Public Health Assessment

Final Release

Evaluation of Exposure to Contaminants at the

NEW IDRIA MERCURY MINE SUPERFUND SITE

SAN BENITO COUNTY, CALIFORNIA

EPA FACILITY ID: CA0001900463

Prepared by
California Department of Public Health

JULY 7, 2016

Prepared under a Cooperative Agreement with the
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry
Division of Community Health Investigations
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.

PUBLIC HEALTH ASSESSMENT

Evaluation of Exposure to Contaminants at the

NEW IDRIA MERCURY MINE SUPERFUND SITE

SAN BENITO COUNTY, CALIFORNIA

EPA FACILITY ID: CA0001900463

Prepared by:

California Department of Public Health
Under Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

Table of Contents

List of Figures

List of Tables

List of Acronyms

A description of some of these terms can be found in Appendix A. Glossary of Terms.

µg—microgram, or one-millionth of a gram (0.000001 gram)
µg/m^3—microgram per cubic meter
AMD—acid mine drainage
ATSDR—Agency for Toxic Substances and Disease Registry
BLM—Bureau of Land Management
Cal/EPA—California Environmental Protection Agency
CDPH—California Department of Public Health
COCs—contaminants of concern
CREG—cancer risk evaluation guide for one in a million excess cancer risk (ATSDR)
DHHS—Department of Health and Human Services
DTSC—California Department of Toxic Substances Control
EMEG—Environmental Media Evaluation Guide (ATSDR)
Agency
IARC—International Agency for Research on Cancer
kg—kilogram
LOAEL—lowest-observed-adverse-effect level
MCL—maximum contaminant level for drinking water (state and federal)
mg—milligram
mg/kg/day—milligram per kilogram per day
MRL—minimal risk level (ATSDR)
NA—not analyzed
ND—not detected
NOAEL—no-observed-adverse-effect level
NPL—National Priorities List (USEPA)
PHA—public health assessment
ppm—parts per million
ppb—parts per billion
PRGs—preliminary remediation goals (EPA)
RfC—reference concentration (USEPA)
RfD—reference dose (EPA)
REL—reference exposure level
RMEG—Reference Dose Media Evaluation Guide (ATSDR)
RWQCB—Regional Water Quality Control Board
USEPA—U.S. Environmental Protection Agency

1.0 Summary

PURPOSE	The California Department of Public Health (CDPH) and the Agency for Toxic Substances and Disease Registry (ATSDR) aim to provide the community near the New Idria Mercury Mine the best information possible to safeguard its health. This Public Health Assessment (PHA) examines whether past, present, or future exposures to contaminants from the New Idria Mercury Mine could harm people's health. It recommends actions to reduce or prevent exposures and to protect the community's health. CDPH evaluated the available environmental sampling data collected from air, mine tailings (dust), water, and sediments near the New Idria Mercury Mine.
BACKGROUND	The New Idria Mercury Mine site ("the Site") is located in the abandoned town of Idria in San Benito County, California, a sparsely populated area approximately 135 miles southeast of San Francisco on the eastern slopes of the Diablo Mountain Range. The New Idria Mercury Mine operated from approximately 1854 to 1972 and built its first brick furnace to produce mercury in 1857. Ore containing cinnabar (mercuric sulfide [HgS]) was crushed and roasted in large furnaces to release elemental mercury vapor that was cooled, condensed, and bottled in iron flasks, each one containing 76.5 pounds of mercury. The Site is now a recognized California Historical Landmark and "ghost town" that attracts an unknown number of recreational visitors to its abandoned buildings, including a general store and the rotary furnace building, a prominent structure at the Site. Currently the Site has signage that warns of the hazardous conditions and is partially fenced, restricting access to most of the abandoned buildings, including the furnace building. In 1996, the Coastal Advocates (a nonprofit environmental advocacy group) petitioned the United States Environmental Protection Agency (USEPA) to conduct a Preliminary Assessment/Site Inspection (PA/SI) around the Site. The petitioners were concerned about downstream mercury contamination potentially impacting the Mendota Pool, San Joaquin River, and San Francisco Bay. USEPA entered the Site into the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) on April 16, 1996 (CA0001900463). USEPA conducted investigations in 2002 and 2010 and identified elevated levels of mercury and other metals on-site and in sediment and surface water samples downstream from the Site. On March 10, 2011, USEPA proposed to add the Site to the NPL and finalized the

