both a child (0.1 mg/kg/day) and adult (0.08 mg/kg/day) are above the provisional oral acute copper MRL of 0.02 mg/kg/day. The MRL is based on a study that found gastrointestinal effects in female adults drinking copper sulfate in water for 2 weeks, with a benchmark dose of 0.05 mg/kg/day. Exposures from drinking water with that level of copper could cause gastrointestinal effects such as abdominal pain, vomiting, and nausea [ATSDR 2022].

CDPH also assessed an acute potential exposure from accidentally ingesting water with a copper concentration of 3,150 µg/L while wading. Neither the adult dose (0.0028 mg/kg/day) or child dose (0.012 mg/kg/day) exceed the MRL (0.02 mg/kg/day).

Since the Joe Creek and AMD discharge confluence has the potential to contain copper at amounts that could cause gastrointestinal distress if ingested by a recreational visitor, CDPH recommends USEPA post signs that will warn visitors not to drink or wade in the water.

To investigate whether potential additive effects occur from a combined exposure to cadmium, copper, and zinc, the HI was determined by calculating HQs based on the most conservative (recreational exposure scenario) child doses for cadmium (HQ = 0.5), copper (HQ = 1.0) and zinc (HQ = 0.03) and summing these ratios. The HI sum is 1.5, with copper being the main contributor. Therefore, we reached the same conclusion that the primary risk is gastrointestinal distress due to the high levels of copper.

Arsenic was not detected in surface water. An evaluation of the detection limit (0.5 µg/L) showed it to be below the child and adult noncancer CVs yet above the cancer CV (0.016 µg/L). If arsenic were present at the detection limit, CDPH estimated the cancer risk using the following equation:

(0.5 µg/L x 2 L/day x 1 day/1^4 days x 33 years/78 years x 0.001 mg/µg x 1.5 $[mg/kg/day]^{-1}$ / 56.8 kg).

The child and adolescent combined risk is 5 in 10 million (if arsenic were present at the detection limit), which does not present an elevated cancer risk (Appendix B, Table 8).

7.4 Exposure to Lead

Child exposure to lead was evaluated by applying a time-adjusted approach to the USEPA IEUBK model v2.0 [USEPA 2021]. Due to infrequent exposure, CDPH applied the 0.14 (1 day of exposure/ 7 days = 0.14) factor to the mean lead concentration of 166 mg/kg measured in WRP 124 surface soil, the 0.0008 µg/m³ estimated lead concentration in fugitive dust, and the maximum detected lead concentration in stream water measured at the confluence of site AMD and Joe Creek of 1.47 µg/L. Accordingly, the values 23.24 mg/kg, 0.0001 µg/m³, and 0.21 µg/L were input into the IEUBK model. The predicted BLL for a child aged 6 years to 7 years is 1.0 µg/dL (Appendix B, Table 9), which is below the CDC reference value of 3.5 µg/dL for children. The percent of children aged 6 to 7 years with BLL exceeding 5 µg/dL is well below 5% (0.06%). Exposure to lead in WRP soil is not a health concern.

Adolescent and adult lead exposures were evaluated using the USEPA ALM [USEPA 2003a]. The predicted adult and adolescent BLL is 0.5 µg/dL (based on 100 mg/day of soil ingestion) with a <1% (0.008%) chance of exceeding 5 µg/dL (Appendix B, Table 9). Both are below the CDC reference value of 3.5 µg/dL for children.

The ALM, unlike the IEUBK model, only includes incidental soil ingestion and breathing fugitive dust. However, because the predicted BLL in children (which also included swallowing water) was <1 µg/dL, it is expected that predicted adult or adolescent BLLs would also be <1 µg/dL. This is well below the 3.5 µg/dL CDC reference value for children.

Regardless of on-site exposures, CDPH and ATSDR recommend that people be informed about the hazards of lead (e.g., vulnerability of young children to this neurotoxin), reduce exposures as much as possible, and know who to contact for blood lead testing if they suspect exposures. Common sources of lead include chipping paint and old water pipes and plumbing fixtures. There is no known threshold for health effects from lead, thus good public health practice is to lower exposure to lead whenever possible.

7.5 On-site Treatment Ponds

In September 2022 the USEPA collected and analyzed six sediment samples from the dry treatment ponds. CDPH examined the metals detected and found the concentrations to be similar to or less than the metals detected in on-site soil samples collected after the USFS remediation effort (Table 7.5). Therefore, like the findings discussed in section 7.1 above, exposure to the drainage pond sediments is not expected to harm the health of recreational visitors. However, given that the purpose of the engineered treatment pond system is to collect and remediate the site's acid mine drainage water, future levels of metals in the pond sediment could increase. Feasibly, metals could accumulate in the sediment over time; possibly to levels where exposure could present a health concern.

Table 7.5 Drainage treatment pond sediment sample and post remediation on-site surface soil results

Contaminant	**September 2022 on-site pond sediment sample maximum concentration** *(milligrams per kilogram)*	**July 2010 to August 2011 On-site surface soil concentration maximum concentration** *(milligrams per kilogram)*
Arsenic	53.4	113
Cadmium	3.42*	1.27
Copper	2500	2508
Lead	199	742
Zinc	525	1350

*Less than ATSDR soil EMEG for children of 5.2 mg/kg (milligrams per kilogram)

8. Evaluation of Present Exposure to Contaminants Released Off-site

CDPH investigated potential public health implications from possible exposures related to present levels of contaminants in Joe Creek, Elliott Creek, and the Applegate River. This investigation evaluates exposure to contaminants along the roughly 2-mile portion of Elliott Creek beginning at the Joe Creek and Elliott Creek confluence and ending where Elliott Creek empties into the Applegate River (Appendix A, Figure 2). This portion of Elliott Creek supports swimming, camping, and fishing. In addition, as observed in the 2011 site visit, Joe Bar residents along this portion of Elliott Creek use water to irrigate vegetable gardens. Elliott Creek is not used for potable water; Joe Bar residents obtain potable water from private wells and natural springs near Elliott Creek.

Because Elliott Creek and Applegate River support recreational fishing, fish have been sampled from both of those water bodies to assess contamination. All samples were analyzed for metals found on the Blue Ledge Mine site.

The Oregon Health Authority also investigated levels of methylmercury in fish tissue taken from the Applegate Reservoir in Oregon [Todd Hudson, Health Assessor, Oregon Health Authority, Public Health Division, Environmental Health Assessment Program, personal communication, January 2013]. Upon request by USEPA in 2014, CDPH evaluated exposure from Applegate Reservoir fish caught and consumed specifically by Joe Bar residents [CDPH 2015], which is summarized in Appendix C.

For this PHA, CDPH evaluated potential exposure to site contaminants released into Elliott Creek and Applegate River from (1) incidentally swallowing water while swimming, (2) consuming fish caught from Elliott Creek or from the Applegate River, and (3) consuming garden vegetables irrigated with Elliott Creek water. To evaluate these potential exposures, CDPH staff used surface water, fish, and home-grown garden vegetable data (Appendix B, Tables 3, 10, and 11).

8.1 Exposure to Contaminants in Elliott Creek

Anecdotal information from Joe Bar residents indicates that swimming occurs at two popular

locations: immediately downstream from the Joe Creek and Elliott Creek confluence known as "Zebra Rock" and at the former United States Geological Survey (USGS) gauging station bridge, located downstream from the Joe Bar community. CDPH staff identified only one surface water sample analyzed for arsenic, cadmium, copper, lead, zinc, and mercury collected near the former USGS gauging station bridge, which was collected in October 2010. Except for cadmium, all concentrations were non-detect or below health risk screening levels. Although the cadmium concentration of 1.1 µg/L slightly exceeds the child noncancer health CV (0.70 µg/L), given that the CV is applied to tap (drinking) water scenarios and the exposure is not expected to be frequent (not residential), this level does not indicate a health concern.

During the 2011 site visit, CDPH observed an area adjacent to the USFS Road 1055 along Elliott Creek known as the Hutton Campground (Appendix A, Figure 2). The potential exposures to contaminants resulting from camping activities are incidental ingestion of soil, drinking Elliott Creek water, and fishing. CDPH identified only one surface water sample, only one riparian soil sample, and only one upland soil sample collected around the campground in October 2010. Samples were analyzed for arsenic, cadmium, copper, lead, zinc, and mercury. Except for the surface water cadmium concentration, all concentrations were non-detect or below noncancer health CVs for drinking water or soil. Although the cadmium concentration of 1.1 µg/L slightly exceeds the child noncancer health CV (0.70 µg/L), given that exposure is not residential, this level does not indicate a health concern. The arsenic riparian soil sample concentration (4.7 mg/kg) exceeds the cancer health CV.

8.1.1 Incidental Swallowing of Water while Swimming

Joe Bar residents and visitors swim in Elliott Creek during the warm, dry summer months. CDPH analyzed surface water data collected during these months to evaluate potential exposure from swimming for up to 90 minutes. Exposure could occur by the incidental ingestion of water while swimming.

Metal concentrations found in surface water samples collected downstream from Zebra Rock prior to the remediation in June 2008 and biannually after the remediation from 2012 to 2015, indicate the remediation has not resulted in an increase of contamination into Elliott Creek. For example, arsenic levels detected in June 2008 were 0.4 µg/L and ranged between 0.31 to 0.58 µg/L from 2012 to 2015; or lead which was detected at 0.012 µg/L in 2008 and then not detected (<0.5, <1, and <0.2 µg/L) from 2012 to 2015. Therefore, this analysis is representative of past and present (and, possibly, future) exposure scenarios.

Surface water samples were collected at the Zebra Rock location in September 2000, April 2001, August 2001, and October 2010. All samples were analyzed for cadmium, copper, lead, and zinc (Appendix B, Table 7). In October 2010, the surface water sample was also analyzed for arsenic and mercury. Arsenic and mercury were not detected (laboratory detection limits were below noncancer health CVs). Maximum detected concentrations of cadmium, copper, lead and zinc were compared to cancer and noncancer media-specific CVs (Appendix B, Table 3). The maximum concentrations of cadmium, copper, and zinc are below the noncancer health CVs, but lead exceeds the noncancer health CVs.

The maximum concentration of lead (28.2 µg/L) was used to estimate a BLL for a child aged 6 to 11 with the IEUBK model. To be health protective, CDPH assumed swimming daily during the 180-day swimming season described previously, so no time-weighted factor was applied to the lead concentration. CDPH used an incidental water intake of 0.12 liter per swimming event for a child. The estimated child BLL increase from swimming is 2.8 µg/dL (Appendix B, Table 9). Given that the estimated BLL for a child is well below CDC's reference level of 3.5 µg/dL and that the percentage of children with elevated BLL <5% (4.3%), it is unlikely that estimated adolescent or adult BLLs resulting from the same exposure scenario would be a public health concern.

Arsenic was not detected in surface water. An evaluation of the detection limit (0.58 µg/L) showed it to be below the child and adult noncancer CVs yet above the cancer CV (0.016 µg/L). If arsenic were present at the detection limit, CDPH estimated the possible increased cancer risk (0.58 µg/L x 0.1 [child] & 0.7 [adult] L/day x 7 days each week/26 weeks x 33 years/78 years x 0.001 mg/µg x 1.5 $[mg/kg/day]^{-1}$ / 56.8 kg). The child and adolescent combined risk is 2 in 10 million (if arsenic were present at the detection limit), which does not present an elevated cancer risk (Appendix B, Table 8).

8.1.2 Eating Fish Caught in Elliott Creek

During CDPH's September 2011 site visit, Joe Bar residents mentioned that both they and recreational visitors catch and consume rainbow trout from Elliott Creek [Innovative Technical Solutions Inc. 2011]. Some Joe Bar residents catch and consume up to three fish meals per week [Bonnie Arthur, USEPA Project Manager, personal communication, June 18, 2012]. Based on USEPA's fish consumption guidance (before cooking), an adult Joe Bar resident could consume up to approximately 96 grams of fish per day (g/day) and a 6-11 year-old child resident up to 35 g/day (USEPA 2011).

Rainbow trout samples were collected from 2010 through 2015 (pre- and post-remediation) at recreational fishing locations in Elliott Creek. In 2010, the fillet (edible) portions of the fish were analyzed separately from the whole fish. CDPH assessed fish consumption exposure using the fillet samples because they represent the most edible portion of the fish. However, people who consume other portions of the fish may have different exposures. A total of 14 fish (trout) fillets were analyzed; however, CDPH evaluated only the 12 samples collected from the potentially impacted section of Elliott Creek (within the Joe Creek confluence to the Applegate River confluence) and not the 2 fillets collected upstream from the Joe Creek confluence.

Twelve trout fillet samples were analyzed for arsenic, cadmium, copper, lead, and zinc. Ten of the fillet samples were analyzed for total mercury, however, to be most health protective CDPH assumed this to be methyl mercury (Appendix B, Table 10). Copper and zinc were found in all fillet samples, cadmium in four samples, arsenic in three samples, lead in one sample, and mercury was not detected in any of the (10) samples. Table 8.1.2 below provides a summary of the analyses.

Table 8.1.2 Fish Fillet Metals Analysis Summary

Total Metals, not speciated	**Number of Samples**	**Number of Detections**	**Minimum and maximum range of detections and non-detections** *(milligrams per kilogram)*
Arsenic	12	3	0.11 - <0.4
Cadmium	12	4	0.046 - <0.1
Copper	12	12	0.29 - 2.37
Lead	12	1	0.09 - <0.2
Zinc	12	12	6.96 - 34.8
Total mercury	10	0	<0.099

There are no ATSDR media-specific CVs for fish consumption, so CDPH estimated exposure doses for all contaminants found in fish. Fishing was assumed to occur mid-April through mid-October (3 servings per week). Child and adult arsenic, cadmium, copper, zinc, and methyl mercury exposure doses were estimated based on either the ProUCL value or the maximum non-detect value and compared to health guidelines. An additional consideration was taken for arsenic. Arsenic occurs in the environment in two forms: inorganic and organic. Studies have shown that arsenic in the inorganic forms can be a significant concern to human health, whereas the organic forms of arsenic are not a health concern (ATSDR 2007). Consensus in the literature reports that roughly 10% of the arsenic found in the edible parts of fish is inorganic arsenic (ATSDR 2007). In Table 8.1.2a, a factor of 0.1 was applied to account for the 10% portion of arsenic that was inorganic. All exposure dose estimates were below health guidelines. Table 8.1.2.a below provides the exposure point concentrations, exposure doses, health guidelines and health indices.

Table 8.1.2a Fish Fillet Exposure Dose and Hazard Index

Metal	**Exposure Point Concentration** ***(milligrams per kilogram)***	**Exposure Dose (child)** ***(milligrams per kilogram)***	**MRL** ***(milligrams per kilogram)***	**HQ (Dose/MRL)**
Inorganic Arsenic	0.04 (0.1 adjustment factor)	0.000009 (child) 0.00001 (adult)	0.0003 (Chronic)	0.03 0.03
Cadmium	0.088 (ProUCL)	0.00002(child) 0.00002 (adult)	0.0001 (Chronic)	0.20 0.20
Copper	1.54 (ProUCL)	0.0007 (child) 0.0008 (adult)	0.02 (Provisional Intermediate)	0.04 0.04
Zinc	23.5 (ProUCL)	0.05 (child) 0.06 (adult)	0.3 (Chronic)	0.02 0.02
Methyl mercury	<0.099 (Max)*	0.000021 (child) 0.000023 (adult)	0.0003 (Chronic)	0.07 0.08
-			HI (sum of HQs)	0.4 (child) 0.4 (adult)

ProUCL values calculated using ProUCL Version 5.1.
*Mercury was not detected in any sample. A ProUCL calculation was not possible. <0.099 mg/kg is the maximum non-detect value.
Exposures assumed fish consumption of 96 grams per day for an adult and 35 grams per day for a child, three servings per week, 24 weeks per year, for 33 years.

To investigate whether potential additive effects occurred from a combined exposure to the copper and zinc, the HI was determined by calculating HQs based on the most conservative child doses based on the fish consumption assumptions stated above. The HQs were summed to determine the HI. The HI for adult (0.4) and child (0.4) are less than 1, indicating that combined exposure to noncancer health effects from copper and zinc are not expected.

Lead was detected in only one of the 12 fillet samples (0.09 mg/kg). To be health protective, the maximum non-detect lead value (0.2 mg/kg) was used to predict a BLL for a child aged 6 to 7 years with the IEUBK model. The estimation assumed that 10% of the total meat consumption was from fish caught in Elliot Creek[5]. The estimated BLL is 2 µg/dL. Given that the estimated BLL for a child is well below CDC's reference level of 3.5 µg/dL and that the percentage of children with elevated BLL <5% (2.6%), it is unlikely that estimated adolescent or adult BLLs resulting from the same exposure scenario would be a public health concern.

[5] https://www.epa.gov/superfund/lead-superfund-sites-frequent-questions-risk-assessors-integrated-exposure-uptake, last accessed March 2022.

CDPH estimated the possible increased cancer risk from consuming arsenic in fish from Elliott Creek. The maximum adjusted inorganic arsenic value (0.04 mg/kg) was used to estimate the cancer risk. The child cancer risk (3 in 1 million) and the adult cancer risks (6 in one million) do not present elevated cancer risks.

In summary, eating fish caught from Elliott Creek does not present noncancer nor cancer health risks. In addition, decreasing concentrations of site related COCs seen in fish post-remediation adds further support that eating fish caught from Elliot Creek does not pose a health concern for recreational visitors presently or in the future.

8.1.3 Eating Home Garden Produce Irrigated with Elliott Creek Water

During the September 2011 site visit, one Joe Bar resident mentioned using water from Elliott Creek to irrigate garden vegetables. Some plants can uptake metals in the soil through their roots and sometimes distribute the metals to edible parts of the plant [USEPA 2007b]. The amount of metal a plant might uptake is highly dependent on how frequently the plant is irrigated, the type of plant (such as a root, leaf, herb, or fruit plant), the metal, and the soil conditions. For example, plants grown in soils comprising mostly sands or clays will more readily absorb lead than plants grown in soils containing organic materials or soils containing equal amounts of sand and clay [Vandenhove 2009].

In August 2013, the USEPA collected vegetable samples from the Joe Bar resident's garden known to have been irrigated with Elliott Creek water. In total, five radish samples and two lettuce samples were collected (see Appendix B, Table 11).

There are no CVs for exposure to metals from eating vegetables; therefore, CDPH compared the radish and lettuce maximum concentrations detected to the U.S. Food and Drug Administration, Total Diet Survey (TDS) metal sampling results. The FDA uses TDS to monitor contaminant (and nutrient) amounts in foods consumed in the average U.S diet [FDA 2021]. CDPH focused on the metals analyzed in Elliott Creek surface water samples: arsenic, cadmium, copper, lead, zinc, and mercury. Among the lettuce samples, only the maximum concentration of zinc (5.3 mg/kg) exceeds the FDA TDS range (1 - 3.2 mg/kg) [FDA 2007 & 2014]. Among the radish samples, the maximum concentration of arsenic (0.04 mg/kg), cadmium (0.05 mg/kg), copper (0.9 mg/kg), lead (0.03 mg/kg), and zinc (10.3 mg/kg) exceed the FDA TDA ranges.

No lettuce or radish samples detected mercury and FDA TDS comparison concentrations were not available for mercury. Therefore, mercury was assessed using the maximum non-detect value. Lead was evaluated separately.