	listing on September, 16, 2011. In October 2011, USEPA began interim cleanup actions; the agency's investigations are ongoing. There are only six residents that live within a 5-mile radius. Several private property owners are near the Site, including a part-time resident inside the fenced area, who stays there several weekends per month. The residences closest to the Site are intermittently occupied, mostly on weekends during spring and summer. The closest permanent residence is located approximately 1 mile downstream of the Site. There are no women of childbearing age or children that permanently live at or near the Site.
OVERVIEW OF THIS PUBLIC HEALTH ASSESSMENT	Conclusions in this PHA are based on a review of available environmental data provided by USEPA, information obtained from site visits, and consultations with involved parties and the public. After reviewing all the available information about the Site and learning about community concerns, CDPH focused on evaluating contaminants found in air, mine tailings (dust), water, and sediments near the Site. The conclusions in this PHA are summarized below. They are addressed in more detail in the body of the report.
CONCLUSION 1	**Current and future exposures from inhalation of high levels of mercury vapors in ambient air near the former processing area, furnace building, and other "hot spots" could harm people's health. These areas are public health hazards.**
BASIS FOR CONCLUSION 1	Ambient air sampling data collected by USEPA and CDPH staff reveal high levels of mercury vapors in ambient air near the former processing area and the furnace buildings. People who enter the Site and breathe high levels of mercury vapors from these areas are at increased risk for health effects such as shortness of breath, chest pain, nausea, and increased blood pressure or heart rate.
CDPH/ATSDR RECOMMENDATION FOR CONCLUSION 1	CDPH and ATSDR recommend that USEPA continue to restrict public access to the Site via fencing and signage, particularly at mercury vapor "hot spots" such as areas near the furnace building and former processing areas. CDPH and ATSDR also recommend that USEPA take measures to identify and remove sources of mercury vapor emissions on the Site to prevent future emissions of and exposures to mercury vapor in ambient air.

CONCLUSION 2	**The dilapidated buildings on-site pose a physical hazard to part-time on-site and nearby residents and recreational visitors. These are public health hazards.**
BASIS FOR CONCLUSION 2	The Site is a recognized California Historical Landmark and "ghost town" that attracts recreational visitors to its abandoned buildings, including a general store and the rotary furnace building, a prominent structure at the Site. There are also part-time residents that live on or near the Site. The closest permanent residents live 1 mile downstream from the Site. During site visits, CDPH witnessed several visitors entering the abandoned and dilapidated buildings, despite the partial fencing and signage designating this as a hazardous area. Hazards include steep pits, missing floorboards in multistory buildings, fallen in roofs, broken glass and debris on the ground.
CDPH/ATSDR RECOMMENDATION FOR CONCLUSION 2	CDPH and ATSDR recommend that USEPA continue public access restriction via fencing, particularly at areas where physical hazards are present. Better signage that warns of the hazards present is also recommended.
CONCLUSION 3	**Exposure to mercury from mine tailings via ingestion could pose elevated noncancer health risks to visiting children.**
BASIS FOR CONCLUSION 3	CDPH and ATSDR calculated doses for children who visit the Site and accidentally ingest dust from the mine tailings. CDPH conservatively assumed that a child would visit the Site for 104 days per year for a two-hour period per day. This is a possible scenario for visiting children. The calculated children's dose for mercury poses noncancer health risks that include effects on the nervous system and kidneys.
CDPH/ATSDR RECOMMENDATION FOR CONCLUSION 3	CDPH and ATSDR recommend close supervision of children visiting the Site and practice of proper hygiene (frequent washing of hands, arms, and face) if mine tailings are accidentally touched, especially before eating and drinking, to avoid exposure to contaminants in mine tailings.
CONCLUSION 4	**Exposure to arsenic from mine tailings via ingestion could pose a slightly elevated cancer health risk to adults and children.**
BASIS FOR CONCLUSION 4	CDPH and ATSDR calculated doses for adults who live near or visit the Site and incidentally ingest fugitive dust from the mine tailings. Arsenic can cause skin and bladder cancer if a person is chronically exposed to a sufficient dose. The calculated doses for adults assumed that a person would visit or a part-time resident would spend time