The number of homegrown radishes Joe Bar residents and guests consume per day is unknown. CDPH assumed adults and adolescents could consume up to two radishes per day. Although no children permanently reside at Joe Bar, at the time produce was sampled visiting families included children. Therefore, CDPH also assessed exposure to children aged 2 to 6 years and

assumed children consumed one radish per day. Total radish intake amounts were estimated from US Department of Agricultural measurement data that reports the average weight of a medium- sized radish (3/4" to 1" diameter) to be 4.5 grams (https://fdc.nal.usda.gov/fdc-app.html#/food-details/169276/nutrients). Therefore, two radishes per day is equal to 9 grams (4.5 grams X 2) and one is equal to 4.5 grams.

Daily intake rates for lettuce were derived from consumption of persons eating home-grown vegetables and living in rural areas in the western United States [USEPA, 2011]. CDPH assumed that Joe Bar residents and guests would consume home-grown produce during the spring, summer, and early fall (mid-April to mid-October). None of the exposure doses exceed the noncancer health guidelines for arsenic, cadmium, copper, zinc, or mercuric chloride (Appendix B, Table 12).

To investigate whether potential additive effects occurred from a combined exposure to the arsenic, cadmium, copper, mercury, and zinc, the HI was determined by calculating HQs based on the most conservative child doses: arsenic (HQ = 0.02), cadmium (HQ = 0.06), copper (HQ = 0.01), mercury (HQ = 0.002) and zinc (HQ= 0.004). The HQs were summed to determine the HI (0.1). The HI sum is less than 1 indicating that noncancer health effects are not expected. Refer to Appendix B, Table 12 for child and adult exposure doses and HQs.

Lead exposure was estimated for a young child using the maximum concentration of lead found in radishes (0.04 mg/kg) and lettuce (0.015 mg/kg) using the IEUBK model. The predicted BLL from radish consumption was 1.8 µg/dL and the percentage of children with elevated BLL is <5% (1.4%); the BLL from lettuce consumption was 1.7 µg/dL and the percentage of children with elevated BLL is <5% (1.3%). The estimations assumed that 10% of the total vegetables consumed were from the home-grown radishes and lettuce. These estimated contributions are below 3.5 µg/dL, the CDC reference level.

CDPH estimated the potential cancer risk for a child and adult from consuming arsenic in home-grown vegetables (Appendix B, Table 13). The combined cancer risk for a child aged 2 years to 21 years is 2 in 1,000,000 and for an adult is 1 in 1,000,000, which does not present cancer risks.

8.1.4 2010 Adit Release Evaluation

Joe Bar Residents raised concerns regarding a large release of adit water in August 2010 that contaminated Elliott Creek. On August 18, 2010, an excavator uncovered an unknown mine adit. The adit, which was full of water, released significant amounts of AMD into Joe Creek and then emptied into Elliott Creek. Joe Bar residents noticed the release and reported that Elliott Creek had temporarily turned into an orange "rusty" color for roughly a week.

In response to residents' concerns, the USFS collected surface water samples from Elliott Creek at Joe Bar (the Elliott Creek bridge) on August 18, August 19, August 26, and September 2 of 2010. The water samples were analyzed for site-related metals, sulfate, and total dissolved

solids. Table 8.1.4 provides the concentrations found. All metals detected from August 18 through September 2 were reported either below laboratory limits or below health comparison values. Results of water samples indicate that the August 18, 2010, incident did not cause Elliott Creek to be a concern for human health.

Table 8.1.4: Elliott Creek Surface Water Samples Collected at Joe Bar During 2010 Adit Water Release Event

Sample Date	Sulfate	Total Dissolved Solids	Arsenic	Cadmium	Lead	Copper	Zinc
August 18	NR	NR	<0.002	<0.001	<0.001	<0.004	0.005
August 19	8.10	94	<0.002	<0.001	0.033	0.03	0.03
August 26	6,160	85,000	<2.00	<1	<1.00	<4	6.72
September 2	NR	NR	9.86	<1.34	6.37	51.6	65.3
MCL	**250,000**	**500,000**	**10**	**5**	**15**[1]	**1000**[2]	**5000**[2]

NR: Not reported
MCL: Maximum contaminant level for drinking water
[1]This value is an established USEPA action level, not an MCL.
[2] This value is a secondary drinking water standard, not an MCL. Amounts above the standard could cause an undesirable metallic taste or discoloration (see https://www.epa.gov/sdwa/secondary-drinking-water-standards-guidance-nuisance-chemicals table. Last accessed March 2022.)
*All metal concentrations in milligrams per kilogram

Sediment samples collected at Elliott Creek roughly 500 feet downstream from the Joe Bar community from 2008 through 2012 indicate that contaminants from the 2010 adit release did not settle to the bottom of Elliott Creek near the Joe Bar community. In June 2008, arsenic was found at 6.2 mg/kg, cadmium at 0.27 mg/kg, copper at 51.3 mg/kg, and lead at 5.52 mg/kg. The ranges of metal detection among the three sampling events from 2011 to 2012 are as follows: arsenic between 1.82 mg/kg and 5.97 mg/kg, cadmium between 0.34 mg/kg to <0.67 mg/kg, copper between 33.3 mg/kg to 73.7 mg/kg, and lead between 3.4 mg/kg to 5.8 mg/kg.

Overall, the levels of metals found in sediment samples did not increase from 2008, indicating that metals released did not settle to the bottom of the creek and accumulate in the sediment over time.

8.2 Exposure to Off-site Contaminants in the Applegate River and Applegate Reservoir

Elliott Creek joins the Applegate River, which enters Oregon and empties into the Applegate Reservoir (Appendix A, Figure 2). Joe Bar residents and recreational visitors use both the Applegate River and Applegate Reservoir for swimming and fishing. The calculations in this section address exposures during swimming in Elliott Creek and the Applegate River. Eating fish from the Applegate Reservoir is addressed in CDPH's 2015 Health Consultation Letter to USEPA [CDPH 2015], which identified elevated mercury levels in some fish from the Reservoir and

recommended limits on the consumption of these fish (see Appendix C).

Pre-remediation surface water samples from June 2008 to October 2010 were collected from a popular day-use area known as Seattle Bar, which is adjacent to where the Applegate River empties into the Applegate Reservoir (see Appendix B, Table 3). In 2010, surface water samples were analyzed for arsenic, cadmium, copper, lead, zinc, and mercury. Lead is discussed separately below. None of the maximum concentrations exceed noncancer health CVs for adults. The maximum concentrations of copper (149 µg/L) and cadmium (1.1 µg/L) exceed child media-specific CVs and were examined further.

CDPH estimated exposure doses for a child accidentally swallowing cadmium and copper in the water while swimming (Appendix B, Table 7). Seattle Bar is open from May through July (90 days), and a child (age 6 to 11 years) was assumed to swim for 1 hour each day. The estimated cadmium and copper doses (1.0E-06 mg/kg/day; 0.00056 mg/kg/day) for a child do not exceed the applicable health guidelines (1.0E-04 mg/kg/day [cadmium]; 0.02 mg/kg/day [copper]).

Due to the small number of samples, the maximum lead concentration detected (28.3 µg/L) was used to estimate BLL in the IEUBK model rather than the mean. We assumed a child would visit Seattle Bar once per week and applied a time-weighted factor of 1/7 (1/7 =0.14) to the lead concentration to account for the infrequent exposure (28.3 µg/L * 0.14 = 3.96 µg/L). The estimated BLL for children aged 2 to 6 years is 1.8 µg/dL, which is well below the CDC reference level of 3.5 µg/dL, and the percentage of children with elevated BLL is <5% (1.6%) (Appendix B, Table 9). Adolescent and adult BLLs are expected to be even lower than child BLLs.

The maximum arsenic concentration exceeds the cancer CV (Appendix B, Table 3). CDPH applied the assumptions used to estimate noncancer exposure doses above to estimate cancer risks from exposure to swimming at Seattle Bar (Appendix B, Table 8). The child (age 6 to 21 years) cancer risk is 4 in 10 million, and the adult risk is 3 in 10 million, which do not present cancer risks.

9. Community-requested Evaluation of Joe Bar Potable Water Sources

During CDPH's outreach to the Joe Bar community, residents expressed concerns about their drinking water. The five residences that make up the Joe Bar community obtain potable water from private groundwater wells and a natural spring. CDPH evaluated the available drinking water data at their request. Based on existing data, the Blue Ledge Mine site does not impact their private wells and natural spring. According to the 2013 assessment, "arsenic present in drinking water samples cannot be directly attributed to contamination at the site and may be the result of naturally occurring arsenic" [Engineering/Remediation Resources Group 2013].

Two of the residences share a water source. Water samples were collected from the residences at various times of the year from 2008 to 2021 and analyzed for arsenic, cadmium, copper, lead, zinc, iron, sulfates, pH, and total dissolved solids.

CDPH compared the maximum detected concentrations per residence to the federal and state drinking water standards or MCLs (Appendix B, Table 14). Except for iron (discussed below), all contaminants are below the federal and state drinking water limits. Table 9.1 below shows the maximum metal concentrations found in Joe Bar residential water samples.

Table 9.1: Joe Bar Maximum Residential Water Concentrations and MCLs

Joe Bar Residences	***Arsenic**	***Cadmium**	***Lead**	***Copper**	***Zinc**	***Iron**
Residence 1	7	0.9	3.16	12.1	1,300	1,760
Residence 2	5.58	0.13	0.3	22.2	191	2,170
Residence 3 & 4	3	0.5	2.02	18.9	1,730	1,380
Residence 5	4.38	0.17	1.43	57.2	1,210	1,490
MCL (federal and state)	**10**	**5**	**15**[1]	**1000**[2]	**5000**[2]	**300**[2]

*****indicates **Maximum Detected Concentration**

[1]This value is an established USEPA action level, not an MCL.

[2] This value is a secondary drinking water standard, not an MCL. Amounts above the standard could cause an undesirable metallic taste or discoloration (see https://www.epa.gov/sdwa/secondary-drinking-water-standards-guidance-nuisance-chemicals table. Last accessed March 2022.)

All metal concentrations in milligrams per kilogram

Iron was detected above the USEPA's secondary MCL (300 µg/L) [USEPA 2017] in all residences (Appendix B, Table 14). A secondary MCL is not based on health effects, but, rather, on cosmetic effects (such as tooth or skin discoloration) or aesthetic effects (such as odor, taste, or color). Drinking water that does not meet secondary drinking water criteria can increase the risk of health effects from dehydration because people may drink less water. Dehydration health effects include unclear thinking, mood changes, lowered heat tolerance, constipation, and kidney stones [CDC 2020]. Elevated iron could cause water to be rusty in color, have a metallic taste, and leave reddish or orange staining on clothes. An adult drinking approximately 2 liters of water each day with the maximum concentration of iron detected in a Joe Bar residence (2,170 µg/L) would result in daily iron ingestion of 4,340 µg/day, which is much less than the NIH's 40,000 µg/day level known to cause gastrointestinal distress [U.S. Department of Health and Human Services 2011].

Arsenic is a naturally occurring element often found in drinking water sources at low levels [ATSDR 2007]. In California, the range of naturally occurring arsenic found in drinking water sources is less than 1 µg/L to 52 µg/L [OEHHA 2004], and the maximum detected arsenic concentrations in Joe Bar drinking water (3 µg/L to 7.0 µg/L) are within this range, which are also below the MCL of 10 µg/L. Joe Bar residents can obtain a water treatment device to filter contaminants, such as iron and arsenic, from their drinking water. The California Water Quality Control Board provides information about registered water treatment devices [SWRCB 2021].

10. Limitations of Evaluation

The identification and analysis of environmental exposures is complex and inexact. To begin with, this PHA was prepared using various sources of information and there are differing amounts of uncertainty associated with each source of information. For instance, CDPH relied on sampling information provided by the USEPA, the USFS, and private contracting companies. CDPH also used assumptions to estimate exposure doses. The exposure assumptions are meant to provide health-protective (conservative) results for the exposure estimates while balancing plausible scenario elements such as the number of recreational visits per year; quantity and type of fish consumed; site conditions; climate and time of year; and potential ages of exposed populations. Exposure doses are compared to health-protective levels determined in toxicity studies. Toxicity studies are usually conducted with adult animals; and, human toxicity studies, when available, often monitor adult workers who are exposed to high concentrations of contaminants. Extrapolating animal and human toxicity findings to residential levels of exposure is challenging and inexact.

11. Community Health Concerns

The collection, documentation and response to community health and exposure concerns are a vital part of the PHA process. CDPH traveled to the Blue Ledge Mine site in September 2011 to conduct a site visit and interview residents from the Joe Bar community to identify community concerns and potential exposure pathways related to the site.

The main concerns expressed by the Joe Bar residents were (1) potential negative health effects from using/drinking water from their wells, the local spring, Elliot Creek, and Joe Creek, (2) health effects from eating fish caught from the Applegate Reservoir (assessed in Appendix C) and Elliott Creek, and (3) whether a large release of adit water in August 2010 significantly contaminated Elliott Creek. CDPH addressed these concerns in various parts of this report and summarized our findings in the Summary (Section 1) and Conclusions (Section 12) sections of this report.

12. Conclusions

CDPH evaluated the ways people could come into contact with contaminants from the Blue Ledge Mine site, in the past, in the present, and in the future. Conclusions about present exposure also apply to the future. All conclusions are based on site visits, available data, and reports. ATSDR and CDPH's conclusions of this evaluation are as follows:

1. Drinking water from where acid mine runoff empties into Joe Creek at the base of the Blue Ledge Mine site presently or in the past might cause recreational visitors to experience gastrointestinal distress, such as abdominal pain, vomiting, and nausea.

2. We are not certain whether touching, breathing, or swallowing on-site sediments found in treatment ponds might could harm the health of recreational visitors.

3. Touching, breathing, or incidentally swallowing contaminants in on-site surface soil

or sediment presently or in the past at the Blue Ledge Mine site is not expected to harm the health of recreational visitors walking on the site.

4. Accidentally swallowing water while swimming in Elliott Creek or the Applegate River is not likely to harm or have harmed the health of recreational visitors presently or in the past.

5. Eating fish caught in Elliott Creek is not expected to harm or have harmed the health of recreational anglers or Joe Bar residents presently or in the past.

6. Eating vegetables grown in Joe Bar home gardens irrigated by Elliott Creek water is not expected to harm residents' health.

7. Drinking tap water from Joe Bar homes could contain natural levels of arsenic, but the levels are not likely to harm people's health. The levels found in water do not exceed California or USEPA drinking water standards.

13. Recommendations

ATSDR and CDPH recommend the following:

- USEPA continue monitoring the surface water runoff from the Blue Ledge Mine site for metals.
- USEPA and CDPH provide Joe Bar residents with resources to assist them with evaluating and reducing common exposures to lead such as chipping paint, old water pipes, and plumbing fixtures.

14. Public Health Action Plan

The Public Health Action Plan (PHAP) for this site contains a description of completed actions, actions that are to be taken in the future, and other actions at or near the site that are under consideration by ATSDR and CDPH. The purpose of the PHAP is to ensure that this PHA not only identifies public health hazards, but also provides a plan of action designed to mitigate and prevent adverse human health effects resulting from exposure to hazardous substances in the environment.

- CDPH gathered community concerns by meeting with local residents in September 2011.
- CDPH assessed exposure specifically for a Joe Bar resident consuming fish from Applegate Reservoir. Results were provided to the USEPA in the summer of 2015.
- CDPH disseminated this PHA for public comment and responded to all comments received in Appendix G of this report.
- USEPA and CDPH provided Joe Bar residents with resources about obtaining water filtration devices.
- USEPA posted signs where on-site AMD empties into Joe Creek to discourage recreational visitors from drinking from that location.

- USEPA posted signs at the treatment ponds to discourage recreational visitors from entering.

15. Report Preparation

The California Department of Public Health (CDPH) prepared this Public Health Assessment for the Blue Ledge Mine Superfund Site in Siskiyou County, California. This publication was made possible by a cooperative agreement (program number TS20-2001) with the federal Agency for Toxic Substances and Disease Registry (ATSDR). CDPH evaluated data of known quality using approved methods, policies, and procedures existing at the date of publication. ATSDR reviewed this document and concurs with its findings based on the information presented by CDPH.

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Appendix A. Figures

Figure 1. Location of the Blue Ledge Mine site, border between California and Oregon, surrounding cities, and the Applegate Reservoir (page 11).

Source: Google Earth © 2017

Figure 2. Vicinity of the Blue Ledge Mine Site: Joe Creek, Elliott Creek, United States Forest Service (USFS) Roads 1060 and 1055, Zebra Rock, Pacific Crest Trail, and Joe Bar Community.

Source: [USFS Pacific Crest National Scenic Trail http://www.fs.usda.gov/pct, Engineering/Remediation Resource Group Inc. 2012, Innovative Technical Solutions Inc. 2011]

Figure 3. Past accessibility of waste rock piles 1-4, Blue Ledge Mine, California

Source: 2005 image from Google Earth

Figure 4. View of the drainage channel as it enters Joe Creek, Blue Ledge Mine, California

Source: [Weston Solutions Inc. 2004]

Figure 5. Current accessibility of waste rock piles 1-4, Blue Ledge Mine, California

Source: Google Earth © 2022 Note: Many of the roads used during the 2011 USFS removal action have been decommissioned and are now overgrown.

Appendix B. Tables

Table 1. Completed exposure pathways, Blue Ledge Mine, California

Exposure Source	Environmental Media	Exposure Activity	Exposure Route	Exposed Population	Time Frame
Waste rock piles (on-site)	Soil/sediment, dust	Hiking or visiting the site	Incidental ingestion, breathing dust, dermal*	Recreational visitors	Past, Present, Future
Confluence of acid-mine drainage and Joe Creek (on-site)	Surface water	Filling a water bottle, wading	Drinking, incidental ingestion, dermal*	Recreational visitors	Past, Present, Future
Elliott Creek (off-site)	Surface water	Swimming	Incidental ingestion, dermal*	Recreational visitors	Past, Present, Future
Onsite treatment ponds (on-site)	Surface water and sediment	Hiking or visiting the site	Drinking, incidental ingestion, dermal. Incidental ingestion, breathing dust, dermal*	Recreational visitors	Present, Future
Elliott Creek (off-site)	Fish	Fishing	Eating	Joe Bar residents, recreational anglers	Past, Present, Future
Elliott Creek (off-site)	Home-grown vegetables	Irrigating garden	Eating	Joe Bar residents and visitors	Past, Present, Future
Applegate River and Reservoir (off-site)	Surface water	Swimming	Incidental ingestion, dermal*	Recreational visitors	Past, Present, Future
Potable water (community-requested, not site-impacted)	Groundwater	Drinking from private well	Drinking	Joe Bar residents and guests	Past, Present, Future

* No other exposure routes for this pathway indicate a health concern, so dermal absorption exposure was not evaluated.