	near the mine tailings piles for 104 days per year for two hours per visit for a total of 30 years. The calculated doses for children assumed that a child would visit the mine tailings piles for 104 days per year for two hours per visit for a total of 10 years. The calculated adult visitor's and/or part-time resident's dose from ingesting arsenic in dust from the mine tailings resulted in an increased estimated cancer risk of 4 in 1 million. For children, the estimated increased cancer risk from ingesting arsenic from dust from mine tailings was 6 in 1 million. When we say that there is a "4 in 1 million" cancer risk, we mean that if 1 million people are exposed over 30 years to a carcinogen at a certain concentration, then 4 cancers may appear in those million people over their lifetime (70 years) due to that particular exposure.
CDPH/ATSDR RECOMMENDATION FOR CONCLUSION 4	CDPH and ATSDR recommend that USEPA continue public access restriction to the Site via fencing and signage. CDPH and ATSDR recommend close supervision of children visiting the Site and practice of proper hygiene (frequent washing of hands, arms, and face) if mine tailings are accidentally touched, especially before eating and drinking, to avoid exposure to contaminants in mine tailings
CONCLUSION 5	**Inhalation of mercury vapor in ambient air prior to 1972 when the mines were in operation could have harmed workers' and residents' health.**
BASIS FOR CONCLUSION 5	The New Idria Mercury Mine operated from 1854 through 1972. In order to assess exposures while the mine was in operation, CDPH and ATSDR would need air-monitoring data for mercury vapors for this time period. These data were not collected while the mine was in operation. Thus, the potential for health hazards from mercury vapors cannot be determined for past exposures. Current and future exposures to mercury vapors are addressed in this document.
CDPH/ATSDR RECOMMENDATION FOR CONCLUSION 5	In the absence of environmental and exposure data, a recommendation cannot be made. CDPH recommends that persons who believe they were exposed to mercury vapors from the Site in the past and are concerned about their health contact their physician.
CONCLUSION 6	**Dermal (skin) contact with or ingestion of surface water or sediment is not expected to result in harmful exposures.**
BASIS FOR CONCLUSION 6	The surface waters near or downstream from the Site are not a source of drinking water for residents currently living on or near the Site. The aesthetic conditions of the San Carlos Creek surface waters (discoloration, brown to reddish hue, sulfur odor) are likely to deter

	a recreational visitor from drinking it or accidentally swallowing it since the creek is too shallow for swimming. CDPH and ATSDR calculated doses of nickel and mercury from ingestion of surface waters for residents living 1 mile downstream from the Site. The doses calculated do not exceed health-based levels and are not expected to cause harm. CDPH and ATSDR also calculated doses for children and adults who visit or live near the Site and might do light wading in the shallow surface waters near the Site. The exposure doses calculated from dermal contact with surface waters or sediments also are not expected to cause harm.
CDPH/ATSDR RECOMMENDATION FOR CONCLUSION 6	No additional recommendation, unless site or exposure conditions change.
CONCLUSION 7	**Dermal (skin) contact with or inhalation of dust particles from mine tailings are not expected to result in harmful exposures.**
BASIS FOR CONCLUSION 7	CDPH and ATSDR calculated doses from past and present skin contact with or inhalation of contaminants in dust particles from mine tailings. The exposure doses calculated from these pathways are not expected to harm people's health.
CDPH/ATSDR RECOMMENDATION FOR CONCLUSION 7	No additional recommendation, unless site or exposure conditions change.
CONCLUSION 8	**CDPH and ATSDR cannot determine whether past, current, or future levels of mercury vapors near the on-site residences could harm people's health (exposures after the mines closed in 1972).**
BASIS FOR CONCLUSION 8	No long-term outdoor-air-monitoring data have been collected to determine the levels of mercury vapors around the on-site residence or residences adjacent to the Site. Although CDPH and USEPA took ambient air samples in individual sampling events, more outdoor-air monitoring around the on-site residences are needed to determine if long-term exposures are of concern.
CDPH/ATSDR RECOMMENDATION FOR CONCLUSION 8	CDPH and ATSDR recommend that USEPA monitor for ambient mercury vapors near the part-time residences, including during remediation activities, and promptly inform residents of the results. In addition, CDPH recommends that USEPA offer a screening of mercury levels in urine to part-time residents that may have been