Table 2. On-site soil (top 3 inches) sample results, Blue Ledge Mine, California

Location	Sample Period	Contaminant	Number of Samples	Number of Detects	Maximum Concentration (mg/kg)	Comparison Value (CV) (mg/kg)	Type of CV
WRP 1 & 2	7/2005, 7/2010 (past)	Arsenic	12	12	**301	16 *	chronic EMEG/RMEG child
WRP 1 & 2	7/2005, 7/2010 (past)	Cadmium	8	4	3.6	5.2	chronic EMEG child
WRP 1 & 2	7/2005, 7/2010 (past)	Copper	8	8	**2,740	1,000	intermediate EMEG child
WRP 1 & 2	7/2005, 7/2010 (past)	Iron	8	8	**121,000	55,000	USEPA RSL
WRP 1 & 2	7/2005, 7/2010 (past)	Lead	12	12	**7,890	80	CalEPA CHHSL
WRP 1 & 2	7/2005, 7/2010 (past)	Mercury	6	6	**92.8	16	RMEG child for mercuric chloride
WRP 1 & 2	7/2005, 7/2010 (past)	Silver	4	4	**390	260	RMEG child
WRP 1 & 2	7/2005, 7/2010 (past)	Zinc	8	8	754	16,000	chronic EMEG child/ Intermediate EMEG child/ RMEG child
WRP 1, 2 & 4	7/2010 – 8/2011 (present/future)	Arsenic	41	41	**113	16	chronic EMEG/RMEG child
WRP 1, 2 & 4	7/2010 – 8/2011 (present/future)	Cadmium	41	3	1.27	5.2	chronic EMEG child

Location	Sample Period	Contaminant	Number of Samples	Number of Detects	Maximum Concentration (mg/kg)	Comparison Value (CV) (mg/kg	Type of CV
WRP 1, 2 & 4	7/2010 – 8/2011 (present/future)	Copper	41	41	**2,508	1,000	intermediate EMEG child
WRP 1, 2 & 4	7/2010 – 8/2011 (present/future)	Lead	41	41	**742	80	CalEPA CHHSL
WRP 1, 2 & 4	7/2010 – 8/2011 (present/future)	Zinc	41	41	1,350	16,000	chronic EMEG child/ Intermediate EMEG child/ RMEG child
WRP 3	7/2010 – 8/2011 (present/future)	Arsenic	26	26	**32	16 *	chronic EMEG/RMEG child
WRP 3	7/2010 – 8/2011 (present/future)	Cadmium	26	0	0.68	5.2	chronic EMEG child
WRP 3	7/2010 – 8/2011 (present/future)	Copper	26	26	660	1,000	intermediate EMEG child
WRP 3	7/2010 – 8/2011 (present/future)	Lead	26	26	**161	80	CalEPA CHHSL
WRP 3	7/2010 – 8/2011 (present/future)	Zinc	26	26	561	16,000	chronic EMEG child/ Intermediate EMEG child/ RMEG child

Sources: [ICF International 2010, Engineering/Remediation Resource Group Inc. 2012]

Note: Samples collected prior to 7/2010 are pre-remediation (past exposure) and samples collected post 7/2010 are post

remediation (current or future exposure)
****Bolded** values equal or exceed CVs, while non-bolded values do not.
Abbreviations: % = percent; mg/kg = milligram per kilogram; CalEPA = California Environmental Protection Agency; CHHSL = California Human Health Screening Level [OEHHA 2009]; Conc. = concentration; CV = comparison value; EMEG = environmental media evaluation guide; NC = not calculated (too few samples); past = sample collected before remediation; present/future = sample collected after U.S. Forest Service 2010-2011 remediation; RMEG = reference dose media evaluation guide; RSL = Regional Screening Level [USEPA 2019]; WRP = waste rock pile
* The CREG for arsenic is below background levels, so the recommended soil CV is the chronic EMEG/RMEG.

Table 3. On-site and off-site surface water* sample results, Blue Ledge Mine, California

Location	Sample Period	Contaminant	Number of Samples	Number of Detects	Maximum Concentration (µg/L)	Comparison Value (CV) (µg/L)	Type of CV
On-site: Confluence of AMD and Joe Creek	9/2000 – 5/2012 (past)	Arsenic	2	2	**0.07	0.016 2.1	CREG chronic EMEG child
On-site: Confluence of AMD and Joe Creek	9/2000 – 5/2012 (past)	Cadmium	5	3	**4.1	0.70	chronic EMEG child
On-site: Confluence of AMD and Joe Creek	9/2000 – 5/2012 (past)	Copper	5	5	**790	140	intermediate EMEG child

Location	Sample Period	Contaminant	Number of Samples	Number of Detects	Maximum Concentration (mg/kg)	Comparison Value (CV) (mg/kg	Type of CV
On-site: Confluence of AMD and Joe Creek	9/2000 – 5/2012 (past)	Lead	5	3	10.7	15	USEPA Action Level
On-site: Confluence of AMD and Joe Creek	9/2000 – 5/2012 (past)	Zinc	5	5	774	2,100	chronic EMEG child/ intermediate EMEG child/ RMEG child
On-site: Confluence of AMD and Joe Creek	5/2012 – 4/2015 (present/future)	Arsenic	21	0	**<0.5	0.016	CREG
On-site: Confluence of AMD and Joe Creek	5/2012 – 4/2015 (present/future)	Cadmium	21	19	**28.5	0.70	chronic EMEG child
On-site: Confluence of AMD and Joe Creek	5/2012 – 4/2015 (present/future)	Copper	22	22	**3,150	140	intermediate EMEG child
On-site: Confluence of AMD and Joe Creek	5/2012 – 4/2015 (present/future)	Lead	21	2	1.47	15	USEPA Action Level
On-site: Confluence of AMD and Joe Creek	5/2012 – 4/2015 (present/future)	Zinc	21	21	**4,900	2,100	chronic EMEG child/ intermediate EMEG child/ RMEG child

Location	Sample Period	Contaminant	Number of Samples	Number of Detects	Maximum Concentration (mg/kg)	Comparison Value (CV) (mg/kg	Type of CV
Off-Site: Elliot Creek at Zebra Rock	9/2000 – 10/2010 (present/future)	Arsenic	1	0	**<0.58	0.016	CREG
Off-Site: Elliot Creek at Zebra Rock	9/2000 – 10/2010 (present/future)	Cadmium	4	0	<0.63	0.70	chronic EMEG child
Off-Site: Elliot Creek at Zebra Rock	9/2000 – 10/2010 (present/future)	Copper	4	2	73.5	140	intermediate EMEG child
Off-Site: Elliot Creek at Zebra Rock	9/2000 – 10/2010 (present/future)	Lead	4	1	**28.2	15	USEPA Action Level
Off-Site: Elliot Creek at Zebra Rock	9/2000 – 10/2010 (present/future)	Mercury	1	0	<0.2	2	USEPA chronic MCL
Off-Site: Elliot Creek at Zebra Rock	9/2000 – 10/2010 (present/future)	Zinc	4	3	95	2,100	chronic EMEG child/ intermediate EMEG child/ RMEG child
Off-Site: Applegate River at Seattle Bar	6/2008 – 10/2010 (present/future)	Arsenic	1	1	**2.4	0.016	CREG
Off-Site: Applegate River at Seattle Bar	6/2008 – 10/2010 (present/future)	Cadmium	1	1	**1.1	0.70	chronic EMEG child

Location	Sample Period	Contaminant	Number of Samples	Number of Detects	Maximum Concentration (mg/kg)	Comparison Value (CV) (mg/kg	Type of CV
Off-Site: Applegate River at Seattle Bar	6/2008 – 10/2010 (present/future)	Copper	1	1	**__149__	140	intermediate EMEG child
Off-Site: Applegate River at Seattle Bar	6/2008 – 10/2010 (present/future)	Lead	1	1	**__23.8__	15	USEPA Action Level
Off-Site: Applegate River at Seattle Bar	6/2008 – 10/2010 (present/future)	Mercury	1	1	0.08	2	USEPA chronic MCL
Off-Site: Applegate River at Seattle Bar	6/2008 – 10/2010 (present/future)	Zinc	1	1	151	2,100	chronic EMEG child/ intermediate EMEG child/ RMEG child

Sources: [Environment International Ltd. 2002, URS Corporation 2009, Innovative Technical Solutions Inc. 2011, Engineering/Remediation Resources Group Inc. 2015]

****__Bolded__ values meet or exceed CVs, while non-bolded values do not.

Abbreviations: < = less than; µg/L = microgram per liter; AMD = acid mine drainage; CREG = cancer risk evaluation guide, CV = comparison value; EMEG = environmental media evaluation guide; MCL = maximum contaminant level; NA = not available; past = sample collected before remediation; present/future = sample collected after U.S. Forest Service 2010-2011 remediation; RMEG = reference dose media evaluation guide; USEPA = United States Environmental Protection Agency

* Surface water samples were filtered prior to analysis.

Table 4.1. On-site recreational visitor: site-specific, ingestion-only exposure doses for chronic exposure to contaminants in soil with noncancer hazard quotients, Blue Ledge Mine, California

Exposure Period	Contaminant	Concentration (mg/kg)	Concentration Type	RME Dose (mg/kg/day) and Receptor	Noncancer Health Guideline (mg/kg/day) and Type	RME Non-cancer Hazard Quotient
Past	Arsenic	197	95% UCL of the mean	0.00003 (child)	0.0003 (chronic MRL)	0.095
	Copper	2740	Maximum	0.0025 (child)	0.02 (provisional intermediate MRL)	0.13
	Mercury	92.8	Maximum	0.00002 (child)	0.0003 (RfD for mercuric chloride)	0.073
	Silver	390	Maximum	0.00009 (child)	0.005 (RfD)	0.019
Present/Future	Arsenic	70	95% UCL of the mean	0.00001 (child)	0.0003 (chronic MRL)	0.034
	Copper	738	95% UCL of the mean	0.00066 (child)	0.02 (provisional intermediate MRL)	0.033

Source: The calculations in this table were generated using ATSDR's PHAST v1.5.0.0.
Abbreviations: mg/kg/day = milligram chemical per kilogram body weight per day; MRL = minimal risk level; RfD = reference dose; RME = reasonable maximum exposure (higher); UCL = upper confidence limit from ProUCL version 5.0 [USEPA 2013] Assumed a child body weight to be 31.8 Kg and an adult body weight to be 80kg
Assumed exposure 1 day per week and 14 weeks per year over 33 years.

Table 4.2. On-site recreational visitor: site-specific, ingestion-only exposure doses for chronic exposure to contaminants in soil with cancer risk estimates, Blue Ledge Mine, California

Exposure Period	Contaminant	Concentration (mg/kg)	Concentration Type	RME Dose (mg/kg/day) and Receptor	Cancer Slope Factor $(mg/kg/day)^{-1}$	Estimated Increased Cancer Risk
Past	Arsenic	197	95% UCL of the mean	0.00003 (child)	1.5	4 / million
				0.000006 (adult)	1.5	4 / million
Present/Future	Arsenic	70	95% UCL of the mean	0.00001 (child)	1.5	3 / million
				0.000002 (adult)	1.5	1 / million

Source: The calculations in this table were generated using ATSDR's PHAST v1.5.0.0.

Abbreviations: mg/kg/day = milligram chemical per kilogram body weight per day; RME = reasonable maximum exposure; UCL = upper confidence limit from ProUCL version 5.0 [USEPA 2013]
Assumed: exposure 1 day per week and 14 weeks per year, for 33 years & child body weight to be 31.8 Kg and an adult body weight to be 80kg

Table 5. On-site estimated airborne fugitive dust concentrations, Blue Ledge Mine, California

Location	Sample Period	Contaminant	Basis of Soil Concentration	Estimated Air Concentration (µg/m³)	Comparison Value (CV) (µg/m³)	Type of CV
WRP 1 & 2	7/2005, 7/2010 (past)	Arsenic	95UCL	**0.00078	0.00023	CREG
WRP 1 & 2	7/2005, 7/2010 (past)	Cadmium	MDC	0.00001	0.00056	CREG
WRP 1 & 2	7/2005, 7/2010 (past)	Copper	MDC	0.0051	100	CalEPA acute REL
WRP 1 & 2	7/2005, 7/2010 (past)	Lead	95UCL	0.011	0.15	USEPA NAAQS
WRP 1 & 2	7/2005, 7/2010 (past)	Mercury	MDC	0.00037	0.20	chronic EMEG / MRL
WRP 1 & 2	7/2005, 7/2010 (past)	Silver	MDC	0.0015	NA	NA
WRP 1 & 2	7/2005, 7/2010 (past)	Zinc	MDC	0.0015	NA	NA
WRP 1, 2 & 4	7/2010 – 8/2011 (present/future)	Arsenic	95UCL	**0.0003	0.00023	CREG
WRP 1, 2 & 4	7/2010 – 8/2011 (present/future)	Cadmium	95UCL	0.00001	0.00056	CREG
WRP 1, 2 & 4	7/2010 – 8/2011 (present/future)	Copper	95UCL	0.01	100	CalEPA acute REL

Location	Sample Period	Contaminant	Basis of Soil Concentration	Estimated Air Concentration (µg/m³)	Comparison Value (CV) (µg/m³)	Type of CV
WRP 1, 2 & 4	7/2010 – 8/2011 (present/future)	Lead	95UCL	0.03	0.15	USEPA NAAQS
WRP 1, 2 & 4	7/2010 – 8/2011 (present/future)	Mercury	MDC	0.004	0.20	chronic EMEG / MRL
WRP 1, 2 & 4	7/2010 – 8/2011 (present/future)	Silver	MDC	0.001	NA	NA
WRP 1, 2 & 4	7/2010 – 8/2011 (present/future)	Zinc	95UCL	0.001	NA	NA
WRP 3	7/2010 – 8/2011 (present/future)	Arsenic	95UCL	0.00009	0.00023	CREG
WRP 3	7/2010 – 8/2011 (present/future)	Cadmium	95UCL	0.000002	0.00056	CREG
WRP 3	7/2010 – 8/2011 (present/future)	Copper	95UCL	0.002	100	CalEPA acute REL
WRP 3	7/2010 – 8/2011 (present/future)	Lead	95UCL	0.0005	0.15	USEPA NAAQS
WRP 3	7/2010 – 8/2011 (present/future)	Zinc	95UCL	0.002	NA	NA

Source: [Engineering/Remediation Resource Group Inc. 2012]

__Bolded** values__ meet or exceed CVs, while non-bolded values do not.

Abbreviations: µg/m³ = microgram per cubic meter; 95UCL = 95 percent upper confidence limit of the mean calculated using ProUCL

[USEPA 2013]; CalEPA = California Environmental Protection Agency; CREG = cancer risk evaluation guide; CV = comparison value; EMEG = environmental media evaluation guide; MDC = maximum detected concentration (used when too few samples to calculate 95UCL); MRL = minimal risk level; NA = not available; NAAQS = national ambient air quality standard; past = sample collected before remediation; present/future = sample collected after U.S. Forest Service 2010-2011 remediation; REL = reference exposure level; USEPA = United States Environmental Protection Agency; WRP = waste rock pile

Estimated Air Concentration = Soil Concentration (kg/m^3) / Particulate Emission Factor (PEF, m^3/kg), where
PEF = Q/C x [(3600 s/h)/ 0.036 $g/m^2/h$ x (1-V) x $(Um/Ut)^3$ x Fx] = 2.52 x 10^8 m^3/kg

Q/C (31.62 $gram/meter^2$-second per $kilogram/meter^3$): dispersion factor for fugitive dust emitted from soil. Derived using the areal extent of the site (500 acres), and default values based on air dispersion modeling for climate zone 1 (Northern California and Western Oregon) [USEPA 1996], as follows:

$Q/C = A \times \exp[(\ln A_{site} - B)^2/C]$

A = 12.378
B = 21.99
C = 265.319
A site = 500 acres

3,600 s/h (seconds per hour): time conversion factor
0.036 $g/m^2/h$ (gram per square meter per hour): respirable fraction
V (0.5, unitless): fraction of vegetative cover
Um (3.5 meters/second): average wind speed from Squaw Peak meteorological station
Ut (8 meters/second): wind speed at 7 meters. Based on roughness height for a woodland environment
Fx (0.3, unitless): wind speed distribution function. Function dependent on Um/Ut and derived using [Cowherd et al. 1985]

Table 6. On-site recreational visitor: site-specific inhalation exposures for chronic exposure to contaminants in air with cancer risk estimates, Blue Ledge Mine, California

Exposure Period	Contaminant	Dust Concentration ($\mu g/m^3$) and Receptor	Inhalation Unit Risk $(\mu g/m^3)^{-1}$	Estimated Increased Cancer Risk
Past	Arsenic	0.00078 (child, adult)	0.0043	1 / 10 million
Present/Future	Arsenic	0.0003 (child, adult)	0.0043	5 / 100 million

Abbreviations: $\mu g/m^3$ = microgram per cubic meter

Equation and assumptions used in estimating cancer risk from breathing fugitive dust [ATSDR 2005]: Cancer Risk = (Cdust) (IUR) (EF); Cdust: concentration in air ($\mu g/m^3$); IUR: arsenic inhalation unit risk $(\mu g/m^3)^{-1}$; EF: exposure frequency (14 days/365 days)

Table 7. Recreational visitor: Site-specific, exposure doses for chronic exposure to contaminants in surface water with noncancer hazard quotients, Blue Ledge Mine, California

Exposure Location and Period	Route of Exposure	Contaminant	Concentration (µg/L)	Concentration Type	RME Dose (mg/kg/day) and Receptor	Noncancer Health Guidelines (mg/kg/day) and Type	RME Noncancer Hazard Quotient
On-Site: Confluence of AMD and Joe Creek (past)	Direct Ingestion*	Arsenic	0.07	Maximum	0.00000012 (child)	0.0003 (chronic MRL)	0.00040
On-Site: Confluence of AMD and Joe Creek (past)	Direct Ingestion*	Cadmium	4.1	Maximum	0.000007 (child)	0.0001 (chronic MRL)	0.07
On-Site: Confluence of AMD and Joe Creek (past)	Direct Ingestion*	Copper	790	Maximum	0.0050 (child)	0.02 (provisional intermediate MRL)	0.25
On-Site: Confluence of AMD and Joe Creek (past)	Incidental ingestion while wading†	Arsenic	0.07	Maximum	0.00000001 (child)	0.0003 (chronic MRL)	0.000034
On-Site: Confluence of AMD and Joe Creek (past)	Incidental ingestion while wading†	Cadmium	4.1	Maximum	0.0000006 (child)	0.0001 (chronic MRL)	0.006
On-Site: Confluence of AMD and Joe Creek (past)	Incidental ingestion while wading†	Copper	790	Maximum	0.00043 (child)	0.02 (provisional intermediate MRL)	0.02

Exposure Location and Period	Route of Exposure	Contaminant	Concentration (µg/L)	Concentration Type	RME Dose (mg/kg/day) and Receptor	Noncancer Health Guidelines (mg/kg/day) and Type	RME Noncancer Hazard Quotient
On-Site: Confluence of AMD and Joe Creek (present/future)	Direct Ingestion*	Cadmium	28.5	Maximum	0.000048 (child)	0.0001 (chronic MRL)	0.48
On-Site: Confluence of AMD and Joe Creek (present/future)	Direct Ingestion*	Copper	3150	Maximum	0.020 (child recreational scenario)	0.02 (provisional intermediate & acute MRL)	1 – recreation 5 - acute
On-Site: Confluence of AMD and Joe Creek (present/future)	Direct Ingestion*	Zinc	4900	Maximum	0.0083 (child)	0.3 (chronic MRL)	0.028
On-Site: Confluence of AMD and Joe Creek (present/future)	Incidental ingestion while wading	Cadmium	28.5	Maximum	0.0000041 (child)	0.0001 (chronic MRL)	0.041
On-Site: Confluence of AMD and Joe Creek (present/future)	Incidental ingestion while wading	Copper	3150	Maximum	0.0017 (child recreational scenario) 0.012 (acute scenario)	0.02 (provisional intermediate & acute MRL)	0.085 – recreation 0.6 - acute

Exposure Location and Period	Route of Exposure	Contaminant	Concentration (µg/L)	Concentration Type	RME Dose (mg/kg/day) and Receptor	Noncancer Health Guidelines (mg/kg/day) and Type	RME Noncancer Hazard Quotient
On-Site: Confluence of AMD and Joe Creek (present/future)	Incidental ingestion while wading	Zinc	4900	Maximum	0.00071 (child)	0.3 (MRL)	0.0024
Off-site: Applegate River at Seattle Bar (present/future)	Incidental ingestion while swimming	Arsenic	2.4	Maximum	0.0000023 (child)	0.0003 (chronic MRL)	0.0075
Off-site: Applegate River at Seattle Bar (present/future)	Incidental ingestion while swimming	Cadmium	1.1	Maximum	0.000001 (child)	0.0001 (chronic	0.010
Off-site: Applegate River at Seattle Bar (present/future)	Incidental ingestion while swimming	Copper	149	Maximum	0.00056 (child)	0.02 (provisional intermediate MRL)	0.028

Source: The calculations in this table were generated using ATSDR's PHAST v1.5.0.0.
Abbreviations: mg/kg/day = milligram chemical per kilogram body weight per day; MRL = minimal risk level; RME = reasonable maximum exposure
*Assumed a child aged 6 to <11 years old drank the water 1 day per week and 14 weeks per year for 33 years.
† Assumed a child aged 6 to <11 years old accidentally swallowed 0.12 liters of water 1 day per week and 14 weeks per year over 33 years. Assumed child body weight of 31.8 kg.

Table 8. Recreational visitor: ingestion exposure doses and cancer risk estimates for chronic exposure to contaminants in surface water, Blue Ledge Mine, California

Exposure Location and Period	Route of Exposure	Contaminant	Concentration (µg/L)	Concentration Type	RME Dose (mg/kg/day) and Receptor	Cancel Slope Factor $(mg/kg/day)^{-1}$	Estimated Increased Cancer Risk
On-Site: Confluence of AMD and Joe Creek (past)	Direct Ingestion	Arsenic	0.07	Maximum	0.00000012 (child)	1.5	5 / 100 million
On-Site: Confluence of AMD and Joe Creek (past)	Direct Ingestion	Arsenic	0.07	Maximum	0.0000001 (adult)	1.5	7 / 100 million
On-Site: Confluence of AMD and Joe Creek (past)	Incidental ingestion while wading	Arsenic	0.07	Maximum	0.00000001 (child)	1.5	4 / billion
On-Site: Confluence of AMD and Joe Creek (past)	Incidental ingestion while wading	Arsenic	0.07	Maximum	0.000000002 (adult)	1.5	2 / billion
Off-site: Applegate River at Seattle Bar (present/future	Incidental ingestion while swimming	Arsenic	2.4	Maximum	0.0000023 (child)	1.5	4 / 10 million
Off-site: Applegate River at Seattle Bar (present/future	Incidental ingestion while swimming	Arsenic	2.4	Maximum	0.00000053 (adult)	1.5	3 / 10 million

Source: The calculations in this table were generated using ATSDR's PHAST v1.5.0.0.
Abbreviations: mg/kg/day = milligram chemical per kilogram body weight per day; RME = reasonable maximum exposure Assumed child body weight of 31.8 kg

Table 9. Estimated blood lead levels, Blue Ledge Mine, California

Exposure Scenario	Exposure Media Lead Concentrations [Type of Value*]	Child (Age 6 to <11) Estimated Blood Lead Level** (µg/dL)	Adolescent (Age 11 to <21) Estimated Blood Lead Level*** (µg/dL)	Adult Estimated Blood Lead Level*** (µg/dL)
On-site Past: WRP 1 &2 incidental soil ingestion, fugitive dust inhalation; drinking water intentionally & incidentally from confluence of site AMD and Joe Creek	surface soil: 1,568 mg/kg [mean] x (1 d/7 d) = 224 mg/kg fugitive dust: 0.011 µg/m³ [maximum] x (1 d/7 d) = 0.0016 µg/m³ surface water: 10.7 µg/L [maximum] x (1 d/7 d) = 1.53 µg/L	1.8	1.5	1.5
On-site Present: WRP 1, 2, & 4 incidental soil ingestion, fugitive dust inhalation; drinking water intentionally and incidentally from confluence of site AMD and Joe Creek	surface soil: 166 mg/kg [mean] x (1 d/7 d) = 23.7 mg/kg fugitive dust: 0.0008 µg/m³ [maximum] x (1 d/7 d) = 0.00011 µg/m³ surface water: 1.47 µg/L [maximum] x (1 d/7 d) = 0.21 µg/L	1.0	0.5	0.5
Elliott Creek at Zebra Rock: incidental water ingestion while swimming; daily for 180 days	surface water: 28.2 µg/L [maximum]	2.8	NC	NC
Elliott Creek: Consuming fish	fish: 0.2 mg/kg, 3 servings per week	2	NC	NC
Elliott Creek: consuming homegrown vegetables	radish: 0.04 mg/kg [maximum] lettuce: 0.015 mg/kg [maximum]	Radish: 1.8 Lettuce: 1.7	NC	NC
Applegate River at Seattle Bar: incidental water ingestion while swimming; [insert frequency]	surface water: 28.3 µg/L [maximum]	2.9	NC	NC
Comparison Value (CV)	Not Available	3.5	Not Available	Not Available
Type of CV	Not Available	CDC Reference level	Not Available	Not Available

Source: Tables 2, 5, 6 and 10.

Abbreviations: < = less than; µg/dL = microgram per deciliter; µg/L = microgram per liter; µg/m³ = microgram per cubic meter; 1 d/7 d = 1 day out of 7 days; AMD = acid mine drainage; CalEPA = California Environmental Protection Agency; mg/kg = milligram per kilogram; NA = not applicable; Centers for Disease Control reference level; NC = not calculated (unable to predict BLL); WRP = waste rock pile

*Although the mean is to be used in blood lead models, the maximum was used for small sampling datasets.

**Blood lead levels estimated for 7-year-old children using the U.S. Environmental Protection Agency (USEPA) integrated exposure uptake biokinetic (IEUBK) model [USEPA 2021]. The results for 7-year-olds were assumed to apply to children 7 to < 11 years.

***Blood lead levels estimated using the USEPA adult lead methodology (ALM) [USEPA 2003a].

Table 10. Eating fish caught in Elliott Creek: exposure doses and noncancer hazard quotients, Blue Ledge Mine, California

Contaminant	Concentration (mg/kg)	Concentration Type	Dose (mg/kg/day) and Receptor	Noncancer Health Guideline (mg/kg/day) and Type	RME Noncancer Hazard Quotient
Arsenic	0.04	Maximum adjusted	0.000009 (child) * 0.00001 (adult)	0.0003 (chronic MRL)	0.029 0.032
Cadmium	0.088	ProUCL	0.00005(child) * 0.00002 (adult	0.0001 (Chronic MRL)	0.5 0.22
Copper	1.54	ProUCL	0.0019 (child) * 0.0008 (adult)	0.02 (provisional intermediate MRL)	0.095 0.04
Zinc	23.5	ProUCL	0.013 (child)* 0.0058 (adult)	0.3 (chronic MRL)	0.044 0.019
Mercury**	<0.099	Maximum non-detect	0.000056 (child) 0.000024 (adult)	0.0003 (chronic MRL)	0.19 0.081

Concentration results are from wet weight analysis.

Source: The calculations in this table were generated using ATSDR's PHAST v1.5.0.0.

Abbreviations: mg/kg/day = milligram chemical per kilogram body weight per day; MRL = minimal risk level

*Assumed a child aged 6 to <11 years old ate 36 grams per day of fish 3 days per week for 24 weeks per year and an adult ate 96 grams per day of fish 3 days per week for 24 weeks per year (for 33 years).

** For health protective purposes mercury was assumed to be in the more dangerous methylmercury form, which is commonly found in fish.

Table 11. Off-site homegrown vegetables irrigated with Elliott Creek water sample results, Blue Ledge Mine, California

Homegrown Vegetable	Sample Period	Contaminant	Number of Samples	Number of Detects	Maximum Concentration (mg/kg)*
Radish	8/2013 (present/future)	Arsenic	5	5	0.04
Radish	8/2013 (present/future)	Cadmium	5	5	0.05
Radish	8/2013 (present/future)	Copper	5	5	0.9
Radish	8/2013 (present/future)	Lead	5	5	0.04
Radish	8/2013 (present/future)	Mercury	5	0	<0.004
Radish	8/2013 (present/future)	Zinc	5	5	10.28
Lettuce	8/2013 (present/future)	Arsenic	2	2	0.007
Lettuce	8/2013 (present/future)	Cadmium	2	2	0.03
Lettuce	8/2013 (present/future)	Copper	2	2	0.6
Lettuce	8/2013 (present/future)	Lead	2	2	0.015
Lettuce	8/2013 (present/future)	Mercury	2	0	<0.004
Lettuce	8/2013 (present/future)	Zinc	2	2	5.3

Source: [ALS Group USA Corp. 2013]

Abbreviations: present/future = sample collected after U.S. Forest Service 2010-2011 remediation; mg/kg = milligram per kilogram

* CDPH was not able to determine if the results are from wet weight or dry weight analysis. The following exposure calculations were based on the conservative assumption that the results are from wet weight analysis.

Table 12. Off-site home-grown vegetables irrigated with Elliott Creek water: site-specific exposure doses for chronic exposure in solid food along with noncancer hazard quotients, Blue Ledge Mine, California

Contaminant	Exposure Concentration (mg/kg)	Concentration Type	RME Dose (mg/kg/day) and Receptor	Noncancer Health Guideline (mg/kg/day) and Type	RME Noncancer Hazard Quotient
Arsenic	0.04	Maximum	0.000002 (adult 0.000006 (child)	0.0003 (chronic MRL)	0.008 0.02
Cadmium	0.05	Maximum	0.000003 (adult) 0.000006 (child)	0.0001 (chronic MRL)	0.03 0.06
Copper	0.9	Maximum	0.0001 (adult) 0.0002 (child)	0.02 (provisional intermediate MRL)	0.005 0.01
Mercury	0.004	Maximum	0.0000002 (adult) 0.0000005 (child)	0.002 (intermediate MRL for mercuric chloride)	0.00001 0.0003
Zinc	10.3	Maximum	0.0006 (adult) 0.001 (child)	0.3 (chronic MRL)	0.002 0.004

Source: The calculations in this table were generated using ATSDR's PHAST v1.5.0.0.
Abbreviations: mg/kg/day = milligram chemical per kilogram body weight per day; MRL = minimal risk level; RfD = reference dose (USEPA); RME = reasonable maximum exposure

Table 13. Off-site home-grown vegetables irrigated with Elliott Creek water: site-specific exposure doses for chronic exposure in solid food along with cancer risk estimates, Blue Ledge Mine, California

Contaminant	Concentration (mg/kg)	Concentration Type	RME Dose (mg/kg/day) and Receptor	Cancer Slope Factor $(mg/kg/day)^{-1}$	Estimated Increased Cancer Risk
Arsenic	0.04	Maximum	0.000006 (child)	1.5	2 / 1 million
Arsenic	0.04	Maximum	0.000002 (adult)	1.5	1 / 1 million

Source: The calculations in this table were generated using ATSDR's PHAST v1.5.0.0.
Abbreviations: mg/kg/day = milligram chemical per kilogram body weight per day; RME = reasonable maximum exposure

Table 14. Community-requested potable water sample results, Blue Ledge Mine, California

Location	Sample Period	Contaminant	Number of Samples	Number of Detects	Maximum Concentration (µg/L)	Comparison Value (CV) (µg/L)	Type of CV	MCL (µg/L)
Joe Bar Residential Water (4 wells)	11/2008 – 4/2022	Arsenic	74	47	**~9.8**	0.16	CREG	10
-	-	Cadmium	74	28	0.63	0.70	chronic EMEG (child)	5
-	-	Copper	74	61	57.2	140	Intermediate EMEG child / acute EMEG child	1,000 *
-	-	Iron	54	46	**~2,170**	300	USEPA SDWR	300 **
-	-	Lead	74	31	3.16	15	USEPA Action Level	15 ***
-	-	Zinc	74	74	1,730	2,100	chronic EMEG child/intermediate EMEG child/ RMEG child	5,000**
-	-	Sulfate	74	69	77,400	NA	USEPA SDWR	250,000
-	-	pH	46	28	8.02	NA	USEPA SDWR	6.5-8.5
-	-	Total Dissolved Solids	38	38	334,000	NA	USEPA SDWR	500,000

Source: [Engineering/Remediation Resources Group Inc. 2015]

~**Bolded** values meet or exceed CVs, while non-bolded values do not.

Abbreviations: µg/L = microgram per liter; CREG = cancer risk evaluation guide; CV = comparison value; ppb = part per billion; EMEG = environmental media evaluation guide; MCL = maximum contaminant level; RMEG = reference dose media evaluation guide;

SDWR = Secondary Drinking Water Regulation; USEPA = United States Environmental Protection Agency

* In lieu of an MCL, the U.S. Environmental Agency (USEPA) regulates copper using a treatment technique that requires systems to control the corrosiveness of their water. If more than 10% of tap water samples exceed the copper action level of 1,300 µg/L, water systems must take additional steps to reduce levels.

** Secondary water standard not based on health effects, but, rather, on cosmetic effects (such as tooth or skin discoloration) or aesthetic effects (such as odor, taste, or color).

*** In lieu of an MCL, USEPA regulates lead using a treatment technique that requires systems to control the corrosiveness of their water. If more than 10% of tap water samples exceed the lead action level of 15 µg/L, water systems must take additional steps to reduce levels.

Appendix C. Eating Fish Caught in the Applegate Reservoir

In 2015, at the request of the USEPA, CDPH assessed fish consumption information obtained from the Applegate Reservoir specifically for Joe Bar residents [CDPH 2015]. In addition, the Oregon Health Authority assessed recreational exposure and recommended limited fish consumption of some fish obtained from Applegate Reservoir due to mercury contamination [Oregon Health Authority, Fish Advisories and Consumption guidelines: Applegate Lake https://www.oregon.gov/OHA/PH/HealthyEnvironments/Recreation/FishConsumption/Pages/fishadvisories.aspx].

The following are the conclusions and recommendations from CDPH's Health Consultation Letter to USEPA [CDPH 2015]. To request the full report, email Russell.Bartlett@cdph.ca.gov

- Overall: The concentration of mercury (methylmercury) detected in fillet samples of smallmouth bass, crappie, and bluegill collected from the Applegate Reservoir are at levels that could potentially cause adverse health effects depending on the amount of fish consumed. Potential exposure to chromium (VI) could not be determined, but the serving amounts protective for mercury (methylmercury) exposure provided in this document are likely protective from potential exposure to chromium (VI). All other metals and nutrients detected are not at concentrations that could present harmful health effects when consumed.
- Smallmouth bass: Children age 2 to 6 years who consume smallmouth bass could be at risk of adverse health effects. Children aged 6 to at least 21 years and adult women of childbearing age (including pregnant women and nursing mothers) consuming more than one 100 gram adult or 50 gram child serving per month could be at risk of adverse health effects. Adult men and adult women beyond childbearing age (>45 years of age) consuming more than one serving of smallmouth bass per week could be at risk of adverse health effects.
- Crappie and bluegill: Children age 2 to 6 years who consume more than two servings of per month could be at risk of adverse health effects associated with mercury. Children age 6 to at least 21 and adult women of childbearing age (including pregnant women and nursing mothers) who consume more than one serving per week are at risk of adverse health effects. Adult men and women beyond child-bearing age (>45 years of age) who consume three servings per week are not at risk of adverse health effects.

Based on the above conclusions, CDPH recommends for the residents of the Joe Bar community:

- Children age 2 to 6 years:
    - not to consume smallmouth bass
    - not to consume more than two servings of crappie or one servings of bluegill per month
- Children age 6 to at least 21 years:
    - not to consume more than one serving of smallmouth bass per month
    - not to consume more than one serving of crappie or bluegill per week
- Adult women of child-bearing age and pregnant women and nursing mothers:
    - not to consume more than two servings of smallmouth bass per month
    - not to consume more than one serving of crappie or bluegill per week.

- Adult men and women beyond childbearing age:
    - not to consume more than one serving of smallmouth bass per week

Appendix D. Response to Public Comments

On August 4, 2022, the Public Health Assessment (PHA) for the Blue Ledge Mine site was released in draft for the collection of public comments. The comment period was open for six weeks, ending on September 21, 2022.

CDPH placed the public comment draft PHA in a local library for public review, emailed PDF copies to several interested parties, and hand delivered printed copies to residents of Joe Bar.

CDPH received comments from two Joe Bar residents, California regulatory agencies, an Oregon health agency, and the USEPA. The comments are provided below. CDPH's responses are provided after each comment in *italics*.

Comments submitted by Joe bar residents

Joe Bar resident commenter 1:

Comment 1 Thank you for the opportunity to comment on the Blue Ledge Public Health Assessment ("Assessment"). While I appreciate the work that has been done so far to assess the public health risks at the Blue Ledge Superfund site, I feel there are glaring omissions in the assessment that still need to be addressed and assessed.

As a resident of Joe Bar, the closest downstream community to the Blue Ledge Mine Superfund site, I have major concerns about the management and cleanup at the site, and am worried about the long-term health implications. I have lived at Joe Bar for 20 years and plan to spend the rest of my life here, so the exposure to the mine's toxic legacy is a life-long concern for me and my husband, and other family members that may live with us in the future.

For this reason, and for the sake of my immediate neighbors and downstream neighbors, I believe the California Department of Public Health has more work to do on the Blue Ledge Public Health Assessment so that it is as thorough as possible and has acknowledged and assessed every avenue of public exposure to the toxic legacy at the Blue Ledge Mine Superfund site.

CDPH Response:
Thank you for submitting your comments. CDPH's responses will address your specific comments below. In relation to the totality of your comments below, note that, CDPH's obligation is to investigate past, current, and future exposures to site contaminants and assess if exposures place human health at risk. Therefore, comments regarding supervision of the surrounding forest, decisions related to the management of site access, and specific behaviors of potential site visitors beyond recreating at the site are beyond the PHA's scope. CDPH responds to comments that pertain to potential exposures to site contaminants.

Comment 2 **Mine Adits**

One of the most glaring omissions is the fact that the Assessment doesn't address public health concerns or risks involving entry into the mine adits themselves. It is my understanding that not all the adits have gates on them, but even those with gates, can easily be opened up with an acetylene torch by those eager enough to enter the adits to explore them. People in the area are well known to use acetylene torches to open gates on roads that they don't like in order to enter an area, and even the current gate on Elliott Creek Road has been cut into pieces with an acetylene torch when someone wanted to gain entry. Metal or gate barriers are not full proof in remote areas such as Blue Ledge, where illegal activity and a lack of respect for restricted areas is common. Gates into sensitive ecological areas such as meadows, wetlands, rare plant rock gardens, etc. on Forest Service land in the area are routinely cut and breached using acetylene torches on gates.

Since unsafe and dangerous mine adits are not all currently gated at the Blue Ledge site, and for the simple fact that gates can be easily breached by people using acetylene torches, the California Department of Public Health should make a full assessment of the health risks involved in entry into the mine adits themselves. This should include, but not be limited to: dangers involving falling in the adits, getting lost in the adits, exposure to toxic substances in the adits, exposure to harmful water in the adits, breathing in toxic dust in the adits, getting harmful dust or water in the eyes in the adits, exposure to harmful fumes in the adits, etc.

CDPH Response:
The USFS identified 14 adits on the site and determined that 10 required gates. Steel gates were installed in 2011 and remain in good condition. Among the remaining four adits where gates were not installed, two adits were considered too shallow to require gates, and the other two were closed using polyurethane foam or rock material. In addition to the steel gates and installed barriers, visitors who want to access the site's adits will need to traverse ground that is unattractive to hiking and difficult to climb. Based on these factors, CDPH determined that USFS has taken sufficient measures to deter access to these adits.