	exposed to mercury vapors. The analyses can be used to confirm that the mercury concentrations in urine are consistent with the ambient air analyses conducted near the on-site and nearby residences by USEPA and CDPH, both of which resulted in levels that did not exceed health screening values for mercury vapor in ambient air.
CONCLUSION 9	**CDPH and ATSDR cannot determine whether contaminants at the Site are impacting private wells and harming people's health.**
BASIS FOR CONCLUSION 9	The information needed to support a conclusion is not available.
CDPH/ATSDR RECOMMENDATION FOR CONCLUSION 9	CDPH and ATSDR recommend that USEPA determine whether private wells are present in the surrounding community and, if they are, conduct sampling and analysis to determine whether they are contaminated from the Site.
FOR MORE INFORMATION	If you have concerns about exposure or your health as it relates to this Public Health Assessment, you may contact Armando Chévez, CDPH, Armando.Chevez@cdph.ca.gov or 510-620-3681. You may also call ATSDR at 1-800-CDC-INFO.

2.0 Background and Statement of Issues

The California Department of Public Health (CDPH) and the Agency for Toxic Substances and Disease Registry (ATSDR) mission is to assess whether past, present, or future exposures from the New Idria Mercury Mine are likely to cause health problems, and to recommend actions to reduce or prevent exposures. ATSDR is a federal agency within the U.S. Department of Health and Human Services and is authorized under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 to conduct Public Health Assessments (PHAs) at hazardous waste sites. Many PHAs are conducted on sites listed on the National Priorities List (NPL). The NPL is a list of hazardous waste sites that warrant further investigation to determine whether they pose risks to public health or the environment and are eligible for federal funds to clean them up. PHA conclusions are based on a review of available environmental data, information obtained from site visits, and consultations with involved parties and the public. While reading this PHA, please refer to the glossary of terms in Appendix A and the overview of the New Idria Mercury Mine Site ("the Site") and the demographics of the surrounding area in Appendix B, Figure B1.

In 1996, the Coastal Advocates (a nonprofit environmental advocacy group) petitioned the United States Environmental Protection Agency (USEPA) to conduct a Preliminary Assessment/Site Inspection (PA/SI) at the Site. The petitioners were concerned about mercury contamination downstream from the Site potentially impacting the Mendota Pool, San Joaquin River, and San Francisco Bay. USEPA entered the Site into the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) on April 16, 1996 (CA0001900463).

USEPA conducted investigations in 2002 and 2010 and identified elevated levels of mercury and other metals on-site, and in sediment and surface water samples downgradient from the Site. On March 10, 2011, USEPA proposed to add the Site to the NPL and finalized the listing on September 16, 2011. In October 2011, USEPA began interim cleanup; its investigations are ongoing [2].

2.1 Site Description

The Site is located in the abandoned town of Idria in San Benito County, California, a sparsely populated area approximately 135 miles southeast of San Francisco on the eastern slopes of the Diablo Mountain Range (Appendix B, Figure B2). The 880-acre site is located on private land within the New Idria Mining District. The location of the Site in relation to other mines of the New Idria Mining District is shown in Appendix B, Figure B3. which includes over a dozen smaller mercury mines and mining operations for chromite, magnesite, asbestos, and benitonite [3]. The area surrounding the Site is mostly undeveloped open space, with some areas used by nearby ranchers for livestock grazing. The geographic coordinates for the Site are 36 degrees 24′ 46″ North latitude and 120 degrees 40′ 28″ West longitude [4].

The Site contains dozens of dilapidated buildings, including a large rotary furnace and process area. On July 28, 2010, a fire destroyed 13 structures and burned 24 acres in the northern portion of the town. San Carlos Creek runs toward the north in the eastern portion of the Site. A small unnamed reservoir, referred to as the San Carlos Creek reservoir, is located off-site, approximately 1 mile upstream of the town. The reservoir served as the drinking water source for the town when the mine was in operation. Extensive waste rock (either rock from which mercury has been extracted, also known as calcine, or low grade rock that was removed from the mine) are exposed, covering a large portion of the Site. It is estimated that from 0.5 to 2 million cubic yards of waste rock and calcines cover approximately 48 acres throughout the Site and along San Carlos Creek [5]. Over 30 miles of tunnels and 20 levels were constructed at the Site. The mine flooded with groundwater and surface water. In the presence of iron and sulfur, an acid known as acid mine drainage (AMD) is formed that is drained to the outside in channels called adits. AMD has been discharging from the Level 10 adit into San Carlos Creek since at least 1969. Before USEPA's removal action in 2011, AMD from the main adit, known as the Level 10 adit, ran for about 2,000 feet between waste rock and calcine piles and discharged directly into San Carlos Creek. The confluence of the AMD and San Carlos Creek is located on the Site.