Comment 3 **Jurisdiction of First Responders**

If someone were to get injured or need first responders at the Blue Ledge site, since it is private land in the state of California, the responsibility would lie on California first responders. The Assessment did not assess the inability of California first responders to get to the site in a timely manner. Yreka is at least 2.5 hours' drive from Blue Ledge, and any rescue attempts would need to be done with a helicopter, which can't land in the steep terrain and narrow canyon at the site. If Search and Rescue comes from Jackson County, OR, they are needing to use cross-boundary, out-of-state first responders who would still come from at least 1.5 hours' away in Medford. The area is remote with no cell service. Anyone who did get injured at the site would probably come knocking on the doors of those of us who live in Joe Bar, putting us in a position to help people in need at the Superfund site, which is not our jobs to do.

Any and all precautions should be made to limit the potential for injury or sickness at the Blue Ledge site in order to limit the burden on distant search and rescue teams, and the impacts to the Joe Bar community that have the burden of helping people in this remote area in need, when it is not our responsibility. We are already carry the burden of dealing with people who are psychotic from drugs partying down at the camps below on Elliott and Middle Fork, or providing gas to people who run out of gas, or dealing with people all bloody from driving off the road drunk. If Blue Ledge isn't managed correctly there will be more need for search and rescue and first responders in an area with no cell coverage, no law enforcement patrols, and no Forest Service presence. Local people perceive the "free camping" area above Applegate Lake as a lawless zone because of the jurisdictional gray areas along the California/Oregon border, where county police never come unless someone has died, so there is a perception that one can "get away with anything," in the area. With this mindset and dangerous mine adits and modern ability to easily use acytelene torches, it's a recipe for disaster. The likelihood of someone dying at the Blue Ledge site is high when you consider the long distances search and rescue and other first responders need to travel to get to the site.

CDPH Response:
This comment is beyond the scope of the PHA. CDPH's obligation is to investigate past, current, and future exposures to site contaminants and assess if exposures place human health at risk.

Comment 4 **Drug & Alcohol Use**

Drug and alcohol use in the area above Applegate Reservoir is a huge concern and public health issue that has the potential to spill out into the Blue Ledge Mine Superfund site. People are routinely getting very drunk and breaking glass bottles, vandalizing, leaving garbage, getting psychotic, drunk driving, going off roads and getting into accidents drunk, etc. The heavy "party vibe" on lower Elliott Creek and Middle Fork in the dispersed camping areas spills out into the Joe Bar neighborhood and sometimes up at the Blue Ledge Mine. People drive motorcycles drunk up to the mine, and if more access was ever given, drugs and alcohol could become a major problem.

Many times in Joe Bar we have had to deal with belligerent drunk or drugged people coming into our neighborhood from the camps below. Once time a large man was so psychotic from a hard drug that he was half naked, with one shoe on, trying to break into our neighbor's car, and when we asked him to leave, he ran at me in a threatening manner, yelling another woman's name, which scared me half to death, but thankfully he pulled himself out of it before harming me. We had to escort the man, who said his friends had drugged him with "bath salts" down to Applegate Lake before he hurt himself or others in the neighborhood or succeeded in stealing one of our cars. Situations like this are rampant in the area. People come here to party and do drugs and get drunk, and it can have devastating consequences. No assessment of this type of local use of public lands was included in the Assessment, but a thorough review of this situation, and Forest Service law enforcement issues in the area is warranted. It's one thing to have this type of behavior on normal public lands, which is bad enough, it's another thing entirely to have it occurring at a Superfund site where people high on drugs or drunk could easily ignore warning signs, commit vandalism, trash the site, harm

themselves or others, or do something else they wouldn't ordinarily do. The site should remain a drug and alcohol-free zone to ensure the safety of the site itself and the safety of others, especially those of us who live downstream. Drugs and alcohol can be a determining factor in leading to human exposure pathways from the Blue Ledge Superfund site.

CDPH Response:
This comment is beyond the scope of the PHA. CDPH's obligation is to investigate past, current, and future exposures to site contaminants and assess if exposures place human health at risk.

Comment 5 **Wildfire Risk**

The Assessment did not assess the risk of human-caused wildfire starting at the Blue Ledge site. This region has many human-caused wildfires every year. Campers routinely leave burning campfires when they leave their camps on lower Elliott Creek and Middle Fork. I have personally had to put out campfires that were creeping out of the fire rings on Elliott Creek as I drove out for work, driving past camps. Many wildfires have been started by campers, hunters, and other recreationalists in the immediate area near Applegate Lake and the headwater streams of the Applegate River.

Wildfire risk is a huge public health issue that deserves to have a complete assessment at Blue Ledge. Not only is the Superfund site itself at risk, with the potential for all the monitoring equipment and cleanup work to be burned in a fire, but also any potential human-caused fires originating at Blue Ledge would burn downstream into the Joe Bar community and possibly even further, impacting nearby residents downstream on Carberry Cree and in the Upper Applegate or Seiad Valley. The Assessment needs to assess the risk of human-caused wildfire at the Superfund site, the potential outcomes of human-caused wildfire originating at the site, and ways that human-caused wildfire risks will be avoided.

Liability issues surrounding human-caused wildfire on the private or public land at the Superfund site could be a major concern if nearby houses are burned in a wildfire or there is a loss of life resulting from a human-caused wildfire originating at Blue Ledge.

CDPH Response:
This comment is beyond the scope of the PHA. CDPH's obligation is to investigate past, current, and future exposures to site contaminants and assess if exposures place human health at risk.

Comment 6 **Incomplete Analysis of the Lack of Forest Service Management in the Area**

There is a lack of Forest Service management in the Blue Ledge area that was not given a hard look or analyzed during the Blue Ledge Heath Assessment. Many of the assumptions and analyses made in the Assessment assume that there are regular patrols of the Superfund site by Forest Service law enforcement or staff; however, as a resident at Joe Bar, I know firsthand that Forest Service personnel rarely drive up Joe Creek at all, and patrols of the area are very, very infrequent, if at all. I have seen Forest Service law enforcement drive through Joe Bar only twice in the entirety of 2022 and they didn't drive up Joe Creek as far as I could see. The

lack of patrols for Blue Ledge is a major concern for public health and safety because vandalism of EPA cleanup or monitoring equipment could lead to serious negative outcomes if left undetected for long periods of time.

People in the Joe Bar community, and downstream in the Applegate Valley have concerns about the inability of the Forest Service to manage the area in a way that will protect human safety and the environment. For example, I just got home from a cross country trip for a family gathering and went all over on Forest Service land, and when I got home there were trashed out camps and garbage all over lower Elliott Creek. It was worse than anywhere I went in the country! The inability of the local Forest Service at Siskiyou Mountains Ranger District, to deal with trash, vandalism, and crime in the area above Applegate reservoir is well known in the Applegate Valley and southern Oregon as a whole, and it is concerning that this will spill out into the superfund cleanup effort at Blue Ledge. In fact, it already has since vandalism of equipment has already occurred.

There are a lot of concerns on many levels. If the Forest Service had a good track record here, where they could deal with the trash and crime in the area, it would be a whole different matter. For those of us who live here, it's a major issue with major ramifications. I wrote an article about it for the fall issue of the Applegater Newsmagazine that can be accessed here: https://www.ifoldsflip.com/i/1477412-applegater-fall-2022-online/13?

CDPH Response:
This comment is beyond the scope of the PHA. CDPH's obligation is to investigate past, current, and future exposures to site contaminants and assess if exposures place human health at risk.

Comment 7 **Vandalism**

Vandalism at the site was not assessed in the Assessment. Vandalism of monitoring and cleanup equipment could lead to harmful public health outcomes if the vandalism is not noticed in a timely manner. Risks from vandalism include, but are not limited to, damage to equipment that could lead to spills of acid mine waste into human communities. A full assessment of the risks to public health if vandalism were to occur at the Blue Ledge site should be included in the Assessment. Vandalism has already taken place at the site and is likely to occur again in the future. This is a real fear of local Joe Bar community members, because we will likely be the people exposed if another release of acid mine waste was released into Elliott Creek or in other likely scenarios.

CDPH Response:
This comment is beyond the scope of the PHA. CDPH's obligation is to investigate past, current, and future exposures to site contaminants and assess if exposures place human health at risk.

Comment 8 **Historic and Future Accidental Acid Mine Waste Releases**

When I first moved to Joe Bar in 2002 Joe Creek always had an orange stain in the creek, all the way to its confluence with Elliott Creek. Even just downstream of the confluence on Elliott Creek would sometimes have an orange stain from the acid mine waste from Blue Ledge. In 2010 a very large release of acid mine waste was released during the EPA cleanup of the mine when an unknown (to the equipment operator) mine adit was hit with a "spider cat," and a large volume of mine waste water blew out of the adit, nearly knocking the equipment operator off of the cliff he was working on, and sending mine waste down Joe Creek into Elliott Creek and then into the Applegate River. The bright orange mine waste was visible in the creeks for at least a few days. There is always a potential for such a harmful event to happen again; however, the Assessment did not make any mention of the potential for new releases to happen.

Many unknowns still exist at the site, and what is known, is that the rock removal did little to lessen the long-term releases of toxic mine waste from the site. Lower Joe Creek is a little better, but upper Joe Creek is as bad as it has ever been. The acid mine waste is coming out of the adits themselves, and seismic activity or human error could easily release a similar, if not more harmful acid mine waste release event in the future. The potential for future releases of acid mine waste should be fully analyzed, including how the California Department of Public Health would respond to such an event. In 2010 there was no public notice given to the public until people at Joe Bar requested that signs be put along Elliott Creek that the water was dangerous. Without people at Joe Bar making the request, the public would have been exposed to acid mine waste in Elliott Creek and the Applegate River, including Applegate Reservoir.

There was an incomplete analysis of this release in Elliott Creek. From the Assessment it is clear that only one surface water sample was taken during the 2010 release, at the bridge over Elliott Creek in Joe Bar. One single water sample does not determine water safety. A much more thorough testing of both soil and water should have been conducted in 2010.

For more information and guidance on soil/water sampling and the need for more sample sites for the Blue Ledge Superfund site, please see the recommendations in the reference at the bottom of this comment about soil and water sampling in the Risk Assessment Guidance for Superfund Volume I, Human Health Evaluation Manual (Part A).

CDPH Response:

The 2010 accidental release occurred during the USFS's removal and cleanup efforts. Large machinery that was involved in the adit rupture, such as the "spider cat" referenced in your comment, was required to move the roughly 60,000 tons of waste rock material on a very steep slope. The cleanup efforts were a one-time event. This waste removal effort has concluded, and there are no current plans for future waste rock removal, therefore the conditions that caused this adit mine rupture are unlikely to be repeated. CDPH cannot anticipate future scenarios. Please refer to section 8.1.4, "2010 Adit Release Evaluation" for CDPH's analysis of the 2010 (past) adit release.

Comment 9 **Incomplete Analysis of Sediments in Elliott Creek**

According to the Assessment report, only a paltry number of samples of sediments in Elliott Creek have been taken, and these have not been taken after peak flows in the backyards of those who live in Joe Bar along Elliott Creek. The timing of when sediment samples are taken is very important in being able to detect toxicity. Children live in the neighborhood and play on "beaches" of erosive sediments coming down from Joe Creek and the Blue Ledge mine along Elliott Creek, but to my knowledge, those play areas in the backyards of people living in Joe Bar have never been tested following peak flows, after sedimentation occurs. Children are likely to put soil into their mouths and eat soils, but this kind of assessment didn't occur.

For more information and guidance on soil/water sampling and the need for more sample sites for the Blue Ledge Superfund site, please see the recommendations in the reference at the bottom of this comment about soil and water sampling in the Risk Assessment Guidance for Superfund Volume I, Human Health Evaluation Manual (Part A).

CDPH Response:

As discussed in section 5.1, dermal absorption to contaminants in soil contribute much less than exposure via ingestion, inhaling dust, or incidentally swallowing water, therefore, CDPH did not include dermal exposure scenarios.

Sediment samples were collected in Elliott Creek within the vicinity of Joe Bar (Zebra Rock and immediately downstream from Joe Creek and Elliott Creek confluence) in 2008, 2010, 2011, and 2012. In 2011, when CDPH was collecting potential Joe Bar exposure concerns, the inadvertent ingestion of soil was not submitted as a concern, and thus was not included in the investigation. However, the recent comment suggests that ingestion of soil by children could be a potential exposure issue. The concentrations of metals found in sediment samples collected after USFS's massive remediation in 2011 and 2012 are the best available data to assess potential current exposures through the ingestion of soil from Joe Bar's Elliott Creek shoreline.

The reported site-related concentrations of arsenic (4mg/kg and 6mg/kg), cadmium (0.3 mg/kg and 0.2mg/kg), copper (31 mg/kg and 33 mg/kg), and zinc (57 mg/kg and 39 mg/kg) are below ATSDR comparison levels, and with the exception of copper are protective for soil-ingesting behaviors, including pica. The maximum concentration of copper found in the sediment samples (33mg/kg) is below ATSDR's copper pica comparison value (53 mg/kg). Therefore, exposures to these metals through ingestion of these soils, including through pica behavior, is not expected to cause harm to health.

Comment 10 **Children Eating Soil at Mine Site and Beyond**

People with children often drive motorcycles, side by sides, and ATVs up to the Blue Ledge mine site currently. Children are known for putting soil in their mouths, but an assessment of children eating soil at the site was limited in the Assessment. Not only could this occur near the water or in the water, but also in other areas away from the water, but still exposed to

toxic mine waste. Children playing in or along Joe Creek could also put soil into their mouths, and this too could be problematic and warrants inclusion in the Assessment. There was no information about the quantity of soil samples included that lead to the conclusion in the Assessment that children eating soil at the site was safe. Many more samples at both the mine site itself and downstream of the mine site should be taken and analyzed in order to better determine if children eating soil at the site is safe.

For more information and guidance on soil/water sampling and the need for more sample sites for the Blue Ledge Superfund site, please see the recommendations in the reference at the bottom of this comment about soil and water sampling in the Risk Assessment Guidance for Superfund Volume I, Human Health Evaluation Manual (Part A).

CDPH Response:
As discussed in section 5.1 of the PHA, due to the site's rough and steep terrain and its remote location, CDPH assumed that children younger than 6 years of age are not likely to visit and explore the site (specifically in the vicinity of the drainage pond area). Children younger than 6 are most likely to exhibit soil eating or pica-type behavior (see previous comment).

The scope of the PHA is to investigate and assess the public health implications of exposure to released contaminants. This does not include commuter roads.

Comment 11 **Gated Access to the Private Land at Blue Ledge Superfund Site Would Not be Adequate**
In the recent interview on Jefferson Public Radio "Jefferson Exchange" about the toxic legacy of the Blue Ledge Superfund site, it was mentioned that a gate would be placed to prevent access to the private land at the Superfund site. A gate on private land; however, would not block access to the area below the road where the water is still toxic and harmful.

When driving up Joe Creek Road, the first and only place where a person would reasonably stop is right along the creek just below the mine where the first major pull off alongside the road is located. This location is a site that has toxic and harmful water, but it is on public land, not private land. The thinking that the harmful material is only on private land is mistaken, as the toxicity exposure is on both private and public land, including where the repository is and the surrounding area where water is released from the repository due to the springs below. Gating just the private land would not be adequate to limit exposure to the toxic mine waste.

CDPH Response:
This comment is beyond the scope of the PHA. CDPH's obligation is to investigate past, current, and future exposures to site contaminants and assess if exposures place human health at risk.

Comment 12 **Hunters**
Hunters in the area may walk down from the Tincup Trail into the Blue Ledge Mine area and hunt deer that drink the water out of Joe Creek without realizing they are near the Superfund

site. There was no assessment of people eating hunted game animals that drink Superfund site water. It is likely that deer and other hunted game animals that live in Joe Creek, that only have Joe Creek as a water source that high up on the slope at high elevations, where water is scarce, could have toxicity in their meat. Warnings to hunters should be included as part of the Assessment, and hunted meat should be analyzed for toxicity.

CDPH Response:
Studies conducted on Siskiyou Mountain deer populations indicate that compared with other California deer populations, they have larger than normal ranges and longer migration routes in order to find multiple water sources due to water sources drying up in the summer months. Therefore, it's unlikely that deer use Joe Creek (or onsite water) as their only water source, but rather obtain water from multiple sources. In order to ascertain exposure, specific information regarding if or for how long deer using Joe Creek or onsite water as a source is needed. In addition, habits of hunters consuming deer obtained nearby the site is necessary. CDPH recommends contacting the USFS for this specific information, and if necessary, the USEPA for more exposure-related concerns.

Potential (helpful) resource:
California Department of Fish and Wildlife, Final Report: Siskiyou Deer-Mountain Lion Study
https://bpb-us-e1.wpmucdn.com/sites.ucsc.edu/dist/0/1412/files/2022/08/Siskiyou-Deer-final-report_2Mar2021.pdf

Comment 13 **Public Land Grazing**

Public land grazing does occur in the Blue Ledge Superfund site. Cows dung is routinely observed at the site, making it clear that cows are drinking the water at the mine site, as that is the only water source available in that area. There has been no assessment of the impacts to cows grazing on public land in the area, or what the human health impacts are to someone eating beef from cows that drank the water at the Blue Ledge Superfund site. The grazing permittee should be fully notified and made aware of the potential human health concerns with grazing animals at Blue Ledge, and the meat should be considered inedible until a full analysis of what the human impacts to eating this meat are.

Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (Part A)
Page 141
"Terrestrial animals. Use tissue monitoring data when available and appropriate for estimating human exposure to chemicals in the terrestrial food chain. In the absence of tissue monitoring data, use transfer coefficients together with the total chemical mass ingested by an animal per day to estimate contaminant concentrations in meat, eggs, or milk. Data to support modeling of uptake by terrestrial animals generally are not available for birds, but are available for some mammalian species. Terrestrial mammals such as cattle are simultaneously exposed to chemicals from several sources such as water, soil, corn silage, pasture grass, and hay. Cattle ingest varying amounts of these sources per day, each of which will contain a different contaminant concentration. Because all sources can be important with regard to total body burden, an approach based upon the daily mass of chemical ingested per day is recommended because it can be applied to input from many sources."

CDPH Response:

The USEPA's 2011 Hazard Ranking System for the Blue Ledge Mine Site reported "there is no evidence of commercial agriculture, commercial silviculture, or commercial livestock production of commercial livestock grazing on the Blue Ledge Mine facility"[2] (section 5.1.3.4). Therefore, commercial livestock now grazing at the site is likely due to the USFS's 2011 revegetation efforts.

Livestock or stock animals consuming onsite foliage are not likely to be exposed to contaminants. In its remediation efforts, the USFS removed the waste rock to original bedrock. Per the USFS's 2012 Removal Action Report, prior to replanting, the agency covered the exposed bedrock with uncontaminated soil (excavated from the nearby repository), mulch, compost, and lime. Given that the seeded plants are growing in new uncontaminated soil they are likely not accumulating metals and would not be a concern for grazing.

Based on water samples collected in 2021, cadmium would be the most concerning contaminant regarding commercial cattle drinking drainage water and accumulating contaminants. However, before using a transfer coefficient factor for cattle meat to estimate accumulated levels, gaining an understanding of specific patterns and information related to the cattle is necessary. Given that cattle will search for multiple water sources, ascertaining how long the cattle are present at the site is needed. Additionally, cattle water intake can vary tremendously, therefore, knowing the specific age, type, weight, gender of the cattle and the weather conditions (air temperature) are needed (affects water consumption). Given that cadmium concentrates primarily in the liver and kidneys, information related to how the cattle are utilized by consumers is also needed.

Potential (helpful) resources:
European regulation of Cadmium in feed https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:328:0086:0092:EN:PDF
The Canadian Council of Resource and Environment Ministers.
https://www.ag.ndsu.edu/waterquality/livestock/Livestock_Water_QualityFINALweb.pdf -
Bureau of Land Management Northwestern California Cattle Grazing Guidelines.
https://www.blm.gov/sites/blm.gov/files/Northwestern%20CA%20standards%20for%20rangeland%20health%20guidelines%20for%20grazing.pdf

Comment 14 **Horses and Other Stock Animals**

People do occasionally ride horses up Joe Creek. Notification should be given to people not to let their horses drink the contaminated water. The impacts on stock animals were not analyzed in this Assessment. Although stock animals are not eaten like deer and cows, the impacts to humans are still important and warrant further assessment.

[2] *https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5317114.pdf*

CDPH Response:

Operators of stock animals on the site can heed the posted signs and keep their horses away from the drainage treatment pond area.

Comment 15 **Vegetation**

No analysis or assessment was included in the Assessment regarding the safety of using or eating vegetation along Joe Creek. Stock animals, hunted game, and cows may all eat the vegetation in areas with toxic water. How that toxic water is taken up and stored by vegetation in the area was not analyzed. Grasses, sedges, and other herbaceous plants readily take up and store heavy metals, and eating them can be detrimental. The same can be said for using vegetation for things like basketry, where the plant material may be placed in the mouth during the process of making a product from plant material. A full study of the toxic potential of the vegetation at the Blue Ledge Mine Superfund site should be undertaken to determine if using or eating the vegetation can be harmful, or if it is harmful to animals that are intertwined and connected to human health, such as cows, horses, stock animals, or hunted game. There are also berries and other edible plants along the stream that could also be a concern and warrant further assessment.

Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (Part A) Page 140
"Plants. Site-related chemicals may be present in plants as a result of direct deposition onto plant surfaces, uptake from the soil, and uptake from the air. When possible, samples of plants or plant products should be used to estimate exposure concentrations."

CDPH Response:

In general, the levels of toxic site contaminants, such as arsenic, cadmium, and lead found in the 28 surface water samples collected from Joe Creek between 2012 – 2015 and post USFS's remediation were well below levels considered safe for drinking water. All samples were non-detect for arsenic; lead was only found in two of the 28 samples at 1.47 and 0.1 micrograms per liter (µg/L), both below the 15 µg/L safe drinking water level; and the mean concentration of the 18 samples that detected cadmium was 1.3 µg/L, which is below the safe drinking water level of 5 µg/L. Given the low levels of arsenic, lead, and cadmium noted, CDPH does not think an exposure assessment related to foliage along Joe Creek uptaking contaminants from Joe Creek is necessary at this time.

The USFS remediation efforts removed all the waste rock down to the original bedrock. Per the USFS's 2012 Removal Action Report prior to seeding/planting the agency covered the bare rock with the uncontaminated excavated soil from the nearby repository, mulch, compost, and lime (where needed). Therefore, given the removal of the onsite metals and that plants are growing primarily in uncontaminated soil, it is unlikely plants are uptaking metals from soil or air or are metals directly depositing onto plants.

Comment 16 **Sensitive Human Populations**

The Assessment did not provide a detailed analysis of how toxicity affects sensitive populations, specifically those with preexisting conditions, reduced immunity, children/elderly, or people with an underlying illness that would make them more sensitive to the toxicity at the Blue Ledge Superfund site.

CDPH Response:

Please refer to section 5.1 Exposure Process. All health guidelines such as MRLs and RfDs are derived to protect the health of sensitive populations.

Comment 17 **High Arsenic in Well Water in Joe Bar**

It is disturbing to know that the house in Joe Bar where the water from Joe Creek first arrives, has high levels of arsenic in the well water. It has never been fully determined that this is not being caused by Blue Ledge, as the source of the arsenic was never determined. A closer look at drinking water and domestic water use in Joe Bar should be done to rule out any high levels of toxic heavy metals coming from Blue Ledge.

CDPH Response:

CDPH addressed this issue in the PHA. Please refer to Section 9, Community-requested Evaluation of Joe Bar Potable Water for CDPH's discussion of arsenic found in Joe Bar private well water.

Comment 18 **Irrigating Vegetables in Joe Bar**

The tests that were done on lettuce and radishes in Joe Bar are not thorough enough to satisfy a safety standard for eating vegetables grown using water from Elliott Creek, downstream of the Blue Ledge Superfund site. Lettuce and radishes are not known to accumulate toxic metals at high levels; however, cucurbits, like squash, melon, cucumbers, and pumpkins, are known to accumulate heavy metals and should have been the garden vegetable species tested by the EPA, and later in the season, once the plants have actually been in the ground during the summer.

Testing short lived lettuce and radishes, both early season plants that don't stay in the ground a long time, did not adequately capture the safety of eating vegetables irrigated with Elliott Creek water. A more thorough and appropriate test using cucurbit plants in the late season would more accurately determine what public and health safety concerns are present with using Elliott Creek water to irrigate gardens in Joe Bar.

CDPH Response:

During CDPH's collection of comments, specific requests related to garden irrigation such as cucurbits were not conveyed or requested to be analyzed. The sampling was conducted by USEPA in collaboration with the one known resident who uses Elliott Creek for irrigation purposes (resident lives adjacent to Elliott Creek). If additional Joe Bar residents are now using Elliott Creek water for irrigation and there are new concerns, the residents should discuss the

matter with the USEPA.

Please see the Oregon Health Authority's information on healthy and safe gardening information:
https://www.oregon.gov/oha/ph/HealthyEnvironments/HealthyNeighborhoods/HealthyGardening/Pages/index.aspx

Comment 19 **Swimming**

The safety of swimming or wading in Joe Creek or Elliott Creek was based solely on testing surface water; however, when "swimming" or "wading," much of the sediments in the stream are dredged up into the water and mix with the water through walking in the sediments at the bottom of the creek. If only surface water is tested, it does not pick up the metal concentrations from the sediments. The swimming hole near Zebra Rocks in Joe Bar has deep sediments at the bottom of the stream in the summer, and when many people are in the water playing, the water can get muddy with sediment mixture, and a surface water test alone will not pick up this sediment without the mixing of sediment and water with foot action in the sediments below.

Also, in the Assessment exposure during swimming or wading was only assessed through incidental water intake and not by absorbed dose through the skin because that goes directly into your blood stream.

Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (Part A)

Page 143
"Intake from dermal contact. Calculate intakes from dermal contact with water while swimming, wading, etc., or during household use (e.g., bathing). Use the equation and variable values presented in Exhibit 6-13. In this case, the calculated exposure is actually the absorbed dose, not the amount of chemical that comes in contact with the skin (i.e., intake). This is because permeability constants (PC) reflect the movement of the chemical across the skin to the stratum corneum and into the bloodstream. Be sure to record this information in the summary of exposure assessment results so that the calculated intake is compared to an appropriate toxicity reference value in the risk characterization chapter."

CDPH Response:
Regarding the absorbed dose through skin, please refer to section 5.1 Evaluation Process of the document.

Reassessing the swimming dose to account for sediments is not necessary. Sediment samples collected from Zebra Rock and from Elliott Creek both before and post the USFS's remediation do not exceed health comparison values.

Comment 20 **Signs**

Signs are not an effective long-term way of notifying the public about health concerns in areas that are open to the public in the area above Applegate Lake. Signs are routinely shot with

bullet holes, torn down, marred with graffiti, and can burn up in wildfires if they are not metal. Signs are constantly in need of replacement. People use signs to "sight in" rifles when hunting, even when they have the American flag on them – sometimes even more so because of that. This Assessment needs to assess the likelihood that signs will be only a short-term notification to the public of a public health risk, and a longer-term solution should be developed to keep people safe in the Blue Ledge Superfund site area. Many people see signs as an invitation for a challenge to do the opposite of what the sign says, and signs could just bring more attention than provide an educational opportunity.

CDPH Response:
CDPH and USEPA developed the signs currently posted at the site to inform and warn the visitor about what behaviors should be avoided for the protection of their health. In particular, these signs were carefully designed to capture people's attention and provide contact information. Assessing the motives, actions, or attitudes of the viewer is beyond the scope of these health protective efforts.

Regarding developing a long-term solution, the USEPA is currently conducting a feasibility study that will inform what remediation project(s) to implement in the future that will continue to reduce the few but remaining potential exposures at the site.

Comment 21 **Eyes**

All public information about the toxicity risks at Blue Ledge should include warnings that the water can damage the cornea of your eyes. Many people may see that they shouldn't drink the water on a sign and take that to mean that dermal or eye exposure is fine.

CDPH Response:
The purpose of the posted signs are to provide informational messages that are uncomplicated, simple, easily understandable, and serve multi purposes. For example, a message on drainage basin sign warns against entering the basins, which prevents water splashing into the eyes.

Comment 22 **Crawdads**

Crawdads live in Elliott Creek and some people eat and consume crawdads. The EPA has only tested fish in Elliott Creek for safety for consumption; however, shellfish are more likely to uptake heavy metals at higher concentrations than fish, and it would be beneficial for the Assessment to determine if eating crawdads out of Elliott Creek is safe.

CDPH Response:
Joe Bar residents, USFS staff, or USEPA staff have not conveyed observing people capturing and consuming crayfish from Elliott Creek in the past. Therefore, this would be a new issue and would not likely be a sustenance scenario, but rather recreational scenario, perhaps for Hutton Campground visitors (not Joe Bar residents). Given that the effluent from the site has improved, it is doubtful Elliott Creek crayfish are currently being impacted to a level that would be an issue for consumption by an Elliott Creek recreational visitor. However, CDPH

recommends contacting the USEPA if more information or sampling is desired.

Comment 23 **Access to the Blue Ledge Superfund Site**

As a downstream resident in Joe Bar, with serious concerns regarding my personal risks and exposure to toxic mine waste from Blue Ledge Superfund site, I urge the California Department of Public Health to do all it can to limit the potential for human exposure to the toxic legacy at the site. Limiting access to the site is the only way to ensure that there won't be lethal exposures or accidents that have the potential for drastic outcomes for our Joe Bar community and the public as a whole. Downstream residents, and all who rely on the Applegate River downstream, from organic farmers and vineyard owners, to riverfront property owners, are relying on the California Department of Public Health to keep our community and water safe in the Applegate River, and within the local Joe Bar community at the confluence of Elliott and Joe Creeks.

CDPH Response:

This comment is beyond the scope of the PHA. CDPH's obligation is to investigate past, current, and future exposures to site contaminants and assess if exposures place human health at risk.

***Joe Bar resident commenter 2**:*

Comment 24 I am a resident of the Joe Bar community where I own 32 acres in the Joe Bar subdivision, directly below the Blue Ledge Mine near the confluence of Joe Creek and Elliott Creek. I have lived in the Joe Bar community for 20 years. I am very concerned by the impact of the Blue Ledge Mine on both the environment, and public health and safety. I am also concerned that the continued public health and safety risks have not been adequately analyzed in the California Department of Human Health, Public Health Assessment (PHA)

Although we support efforts to clean up the toxic material and waterways in the Blue Ledge area, we also concerned that land managers and regulators have not adequately considered the impacts of the mine to public health and safety, as well as environmental health. We are also concerned that neither the public's actual behavior, or the capacity of Forest Service officials to effectively manage dispersed public recreation in the area and/or maintain infrastructure without vandalism is being accurately considered.

As residents of Joe Bar for the past 20 years, we have gained a unique perspective on the region, the Blue Ledge Mine, and the potential for impacts to public health and safety associated with the Blue Ledge Mine. We also understand the scope and scale of previous clean-up efforts, and the limited potential for the EPA and other regulators to effectively mitigate the problems remaining on site.

Finally, we have seen first-hand the impact of the mine on the surrounding environment and in the nearest residential community at Joe Bar. More than anyone else, our community could be impacted by ineffective management, lackluster enforcement, and

ineffective mitigation of the Blue Ledge Mine. If vandalism continues to occur to monitoring equipment, water treatment equipment, or at the repository and this infrastructure becomes less than functional, it is our community and our properties that will be most directly and potentially negatively affected.

In the summer of 2010, during large scale mine clean-up operations an accident involving an unknown adit led to a significant release of mine waste into the larger Elliott Creek watershed and Applegate Reservoir area. The toxic, reddish orange turbidity associated with this release settled into stream sediments and likely impacted aquatic species throughout the Joe Creek and lower Elliott Creek watersheds, the Applegate River watershed, and the Applegate Reservoir area. Stream sediment sampling and water quality sampling sizes were not robust at the time and cannot be used to draw definitive conclusions.

When this release occurred Forest Service officials did not post the area off limits or post warnings to the public, did not shut down recreational use of waterways in the area, and did not identify the massive release of toxic mine tailings as a threat to public safety. In fact, the area was only posted by the Forest Service multiple days after the turbidity event at the request of the Joe Bar community, in which we live. This demonstrates a clear lack of concern for public health and safety, even when mine waste is actively being transported in waterways downstream into popular recreation areas.

I am also very concerned that the current PHA is insufficiently robust and does not accurately consider many potential threats to human health and safety, or responsibly consider management issues that could increase those risks to both residents and Forest Service visitors. Increased access to the mine site and repository will have one result and that will be to increase human health risks and threaten remediation efforts through vandalism, unregulated use, and damage to important monitoring and remediation infrastructure. Knowingly compromising the remediation of a Superfund site through faulty analysis and inappropriate management activities is unacceptable. Current gated closures on Elliott Creek have proven large effective and could be augment with additional closures closer to the mine to reduce the risk of damage to remediation infrastructure and impacts to public health.

The proposal by the Forest Service and others to increase public access and the means by which this is proposed are altogether ineffective and irresponsible, and we believe they will serve only to compromise remediation progress, disrupt water treatment at the repository and increase public health risks in the area.

<u>CDPH Response:</u>
Thank you for submitting your comments. Please note, CDPH's obligation is to investigate past, current, and future exposures to site contaminants and assess if exposures place human health at risk. Therefore, comments regarding supervision of the surrounding forest, decisions related to the management of site access, and specific behaviors of

potential site visitors beyond walking or recreating at the site are beyond the PHA's scope.

Comment 25 **The analysis in the Public Health Assessment is based on faulty assumptions regarding public use in the area.**

The Public Health Assessment (PHA) is based on faulty assumptions regarding public use in the area. The area above the Applegate Dam is located adjacent to the Oregon-California, but on the California side of the border. This area has very limited access by California law enforcement officials. Additionally, it is known regionally that federal Forest Service law enforcement staffing is so limited that effective patrolling is impossible. This is known by segments of the community who are specifically looking for lawlessness and who regularly trash dispersed recreation sites, destroying all forest service infrastructure and signage through direct vandalism, shooting, and participate in illegal dumping, damaging or destroying trees and/or vegetation, driving in areas off-limits to motorized use, and degrading historic resources.

Destroying a beautiful Forest Service property and unique, protected historic resource. When local residents at Joe Bar complained to the Forest Service, no action was taken to address the issue.

Time passed, complaints resumed and no action was taken until another historic structure on private land (Cobbs Mine) in the Elliott Creek watershed was burned down by Forest Service visitors trespassing on vacant private land. Residents at Joe Bar reported the fire and were told by local Forest Service staff it was likely their neighbors burning trash, and refused to send anyone out to investigate or suppress the fire. They ignored the fire report, and later the fire was reported from their Dutchman Peak Lookout as a wildfire. At this point, historic structures had already burned and Forest Service officials finally dispatched fire crews to suppress the blaze.

Our community in Joe Bar was concerned by the damage being done to historic resources and our watershed by inappropriate and completely unmanaged recreational use facilitated by Forest Service officials. The Forest Service's response was to propose burning down the historic Harlow Cabin to address the issues of inappropriate use, vandalism, etc. Local historians who worked to protect Harlow Cabin were outraged and only after articles appeared in the Medford Mail Tribune about the Forest Service's proposal to burn the cabin, did the Forest Service re- evaluate. Since that time, a gate has been erected to protect Harlow Cabin from further abuse and this gate has only been effectively maintained because it is located below Joe Bar, where residents monitor and maintain a Forest Service gate for access to their properties. On numerous occasions this gate has been cut with acetylene torches, locks and chains have been shot to gain access, and chains and locks have been cut with bolt cutters and hack saws. Each time this has occurred, the residential community, not the Forest Service has repaired the damaged gate. If the gate below Joe Bar was removed it is clear Harlow Cabin would be destroyed by Forest Service neglect, a clear lack of law enforcement capacity, and the gate would never effectively close the area and protect its historic resources. It is also important to note that this same gate is protecting the Blue Ledge Mine site and repository from

vandalism, inappropriate public use, and other forms of damage to the remediation process and public safety.

Gates on Forest Service land are almost never effective and should not be analyzed as a solution, unless monitored regularly by local residents. The current gated closure on Elliott Creek as one of the only effective gated closures in the area, due not to Forest Service, but to the maintenance and monitoring of local residents.

Any assumption that gates near the Blue Ledge Mine will be effective is inaccurate and fails to consider the actual results of gated closures on the Rogue River Siskiyou National Forest. Other examples are the gated closures the Forest Service attempted to enact after the 2017 Abney Fire. Gates were placed on numerous local Forest Service roads including road 1055, 1035, and areas on both Middle Fork Applegate River and Carberry Creek. These gates were irreparably vandalized in a matter of weeks. The gated closure at the headwaters of the Middle Fork Applegate River, blocking access to the Hinkle Lake Botanical Area has been ineffective at reducing illegal off-road vehicle use for over 40 years, since approved as a closure in 1981. Not a single year since that time has the gate blocking access to Hinkle Lake been effective. The gate's lock or chain has been cut, the massive cement piers supporting the gate have been dug out of the ground, and acetylene torches have been used to cut the gate into pieces.

The Middle Fork Applegate River, directly adjacent to the Elliott Creek and Joe Creek watersheds where Blue Ledge Mine is located, has a long history of lawlessness. Vandalism of nearly all Forest Service infrastructure is rampant, heavy equipment has been stolen, trash is often illegally dumped, dispersed campsites are trashed, vegetation is destroyed, human waste is improperly deposited along streambanks, and the situation has been getting worse, year after year. Again, complaints to the Forest Service over the course of 40 years or more have been met with inaction and additional neglect. Multiple murders have occurred in the area and public safety is so seriously and regularly threatened that many in the community have abandoned the area and no longer recreate on Middle Fork or lower Elliott Creek below the current gated closure.

Analysis in the PHA that ignores long established human use patterns and realities fails to pass the laugh test. Analysis that assumes important monitoring and mitigation infrastructure at the Blue Ledge Mine will not be vandalized, damaged or destroyed is completely arbitrary and capricious. Any analysis claiming gated closures near Blue Ledge Mine and in remote locations on Joe Creek Road (1060) will be effective are unsupported by the experience of local residents and land managers, and fails to accurately consider existing conditions on the ground. The Forest Service essentially has no capacity and far too few staff to deal with these problems and analysis that claims law enforcement, signage or other Forest Service monitoring or enforcement measures will have any level of success in the Blue Ledge Mine area constitutes a total failure to adequate analyze these issues, a total failure to consider the existing conditions surrounding public use in the area, and a total failure to accurately or credibly analyze public use patterns and their potential impact to both public health and responsible

mine clean up measures.

Any failure to monitor toxic waste at the Blue Ledge Mine, even if associated with vandalism of property by Forest visitors has the potential to directly impact the public health and safety of residents Joe Bar community, directly below this Superfund mine site. We ask at the very least that the PHA accurately analyze the potential health threats associated with public use in the area which has absolutely not been done in the current PHA. We also state clearly that any mine waste that threatens our community due to vandalism based on public use, will create liability for the land management agencies facilitating this public access and ignoring real world impacts associated with public use in this area.

CDPH Response:
CDPH assessed potential exposures to recreational visitation on the site. Issues regarding vandalism, crime, or public use in the surrounding area are beyond the scope of the PHA. CDPH's obligation is to investigate past, current, and future exposures to site contaminants and assess if exposures place human health at risk.