2.2 Demographics

There is no permanent community on the Site, and only six residents live within a 5-mile radius (Appendix B, Figure B1). Several private property owners are near the Site, including part-time residents inside the fenced area, who stay there several weekends per month with other family members, including visiting children. The houses closest to the Site are intermittently occupied, mostly on weekends during spring and summer, with typically one or two adults present and children visiting occasionally. The closest permanent residents live approximately 1 mile downstream of the Site. The racial makeup of the residents within a 10-mile radius is mostly white. There are no women of childbearing age or children that permanently live at or near the Site.

2.3 Site History

The New Idria Mercury Mine operated from approximately 1854 to 1972 and built its first brick furnace to produce mercury in 1857. Ore containing cinnabar (mercuric sulfide [HgS]) was crushed and roasted in large furnaces to release elemental mercury vapor, which was cooled, condensed, and bottled in iron flasks, each one containing 76.5 pounds of mercury. This roasting process is called calcination. Ore from neighboring mines was transported to be processed at the New Idria furnaces. The New Idria Mine was reported to be the second most productive mercury mine in North America, producing over 38,250,000 pounds of mercury [3].

The mining continued nearly uninterrupted until the early 1970s, experiencing a few periods of low production due to the diminishing value and demand for mercury and landowner disputes. In the mid-1980s, a drug rehabilitation program purchased the property and began to illegally dump waste on the surface of the calcine tailings piles on the northern portion of the Site.

Since the 1960s, the following local, state, and federal agencies have been involved with the regulation of the Site and its impact on San Carlos Creek: USEPA, the Central Coast Regional Water Quality Control Board (RWQCB), the United States Geological Survey (USGS), the California Department of Toxic Substances Control (DTSC), the San Benito County Health and Human Services Agency, the California Integrated Waste Management Board (IWMB), and the Bureau of Land Management (BLM). Initially, investigations occurred in response to complaints from area ranchers. Later, monitoring occurred of the Level 10 adit AMD, of upstream and downstream surface water, and of releases to sediment, waste rock and soil. IWMB and DTSC worked with the San Benito County Health and Human Services Agency to remove hazardous materials from the Site's illegal dump in February 2003.

Two major USEPA environmental investigations were published: the first in 1998, a combined Preliminary Assessment/Site Inspection (PA/SI), and the second in 2010, an Expanded Site Inspection (ESI). The PA/SI investigation identified elevated levels of mercury on-site and in sediment and surface water samples downgradient from the Site and documented a significant release (three times the background level per USEPA protocol) to at least 5.7 miles downstream. The 2010 ESI documented releases of arsenic, cadmium, copper, lead, mercury, nickel, selenium, and zinc from hazardous substance sources, including the calcine tailings piles and the Level 10 adit AMD. The 2010 ESI also documented that mercury that was attributable to the Site was detected in San Carlos Creek at concentrations significantly above background to a distance of nearly 20 miles downstream from the Site [3].

Following a site visit in June 2011 (see Site Visits section below), CDPH requested that necessary actions be taken to reduce visitors' potential exposure to mercury vapor and physical hazards (Appendix E, Letter Health Consultation to USEPA). As a result, in the fall of 2011 USEPA fenced the perimeter of the recognized "hot spots" on the Site and posted signs around the perimeter of the Site warning trespassers and visitors about the potential threats to public health. Two separate sections of fence were installed. A 6-foot fence starts immediately east of San Carlos Creek and travels approximately 1,300 feet, where it ends after crossing the western section of the upper access road. A separate 4-foot high fence was installed at the northwest end of the upper access road [6]. Appendix B, Figure 4 shows the approximate location of the fence. Interim cleanup actions began in October 2011 and included rerouting AMD from adit 10 through a conveyance to a settling pond that was expected to minimize the mercury picked up by the water during runoff (Appendix G, EPA Interim Cleanup Actions Factsheet).

Three academic institutions have studied conditions at the Site. In 2000, the University of California, Santa Cruz, determined that mercury in creek water downstream from the Site is due to mercury leaching from the mine tailings and waste rock piles. Researchers from Chapman University and Stanford University analyzed environmental samples for mercury and methylmercury at various mine sites, including New Idria [7,8].

2.4 Watershed and Groundwater

Approximately 4.7 miles downstream from the Site, San Carlos Creek drains into Silver Creek, which joins the Panoche Creek 17 miles from the Site. The Panoche Creek receives drainage from over two dozen mercury mines located on the southern and western hills of the Panoche Valley. Panoche Creek flows eastward to the Panoche alluvial fan in agricultural land of the Central Valley. During dry years, Panoche Creek drains into the Panoche alluvial fan with poorly defined channels. During moderate and heavy rainfall years and flooding events, water can reach the Mendota Pool and San Joaquin River. Surface water from this area drains to the San Joaquin River, which flows into San Francisco Bay [3]. Extensive wetlands in a predominantly arid environment stretch for over 20 miles along San Carlos and Silver Creeks. San Carlos, Silver, and Panoche Creeks are considered intermittent streams, but San Carlos Creek may have perennial flow due to AMD discharges from the mine [4]. The San Carlos-Silver-Panoche Creek watershed is characterized as an important habitat for native species, some of which are considered rare in the region [3].

There are no known drinking water wells within 4 miles of the Site and no known surface water intakes within 20 miles downstream from the Site [3]. However, there may be privately owned or unregistered water wells in the area that are not regulated by the State of California.

3.0 Site Visits

CDPH staff accompanied USEPA Region IX staff on a tour of the Site on June 13, 2011. During the tour, both staffs identified a potential threat to recreational visitors from breathing elevated mercury vapor levels at the Site near the rotary furnace building and the condenser duct. At the request of CDPH, USEPA staff screened ambient air for mercury vapor using a handheld Lumex Mercury Vapor Analyzer. The measured mercury vapor levels around the furnace and the condenser exceeded USEPA's and the California Office of Environmental Health Hazard Assessment's (OEHHA) health screening levels (see Exposure to Mercury Vapors in Ambient Air section below). CDPH staff also identified physical hazards posed by the dilapidated furnace structure and other dilapidated buildings near the processing areas (see Figure 1 below) and alerted USEPA in a Letter Health Consultation, which resulted in perimeter fencing and signage (Appendix E).

CDPH staff returned to the Site on March 28 and June 29, 2012, to interview residents about health concerns regarding potential exposures to site-related contaminants, to gather more information about the Site, and to explain the public health assessment process. The residents provided valuable information regarding the Site's history, the frequency of recreational visitors, security concerns, and health concerns about San Carlos Creek surface water. CDPH was able to survey the Site's perimeter and noticed that although the installed fence covered most of the central portion of the Site, sizable gaps allowing access along the fence were evident. CDPH also witnessed several persons entering the abandoned buildings in the nonfenced area. In June 2012, CDPH staff was able to closely examine the abandoned buildings and structures that clearly pose a physical hazard to trespassers. CDPH staff conducted sampling of mercury vapors in ambient air at select locations on and near the Site. The findings are discussed in the Exposure to Mercury Vapors in Ambient Air section. Some recreational visitors trespass onto the Site, although the Site is fenced off, gated and visible signs warn of the potential hazardous conditions. CDPH was informed by residents that the frequency of trespassers had diminished substantially as a result of the fence and padlocked gate. Community health concerns are further discussed in the Toxicological Evaluation section and the Community Health and Exposure Concerns section.

Figure 1. Dilapidated Building Next to Furnace

4.0 Discussion

In this section, CDPH reviews available environmental data, determines relevant exposure pathways, and assesses their public health implications.

4.1 Conceptual Site Model

The Conceptual Site Model shows the source, environmental media, exposure points, the completed and potentially completed exposure routes, and the time frame relevant for the evaluation. The elements of the model are shown in Figure 2 below.