Comment 26 **The analysis in the Public Health Assessment is based on faulty, unrealistic and overly optimistic assumptions regarding the Forest Service's ability to effectively managed dispersed public use in the area.**

As identified above the drainages above Applegate Dam including Joe Creek, Elliott Creek and Middle Fork Applegate River have a long history of vandalism, abuse, illegal dumping, violation of closure orders, damage to historic resources, ect. The current PHA dramatically overestimates the Forest Service's ability to implement effective closures and manage dispersed recreational use in the area. It also relies on this overestimation in the findings of the PHA. There is simply nothing to support these claims and ample information to demonstrate otherwise. The assumptions for analysis used to support the PHA and the dependency of PHA findings on effective closures, signage and other forms of Forest Service enforcement, education or regulation are faulty, unrealistic and do not reflect the realities or history of public use in the immediate area surrounding the Blue Ledge Mine Site. The agency cannot claim that closures will be effectively maintained or that infrastructure of any sort on the Blue Ledge Mine site can be maintained if public use of Joe Creek Road (1060) is re-initiated. Many years of history demonstrate this assumption is unrealistic, arbitrary and capricious.

CDPH Response
CDPH used established peer-reviewed science, available data, and realistic scenarios to investigate known and reasonable potential exposures. For more information on the process and tools CDPH used, please see ATSDR's online resource, Public Health Assessment Guideline (https://www.atsdr.cdc.gov/pha-guidance/index.html).

Assessing the US Forest Service's approaches to site enforcement or management is outside the scope of this PHA. CDPH's obligation is to investigate past, current, and future

exposures to site contaminants and assess if exposures place human health at risk.

Comment 27 **The analysis in the Public Health Assessment is based on faulty, unrealistic and overly optimistic assumptions regarding the Forest Service's actual law enforcement capacity in the region.**

As identified above the law enforcement capacity in the area is extremely minimal and federal law enforcement have little to no capacity or track record in maintaining closures, protecting Forest Service infrastructure, curtailing illegal dumping or other damaging or illegal activities in the Middle Fork or Elliott Creek watersheds. To assume otherwise, as is done in the PHA analysis of public use, is simply inaccurate and fails to address real, documented concerns with public use in the area. Gated closures and Forest Service infrastructure are routinely vandalized in this area and that reality was not incorporated into the PHA analysis.

Additionally, the Blue Ledge Mine site is still private land where the mine adits, settling pools and other infrastructure is located. Thus, federal law enforcement do not have jurisdiction to either allow or facilitate public use of this site (as is proposed by the Forest Service with their signage and proposed interpretive signs). They also do not have jurisdiction if the property is damaged or vandalized or if inappropriate public use is occurring. That jurisdiction would lie with the Siskiyou County Sheriff's office in Yreka, California and over two hour drive on freeways, highways, Jackson county roads, and gravel Forest Service access roads. Opening the dangerous Blue Ledge Mine with its toxic materials, important monitoring and remediation equipment, open mine adits, and private lands to additional public use is irresponsible and all analysis based on effective enforcement of regulations or law enforcement response is arbitrary and capricious, nothing in the historical record supports the position that law enforcement and signage will be effective or can be maintained with the minimal Forest Service Prescence in the area.

CDPH Response
Please see response to comment 26 above.

Comment 28 **The analysis in the Public Health Assessment is based on faulty, unrealistic and overly optimistic assumptions regarding the Forest Service's ability to maintain signage in the area.**

Many of the findings in the PHA rely on the assumption that effective signage will be maintained by Forest Service staff. This assumption is contrary to management of the Siskiyou Mountains Ranger District where very little effective signage remains anywhere in the district. Local Forest Service visitors regular shoot or otherwise vandalize or degrade signage all across this forest. To assume otherwise is arbitrary and capricious and fails to consider existing environmental and social conditions on the Rogue River Siskiyou National Forest. Signage placed at the Blue Ledge Mine site warning the public of public health and safety risks will not be effective and will not be effectively maintained by Forest Service staff or officials. To analyze otherwise is simply inaccurate

and farcical.
CDPH Response:
Please see CDPH's response to comment 20 above.

Comment 29 **The analysis in the Public Health Assessment is based on faulty, unrealistic and overly optimistic assumptions regarding the Forest Service's ability to protect or maintain infrastructure necessary to safely monitor, mitigate, or manage toxic materials at the mine area or at the repository site.**

As stated above any increase in public use or access at the Blue Ledge Mine or repository site will lead to vandalism. The assumption in the PHA that infrastructure can be safely maintained in the area fails to consider existing environmental and social conditions, as well as a long documented history of public use issues above the Applegate Dam on both Elliott Creek and the Middle Fork Applegate River. If monitoring equipment, remediation equipment and water treatment equipment or facilitates are damaged (which they most surely will be if public access is increased) threats to public health will undoubtedly increase. Public safety concerns associated with ineffective remediation, water treatment, or signage will also increase. This will increase and/or create unanalyzed public health threats to Forest Service visitors and residents in the nearby Joe Bar community.

For example, the existing infrastructure and repository site for the Blue Ledge Mine has already been subjected to theft and vandalism, deeming most equipment inoperable. The structures have been broken into and most meaningful equipment has been destroyed. This reality was not considered and the track record of federal law enforcement in mitigating this sort of vandalism is essentially without success in this area, including the Elliott Creek drainage and in the Middle Fork Applegate River. In these areas the public regularly flaunts regulations and behaves as they please without effective Forest Service enforcement. In fact, Forest Service law enforcement has very little ability to regularly patrol these areas and opening new areas with significant public health risks up to the public makes absolutely no logical sense. The current closure on lower Elliott Creek is the only effective and responsible option.

CDPH Response:
Please see CDPH's response to comment 26 above.

Comment 30 **The Public Health Assessment appears to promote public use, signage and the Forest Service has proposed interpretative trails on private land where they do not have this jurisdiction.**

The PHA should not even consider allowing public use to the mine sites or repository for the Blue Ledge Mine remediation operation. Many valid reasons inform this position and an evaluation of actual historic public use and law enforcement effectiveness patterns in this region supports continued gating and closure on lower Elliott Creek. This is the only effective means of protect both Harlow Cabin and the Blue Ledge Mine from damaging

public use. It is also the only way to adequately protect public safety.

Yet, the Forest Service and others irresponsibly increased public use at the Superfund site, which is inherently problematic, and is not adequately considered in the PHA. Simply put any level of public use on a Superfund site comes with unacceptable and unnecessary increases public health risk, and should be immediately withdrawn or discontinued.

Additionally, the mine sites in questions are located on private land, where the Forest Service does not have jurisdiction to promote public use or trespass. To do so would be to encourage illegal activity. It would also appear to create a significant public health liability and this liability should squarely fall with the agency's facilitating additional public access to the site.

CDPH Response:
The document's purpose was to investigate public health implications of potential exposures to environmental contaminants. Known and reasonable exposure scenarios were used. Assessing the US Forest Service's approaches to site enforcement or management is outside the scope of this PHA, as are jurisdictional issues.

Comment 31 **The analysis in the Public Health Assessment failed to adequately or accurately consider the potential human health impacts associated with touching, breathing, or swallowing on site sediments found in treatment ponds. (P. 6)**

The PHA inaccurately assumes that signage posted on site will be maintained, as discussed earlier this assumption is patently inaccurate and fails to consider the actual reality of existing environmental and social conditions in the area. It also assumes that Forest Service visitors will a) adhere to posted warnings or b) observe signs of water or soil contamination on site and voluntarily refrain from drinking toxic water or disturbing sediments, stirring up toxic fugitive dust. This is patently inaccurate.

The assessment downplays the risk of human contact with water and dust on site, while also admitting that they do not know the impacts of touching, breathing or swallowing site sediments. The findings of the PHA ignore and contradict this important admission and claim, apparently without merit or supporting data that site sediments and fugitive dust will not threaten public health. If we cannot be certain that site sediments will not impact human health, we should act with an abundance of caution and close the site to public use. Closure has been effective on lower Elliott Creek Road below the community of Joe Bar and should be maintained in that location.

CDPH Response:
Please refer to CDPH's response to comment 20 regarding the posting of signs. The PHA does analyze the potential of visitors incidentally touching site surface soils and discusses why dust would be an unlikely risk (refer to Sections 6.1 and 7.1 of the document).

Regarding sediment, in September 2022, USEPA collected six sediment samples collected

from the dry drainage ponds and analyzed each for metals. CDPH evaluated the results and provided a discussion in section "7.5 Onsite Treatment Ponds" of the PHA Final Release.

Comment 32 **The analysis in the Public Health Assessment demonstrates that water in Joe Creek coming from the Blue Ledge Mine can permanently damage human eyes and the cornea through contact.**

This finding demonstrates clearly that casual and limited public use can have lasting and in fact, permanent public health, and safety impacts. How can the area be safe for public use when contact with your eyes can be damaging? The PHA contradicts itself by saying the limited recreational use of the Joe Creek area will not have lasting public health impacts, when permanent damage to the cornea is a document effect. The PH of the water in the area around the mine is extreme and no effective remediation measures have been proposed or implemented to mitigate the problems with PH and the potential damage to human health it poses. If casual use of Joe Creek near the mine site can leave permanent damage to someone's eyes, access should be limited by maintaining the existing gated closure on lower Elliott Creek. It seems that permanent damage to the eyes of dogs, horses or cattle could also occur, while wildlife could sustain similar impacts. The public health and safety situation at Blue Ledge Mine includes unacceptable and unnecessary risks that could be better managed through limitations on public use, not through signage and increased levels of access. Again, all liability should be place on the Forest Service and other agencies providing public access without adequately considering the risk to human health associated with public use.

CDPH Response:
To clarify, the PHA states on-site water originating from mine adits and groundwater seeps can be acidic and could irritate the eyes from direct contact, not water in Joe Creek. Given that water originating from mine adits and groundwater flow into the engineered drainage pond, signs were posted along the treatment ponds to deter visitors from entering.

Comment 33 **The analysis in the Public Health Assessment failed to adequately consider the potential human health impacts associated with eating beef produced by federal land allotments in the Blue Ledge Mine area.**

The PHA completely fails to consider the impact to public health surrounding federal cattle grazing in the Joe Creek and Blue Ledge Mine area. In the summer of 2021, cattle were congregating in the area around Blue Ledge Mine and when the Forest Service was notified of this problem the agency claimed that being part of a grazing allotment, they were therefore not obligated to address the issue or even identify whose cattle they might be.

This demonstrates that cattle are congregating and spending significant amounts of time in the Blue Ledge Mine site, potentially drinking contaminated water and eating

contaminated vegetation. These cattle are in turn sold at auction and slaughtered for human consumption.

The public eating this beef, have no way of knowing the potential contamination of the beef they are consuming. This beef could be eaten by children, elder folks, or folks with existing medical conditions. The PHA completely fails to consider this direct threat to public health or the impact on the public who may inadvertently be consuming contaminated beef. No cattle were monitored in the area, no beef was tested and the potential impact to the food supply and to individuals consuming this contaminated beef went entirely unaddressed in the PHA. We find this failure to analyze both arbitrary, capricious, and irresponsible given the unknowns surrounding the consumption of contaminated "free range" beef grazing on site.

CDPH Response:
Please refer to CDPH's response to comment 13 above.

Comment 34 **The analysis in the Public Health Assessment failed to adequately consider the potential human health impacts associated with eating deer, elk or other hunted animals that have been contaminated by the Blue Ledge Mine site.**

Like grazing cattle deer, elk and other huntable and consumable wildlife may be impact by eating contaminated vegetation or drinking contaminated water at the Blue Ledge Mine site or at the repository. The PHA completely failed to consider this threat to human health and safety, while the Forest Service specifically proposes opening up the site for hunting access. This failure is arbitraty and capricious, and represents yet another unanalyzed public health risk associated with the Blue Ledge Mine and remediation activities on site. No information in the PHA addresses this concern or this potential public health risk.

CDPH Response:
Please refer to CDPH's response to comment 12 above.

Comment 35 **The analysis in the Public Health Assessment failed to adequately consider the potential human health impacts associated with public use on Joe Creek.**

The assumption in the PHA is that Joe Creek is not a favorable location for swimming or recreational activities (PHA P. 12), yet this assumption is untrue for various reasons. 1) Lower Joe Creek adjacent to the Joe Bar community is highly accessible by a road bridge and contains interesting and appealing bedrock features. 2) The shallow, more slow-moving water is favorable for wading by children upstream of "Zebra Rocks" 3) Historically residents would utilize lower Joe Creek for creek access and 4) Historically the public utilized lower Joe Creek just above the private land on Elliott Creek for stream access and; 5) on the west side of Joe Creek, Joe Bar residents have access and trails

leading to "Lara Spring" and lower Joe Creek where public use of Joe Creek does occur. The assumption that the public does not use lower Joe Creek is inaccurate and has the potential to skew results or findings regarding public health impacts. This is a common creek access on public land for Joe Bar residents. The assumption that the public is not using lower Joe Creek is faulty and inaccurate.

CDPH Response:
CDPH assessed potential exposure to swimming in the Zebra Rock area, which is adjacent to the confluence of Elliott Creek and Joe Creek. The assumption regarding the public using Joe Creek is based on conversations with Joe Bar residents, USEPA staff, USFS staff, and observations of dense vegetation, steep slopes, and rough creek terrain observed during site visits.

Comment 36 **The analysis in the Public Health Assessment failed to adequately consider the potential human health impacts associated off-road vehicle use.**

On page 16 the PHA assumes that the steep terrain would reduce exposure to off-road vehicle enthusiasts and therefore did not require analysis. Yet, this assumption is untrue, off-road vehicle use is not uncommon in the area and often occurs on steep, rocky, difficult terrain in this area.

In fact, off-road motorcycling is common and can occur in very steep, difficult terrain. In fact, the repository has in the past been impacted by illegal off-road vehicle use, which could damage the liner or other aspects of the remediation site. This use is also likely to occur in both wet and dry stream channels and settling pond areas near the mine site.

The assumption that such use need not be analyzed is inaccurate and does not reflect existing use patterns in our area. In dry settling ponds, off-road vehicle use could stir up significant fugitive dust which would become air borne and could cause human health risks for off-road vehicle enthusiasts and others in the surrounding area. The infrastructure and primitive bridge at the Blue Ledge Mine site will attract off-road vehicle use, rather the discourage it and signage identifying the area as closed will also encourage off-road vehicle use. History demonstrates that in the upper Applegate area, signage telling the public not to do something often has the opposite effect. The analysis in the PHA regarding the impact of off-road vehicle use is inaccurate and does not consider the human health concerns this activity can cause when it occurs on the Blue Ledge Mine site or at the repository site. It also fails to consider the damage off-road vehicle use could pose to bioremediation and monitoring infrastructure.

CDPH Response:
CDPH received no evidence or documentation of on-site off-road vehicle use by Joe Bar residents, the USEPA, or US Forest Service. CDPH did not assess the repository in the PHA. If off-road vehicles are observed on the site, CDPH recommends contacting the USEPA and US Forest Service and providing this information.

Comment 37 **The analysis in the Public Health Assessment failed to adequately consider the potential human health impacts associated with the ungated adits still present at the Blue Ledge Mine site.**

The Blue Ledge Mine site contains numerous ungated adits. At a recent field tour in the area EPA officials mentioned recent youtube videos showing individuals entering ungated mine adits at the Blue Ledge site. This video also encouraged others to do the same. These adits are an unanalyzed public health risk in the PHA.

They are particularly concerning given the notoriety of this mine, the remote area in which it is located, and its location in the state of California. Many of these mines have vertical shafts and could collapse when entered by the public. The mine site remains private land and the jurisdiction of the Siskiyou Country Sheriffs office, if individuals enter ungated mine adits, get lost, stuck, or injured, law enforcement and Siskiyou County search and rescue teams are over two hours away. This potential human health risk associated with these ungated adits was not considered at all in the PHA.

CDPH Response:
CDPH reviewed the recent 2021 video posted by "Charley Adventures". The video shows that site visitors were unable to access adits due to steep terrain nor were they able to enter the adits with steel gates.

To the best of CDPH's knowledge, the Blue Ledge Mine site has horizontal adit shafts and all potentially accessible adits are blocked with thick steel gates.

Comment 38 **The Public Health Assessment analysis of irrigation at Joe Bar was entirely inadequate and failed to accurately consider the risks involved with eating produce from gardens watered from Elliott Creek**

The PHA tested only lettuce and radishes from gardens at Joe Bar irrigated with water from Elliott Creek. Yet, both these species are short lived spring annuals that do not have a tendency to accumulate heavy metals or other contaminants. Residents in the area are aware that cucurbit species hyper accumulate metals and other contaminants in water and garden soils.

We had specifically asked that cucumbers or squash watered throughout the growing season be tested to most accurately depict potential human health impacts associated with garden produce on Elliott Creek. Instead of testing cucurbit species that accumulate contaminants and live in gardens soils for extended period, the agency tested radishes that are often only in the ground for a month or so and lettuce that quickly bolts and is unusable. We do not believe that the current testing protocol accurately considered potential risks to our community from irrigation and the contamination of garden produce. The current analysis is incomplete and does not address the concern brought forward by local residents regarding the consumption of locally grown cucurbit species. Finally, we also believe the sample size of 5 radishes and two lettuce samples is entirely

inadequate to draw the conclusion that irrigation from Elliott Creek poses not human health risk.

CDPH Response:
Please see CDPH's response to comment 18 above.

Comment 39 **The analysis in the Public Health Assessment failed to consider that nearly all public use on Joe Creek Road is focused on the Blue Ledge Mine and adjacent Joe Creek.**

The historic nature of the mine and its naming on local maps concentrates use on Joe Creek in the contaminated mine area. It is also the only portion of Joe Creek Road that both contains year round water and flat landings or pullouts to park or camp. This again funnels all public use to the private lands and the contaminated soils and streams at the Blue Ledge Mine site.
Individuals utilizing Joe Creek Road will spend disproportionate amounts of time at the Blue Ledge Mine site and concentrating use at a Superfund site is inherently inappropriate and risky to human health. We ask that you discourage these unnecessary risks by maintaining the gated closure on lower Elliott Creek. If additional or secondary gates are needed, they could be included in addition to the existing gate system.
CDPH Response:
CDPH concluded that it is safe to recreate on the site and visitors should avoid the drainage ponds. Regarding gate closures, this comment is beyond the scope of the PHA. CDPH's obligation is to investigate past, current, and future exposures to site contaminants and assess if exposures place human health at risk.

Comment 40 **Sediment sampling following the 2010 adit release was inadequate.**
The PHA claims that sediments from the 2010 adit release were found in proximity of the Joe Bar community, but those sediments clearly settled somewhere either on Elliott Creek or in Applegate Reservoir. The assumption that the adit release and sediment from it is not a threat to public health is faulty and inaccurate. The stream was at low flow when the release took place and sediments certainly dropped out of the slow-moving water column as they moved downstream from the Blue Ledge Mine. Even if those sediments did not accumulate in riparian soils near Joe Bar, they had to have dropped out or settled somewhere in the system. It is likely these contaminants are now found in the Applegate Reservoir where they could do additional damage to the environment or public health.

This is especially important because recently cross-country off-road vehicle use has become popular as the Applegate Dam recedes. If sediments turn to fugitive dust stirred up by off-road vehicle use, that material could impact individuals recreating nearby or the off-road vehicle users themselves. The sediment material was deposited somewhere after the adit release, yet the agency has not investigated or found where they might be. This is another inadequately analyze human health risk in the PHA. Additionally, the sample size utilized to test the contamination of riparian sediments associated with the mine adit release is insufficient to draw the types of conclusions drawn in the PHA.

CDPH Response:
Regarding the 2010 adit release, please see CDPH's response to comment 8.

Issues related to Applegate Reservoir or Applegate Dam, which are located in Oregon should be directed to the Oregon Health Authority. CDPH's analysis of metals in Applegate Reservoir fish was specific for Joe Bar residents and a request by the USEPA.

Comment 41 **Conclusion:**
In general, I do not believe it is appropriate from either a remediation or public health and safety standpoint to increase public access to the Blue Ledge Mine site or the repository site. There is simply too much risk involved with that access and the mine site itself remains private land, where encouraging trespass is inappropriate. As one of the only nearby residents, I believe every step should be taken to remediate the area's toxic legacy, monitor the sites human and environmental health concerns, and limit public health risk exposure by effectively limiting access to the site. I also believe more analysis is needed to sufficiently identify the public health risks associated with the Blue Ledge Mine. Please review my comment and re- evaluate public health and safety risks as identified in the comment above.

Thank you for the opportunity to comment
(CDPH deleted personal signature information)

CDPH Response:
Thank you for submitting comments. CDPH encourages you to remain involved and provide valuable feedback to USEPA and USFS as the agencies continue mitigating and managing the Blue Ledge Mine Superfund site.
Comments submitted by the California Department of Toxic Substances Disease Control (DTSC):

DTSC's Human and Ecological Risk Office

Comment 42 **Toxicity Criteria**: The California Toxicity Criteria for Human Health Risk Assessments, Screening Levels, and Remediation Goals rule (TCR), which was promulgated in 2018, should be used in the PHA. The TCR requires that human health risk assessments, risk-based screening levels, and remediation goals apply a specified hierarchy of toxicity criteria as ARARs pursuant to the Hazardous Substances Account Act (Health and Safety Code [HSC] §25300 et seq., "Chapter 6.8"). These required toxicity criteria are summarized in DTSC's Human Health Risk Assessment (HHRA) Note 10 and the screening levels utilizing these toxicity criteria are summarized in HHRA Note 3. Please see HEROs website https://dtsc.ca.gov/human-health- risk-hero/ for the most current versions of these documents.

a. Included in Table B of Appendix I is the benchmark incremental change in blood lead of 1 microgram per deciliter (µg/dl). This is the standard that should be used when evaluating exposures to lead in soils, sediment, and surface waters. The PHA uses the Centers for Disease Control (CDC) reference values of 3.5 µg/dl and 5 µg/dl. Multiple scenarios presented in the PHA result in estimates of blood lead that exceed the 1 µg/dl benchmark.
b. Arsenic is included in Table A of Appendix I of the TCR with specific toxicity criteria that should be used in the PHA. The cancer slope factor for arsenic is 9.5 $(mg/kg/day)^{-1}$ as compared to the slope factor used in the PHA of 1.5 $(mg/kg/day)^{-1}$. The risk assessments should be updated using the promulgated toxicity criteria for arsenic.

CDPH Response:
CDPH prepared this PHA under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry. CDPH uses methods and procedures approved by ATSDR and USEPA.

USEPA and ATSDR support the use of the 1.5 $(mg/kg/day)^{-1}$ cancer slope and the CDC reference level of 3.5 ug/dL. The IEUBK and the Adult Lead Model models cannot be run with a benchmark of 1ug/dL because they will report a safe value less than zero.

Comment 43 **Evaluation of Blood Lead Levels**: HERO does not concur with the use of the IEUBK and Adult Lead Model (ALM) to predict blood lead levels. Kinetic models such as these are based on steady-state blood lead levels averaged over an extended period; typically, three months. The exposure frequency used in the PHA is 14 days/year for the recreational visitor. The kinetic models are not applicable to this type of intermittent exposure. In a more standard exposure scenario, HERO recommends the use of LeadSpread 9 to predict blood lead levels rather than the IEUBK and ALM.

CDPH Response:
USEPA and ATSDR support the use of the IEUBK and ALM as the best models to assess recreational exposure, which cannot be run using maximum concentrations. The exposure frequency used in the PHA was derived using USEPA's time-weighted factor approach (section 6.4). Additionally, CDPH (and USEPA) is unaware of LeadSpread 9 being used for recreational exposure scenarios.

Comment 44 **Exposure Duration**: HERO notes that the exposure duration of 33 years for an adult receptor in the calculation of cancer risk is atypical. Standard risk assessments assume a 26 year exposure duration for the calculation of cancer risk for residential receptors (6 years as a child and 20 years as an adult). Additionally, the typical averaging time for cancer risk is 70 years as compared to the 78 years used in the PHA.

CDPH Response:
Per comment 42, CDPH used ATSDR's more conservative duration exposure scenarios.

HERO recommends that the PHA be revised to be consistent with California requirements for human health risk assessments. Please let me know if you have any questions or if you'd like to discuss further.

CDPH Response:
Per comment 42 above, CDPH prepared this assessment under a cooperative agreement with ATSDR, which encourages using the approved methodology by the ATSDR and USEPA, which are protective of public health. Thank you for your comments.

DTSC's Ecological Risk Assessment Section

ERAS reviewed the PHA and determined that ecological risks were not evaluated in this document. ERAS therefore has no technical comments and defers technical review of human health risk considerations to the assigned HERO human health toxicologist.

SPECIFIC COMMENTS:

Comment 45 List of Abbreviated Terms. Formatting errors in this section should be corrected so that the definition for each abbreviation starts on its own line.

CDPH Response:
CDPH reviewed and corrected formatting errors.

Comment 46 Section 6.1.2 Noncancer evaluation of individual and combined exposure. The abbreviation "MRL" is not defined in the main body of the text. The abbreviation "RfD" is used in the main text before it is defined in the footnote of Table 6.1.2. These two abbreviations should be defined in the main text where they first appear.

CDPH Response:

CDPH corrected the issue. Thank you for your comment.

Comments submitted by the US Environmental Protection Agency,

General Comments

Comment 47 This is a great document because it is formatted to answer the most frequently asked and pressing questions that the public will have. Often times, other human health risk assessments I have reviewed are too technical to be of service to the general public. The summary on pages 5-8 gives people the answers the want to know so they can make informed decisions about their recreational activities at the site.

CDPH Response:
Thank you for your comment.

Section 4-

Comment 48 First bullet should not read mine tailings. Technically, tailings are a waste product that is generated after the ore is processed. No ore was processed onsite at Blue Ledge, it was transported to Tacoma Washington for processing. Please use mine waste or waste rock instead.

CDPH response:
CDPH deleted the phrase "mine tailings". No additional text was added since the following text, "WRP", which denotes "waste rock pile".

Section 5-

Comment 49 Standard exposure duration values for EPA risk assessments are 70-year lifetime and 26 years of exposure. However, EPA has no objection to using a 78-year lifetime and 33 years of exposure since people live longer now than when EPA's average lifetime and exposure duration values were created.

CDPH response:
CDPH uses ATSDR preferred exposure time scenario durations.

Section 7-

Comment 50 First paragraph- "Future exposures are expected to be similar to present exposures since the site has been remediated". Consider a sentence after this that explains that additional remediation may occur in the future to further treat AMD discharge from the adits that may further reduce contamination levels.

CDPH response:
CDPH agrees this is important information to include. Since the exact method, focus, and time of future remediation efforts is currently unknown, CDPH included the following statement: "Additionally, future site remediation efforts may reduce levels of contamination and therefore, potential exposure risks."

Comment 51 7.2- Please include a statement that people might be exposed to fugitive dust if riding OHV vehicles at the site. However, due to the steep terrain it is unlikely that OHV riding occurs near the former waste rock piles.

CDPH Response:
Given that the site's steepness will deter OHV operators, adding the suggested statement will only unnecessarily emphasize an unreasonable exposure pathway, which could create confusion for the reader.

Comment 52 7.3 The maximum concentrations of copper observed at the confluence of the AMD drainage channel and Joe Creek likely represent high flow conditions at the site. There are large seasonal variations in COC concentrations throughout the site and concentrations are highest during spring runoff and heavy rain events that increase flow.

CDPH Response:
Thank you for providing this information.

Section 8-

Comment 53 First paragraph- The statement "Elliott Creek is not used for potable water" may need to be reconsidered. EPA has had a conversation with one new property owner that says he plans to draw directly from the Creek for drinking water and use a POU filtration system to treat the water. The individual does not reside in Joe Bar, but plans on building a residence there in the future. He may also drill a well, but since they are expensive, he plans to pull water directly from Elliott Creek in the interim.

CDPH Response:
CDPH suggests that if the potential Joe Bar resident does proceed with a plan to obtain water from Elliott Creek or drill a well, the USEPA should collect a water sample and discuss the findings with the potential future resident.

Comment 54 8.1 – EPA will consider collecting surface water samples from "Zebra Rock" and the former USFS gauging station bridge in summer 2023 since these are popular swimming areas where exposure is most likely to occur, and samples have not been collected from these locations for over 10 years.

CDPH Response:
Thank you for the information.

Comment 55 8.1.1 The assumption that a child might spend 180 days a year swimming at the site during the warm and dry months seems very unlikely.

CDPH Response:
This scenario is based on conversations with Joe Bar residents that conveyed the possibility that their grandchildren could reside on their property during the length of the warmer dry seasons.

Comment 56 8.1.4- Please provide some additional context to help the reader understand how a river being turned orange for a week doesn't necessarily mean that the water is toxic. This is likely due to high iron concentrations in the AMD discharge. It would be good to reinforce that the optics don't always correlate with health risks.

CDPH Response:
Thank you for including this comment. CDPH notes for the record that excessive iron could very likely cause water to turn orange.

Comment 57 Blood Lead Level calculations- Individual exposures such as eating vegetables irrigated with water from Elliott Creek or incidental ingestion of water while swimming at Seattle Bar are not expected to raise a child's BLL above the CDC reference level of 3.5 ug/dL. However, the cumulative impact from exposure to multiple media at multiple locations throughout the site might cause a child's BLL to exceed the CDC reference level under the worst case scenario. It is important to note that the exposure assumptions were extremely conservative and likely do not represent actual exposure at the site. For example, the assumption that a child might spend 180 days a year swimming for 90 minutes each day at the site seems unlikely.

CDPH Response:
CDPH notes the scenarios are conservative in the PHA document, and agrees the likelihood of exposure to multiple lead sources assessed in the document are not likely.

Section 9-

Comment 58 EPA collected drinking water samples from Joe Bar residences in April and June 2021 and suggests that they are included in the PHA.

CDPH Response:
CDPH made the following change: "Water samples were collected from the residences at various times of the year from 2008 to 2021". Note, the analysis and findings did not change.

Section 10-

Comment 59 This is a great concise explanation of the limitations of the PHA. It is written in an accessible way that community members can comprehend.

CDPH Response:
Thank you for this comment.

Section 12-

Comment 60 EPA will provide sediment sample data from the Blue Ledge treatment ponds so CDPH can assess whether touching, breathing, or swallowing on-site sediments from treatment ponds might be harmful to recreational visitors. EPA expects to be able to provide the data to CDPH by the end of this calendar year or sooner.

CDPH Response:
Thank you for this information.

Comment 61 EPA suggests mentioning how low pH water in the drainage channel could damage the cornea. Since this is the most alarming health effect mentioned in the report, it bears repeating in the conclusions section.

CDPH Response:
CDPH disagrees that this information necessitates adding an additional conclusion.

Comment 62 There should be a statement about eating fish from Applegate Lake with a referral to the Oregon Health Authority and Appendix C. Consider the following statement: "EPA is actively investigating whether Blue Ledge Mine is contributing to elevated levels of mercury in Applegate Lake. At this time the Blue Ledge Mine is not believed to be significant source of mercury in the Applegate Lake.

CDPH Response:
The conclusions listed in Section 12 are only for exposures assessed within the document. A reference to the Oregon Health Authority and Appendix C is provided in section 8.2. Due to the nature and focus of PHA work, PHA documents do not include discussions regarding ongoing source investigation efforts.

Section 13-

Comment 63 In short, EPA agrees with all of the recommendations in section 13 and is working to complete the recommendations as expeditiously as possible.

- EPA will continue to monitor runoff from Blue Ledge Mine for metals.

CDPH Response:
Thank you for this information.

Comment 64 EPA will post signs at the Joe Creek and AMD confluence to discourage recreational visitors from drinking water from that location. EPA expects that the signs will be installed by the end of September 2022.

CDPH Response:
Thank you for this comment.

Comment 65 There is a typo in the second bullet. It should read "Joe Creek" not "Joe Bar Creek".

CDPH Response:
Thank you. The typo was corrected. Please note, this item was moved to "Actions Completed".

Comment 66 EPA will collect sediment sampled from dried treatment ponds.

CDPH Response:
Thank you for the information.

Comment 67 EPA can support CDPH in providing educational information on reducing lead exposure and water filtration devices.

CDPH Responses:
CDPH appreciates USEPA support.

Section 14-

EPA concurs with this Public Health Action Plan. However, EPA requests the following additions to the plan:

Comment 68 Include informational outreach to Joe Bar residents on reducing lead exposure and water filtration devices.

CDPH Response:
CDPH visited the Joe Bar residents in July 2022 and provided health information related to private well water. CDPH will be unable to visit the Joe Bar residence in the future.

Comment 69 Host a virtual training for USFS staff that interface with the public to build their capacity to inform recreational visitors of potential risks.

CDPH Response:
USFS staff have not requested this training. CDPH's Blue Ledge mine fact sheet, which has been provided to USFS staff, provides the PHA's findings and recommendations.

Comment 70 Research and address additional public health concerns at the site raised by the community. One such concern is whether cattle grazing on the site are safe for human consumption.

CDPH Response:
Please see comments and provided from Joe Bar community members in Appendix D, specifically Joe Bar resident commenter #1's, "Public Land Grazing" comment.

Comment 71 Figures - The photo quality on the figures is very low and they are difficult to read. Please use higher resolution photos. EPA can provide site photos upon request.

CDPH Response:
Both Figures 3 and 5 were inserted with higher resolution photos.

Comment 72 Figures How do these figures show the accessibility of the site? EPA recommends updating the satellite image for Figure 5 as the topography and roads have changed since 2014. Consider including the following statement regarding site accessibility: "The site is located in remote and rough terrain. Many of the roads used during the 2011 USFS removal action have been decommissioned and are now overgrown. However, determined recreationalists may still access the site." Being vague may be better as it is not EPA or the USFS' goal to publicize the site as a destination for recreation at this time.

CDPH Response:
CDPH updated Figure 5. Information related to USEPA's or USFS's intention for the site is outside the bounds of the PHA.

Comment 73 EPA recommends specifying what constitutes a serving of fish in the summary of the 2015 Health Consultation for fish consumption from Applegate Lake.

CDPH Response:
Based on communications with Joe Bar residents, CDPH assumed adults could consume 100 grams of fish per day and a child 50 grams of fish per day. This information has been added to the text in Appendix C.

Comments submitted by the Oregon Health Authority
Oregon Health Authority's Environmental Health Assessment Program (EHAP, our state's ATSDR cooperative agreement partner) have read your Public Health Assessment for your Blue Ledge Mine site.

Comment 74 Page 14: Change bolded text to "risk assessment equations."

CDPH Response:
The sentence you are highlighting is aimed at describing the process used to evaluate exposures, therefore, the bolded text should remain, "Evaluation Process".

Comment 75 Page 15: This is a good assessment of who visits the site. Since it's so remote, it's not likely that young children would be there, and people aren't likely to be there every day.

CDPH Response:
CDPH appreciates the comment.

Comment 76 Page 18: Table 6.1.1, Did you use the Public Health Assessment Screening Tool to screen and do risk assessment? I don't see reference to it in the document. It may be good to do

your runs through that because I've found that sometimes the most recent CVs/MRLs in PHAST are not reflected in the PDFs we used to get.

CDPH Response:
CDPH did use ATSDR's Public Health Assessment Screening Tool (PHAST) in this public health assessment. PHAST is referenced in Appendix C tables 4.1, 4.2, 7, 8,10, 12, and 13.

Comment 77 Page 19: Section 6.1.3, This section for describing cancer risk is a little short. We have a good writeup that illustrates how this risk is in addition to the 400,000 out of a million people who will get cancer in their lives. It's in our PHA for Bullseye Glass, page 43. Here's the link:
https://www.oregon.gov/oha/ph/healthyenvironments/trackingassessment/environmentalhealthassessment/pages/bgfsite.aspx

CDPH Response:
Similar information to that found in the Bullseye Glass PHA on page 43 (expressing that a cancer risk is the risk above the general background population cancer risk) is found on page 19 of this PHA. Section 6.1.3 is a focused discussion about the cancer evaluation conducted for exposure to on-site soil.

Comment 78 Page 27: OHA has a fish advisory in Applegate Reservoir due to mercury. We didn't ascertain if it was from the mine or not. Here's a link to it:
https://www.oregon.gov/oha/ph/healthyenvironments/recreation/fishconsumption/pages/fishadvisories.aspx#southwest

CDPH Response:
Thank you for sharing the link.

Comment 79 Page 29: We've found that saying "not a health concern" can ruffle feathers. Can you change it to "the organic forms of arsenic won't harm a person's health in the same way as inorganic arsenic.

CDPH response:
The current CDPH statement clearly communicates the accepted science that exposure to arsenic in the organic form does not present a health concern, whereas exposure to arsenic in the inorganic form does. The statement presented in your comment suggests that exposure to either form could harm health, just in different modalities.

Comment 80 Page 31: Section 8.1.3, First Paragraph, we frequently cited that while plants can uptake some metals, it is not to a significant degree. We have some language on this in the Bullseye PHA I referenced, page 55.

Also, this is optional: when we get questions of "is my garden safe to eat from?" we often include healthy gardening practices, even if there's no health risk from the vegetables. Exposures can happen from coming into contact and ingesting soil particles that cling to roots and vegetable surfaces. Soils around homes can have lead, PAHs, dioxins, etc. from multiple sources. We make general recommendations about wearing gloves, washing

vegetables, and not tracking in dirt. Take a look at our Healthy Gardening fact sheet: https://www.oregon.gov/oha/ph/HealthyEnvironments/HealthyNeighborhoods/HealthyGardening/Pages/index.aspx

CDPH Response:
Thank you for the information.

Comment 81 Page 35: Table 9.1, We do the same with well water, we use MCLs instead of CVs.

CDPH Response:
Thank you for the information.

Comment 82 Page 37: Recommendations, this is another optional thing, and it might not pass muster in a certified document: we have put healthy gardening recommendations (mentioned above) in here, even when there's no harm to health from the site.

CDPH response:
This is helpful. CDPH will pass the gardening recommendations to interested community residents.

Comment 83 Page 37: Bullet no. 3. Touching, beathing, or incidentally swallowing contaminants in on-site surface soil or sediment presently or in the past at the Blue Ledge Mine site is not expected to harm the health of recreational visitors walking on the site. Spelling mistake - "beathing" should be changed to "breathing".

CDPH Response:
Thank you, the item was corrected.

Comment 84 Page 37: Bullet no. 4. Accidentally swallowing water while swimming in Elliott Creek or the Applegate River is not likely to harm or have harmed the health of recreational visitors in the presently or in the past. "presently" should be changed to "present"

CDPH Response:
Thank you, correction made.

Comment 85 Page 37: Bullet no. 5. Eating fish caught in Elliot Creek is not expected to harm or have harmed the health of recreational anglers or Joe Bar residents in the presently or in the past. Consider using "recreational fishing" instead of "recreational anglers"

CDPH Response:
Anglers refers to a specific population, not a specific activity such as "fishing".

Comment 86 Overall, this is a really good PHA! The exposure pathways are well thought out, and there's definitely nothing I can say is missing.

CDPH Response:
Your comments are very much appreciated.