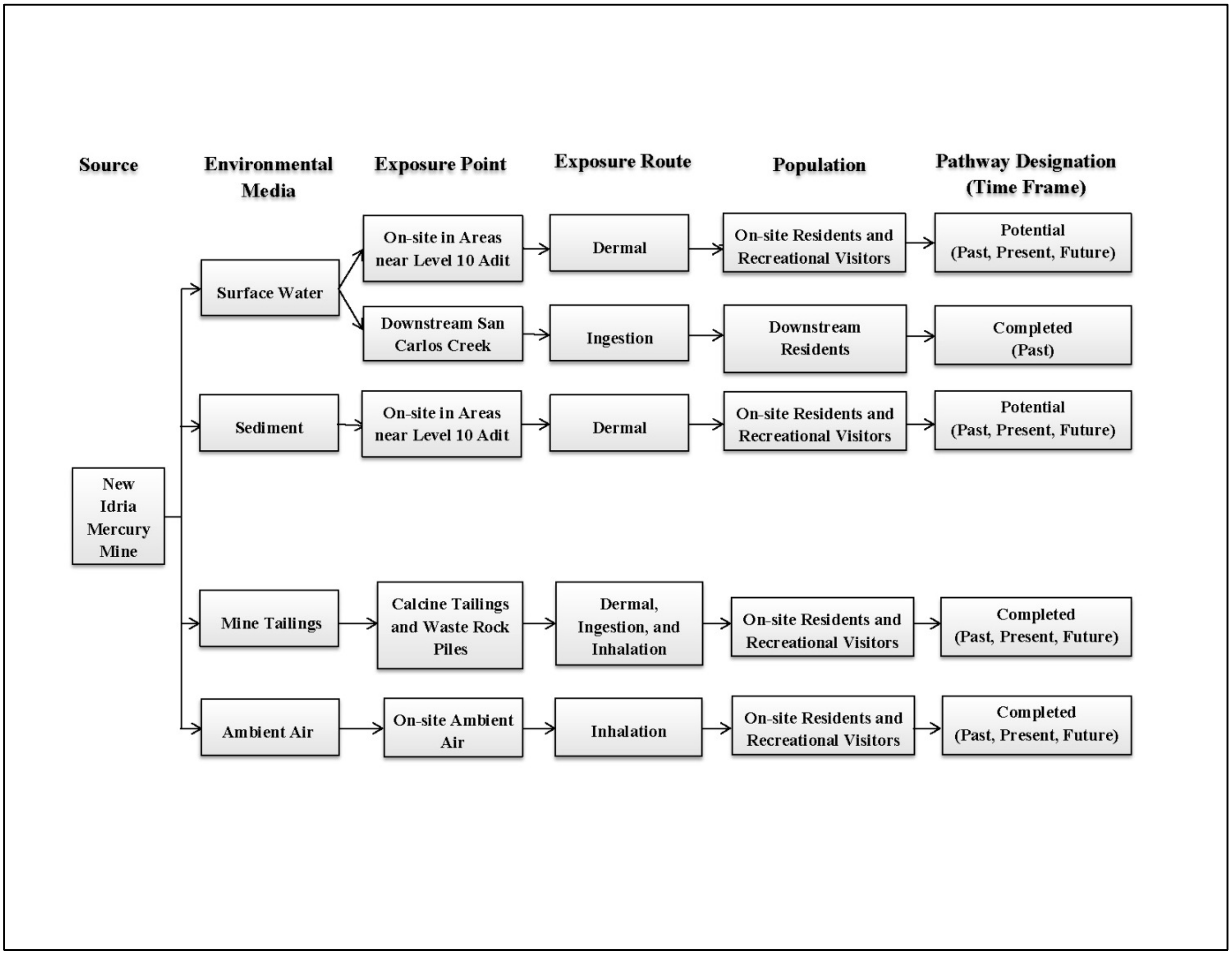


Figure 2. Conceptual Site Model for the New Idria Mercury Mine Site Exposure Pathways

Exposure pathways are means by which people in areas surrounding the Site could have been or could currently be exposed to contaminants from the Site. An exposure pathway consists of five elements:

- A source of contamination
- A contaminated environmental medium (air, soil, water)
- A location where someone contacts the contaminated medium (exposure point)
- An exposure route, such as inhalation (breathing), dermal absorption (skin contact, touching), or ingestion (swallowing or eating)
- A population that may be exposed

An exposure pathway is complete when all five elements are present. Potentially completed exposure pathways are either (1) not currently complete but could become complete in the future or (2) indeterminate due to a lack of information. Pathways are eliminated from further assessment if one or more elements are missing and are never likely to be present [9]. CDPH identified and evaluated three completed pathways (ingestion of downstream surface water; inhalation, dermal contact, and incidental ingestion of mine tailing dust; inhalation of ambient air) and two potential pathways (dermal exposure to surface water and sediment). Completed and potential exposure pathways for each medium evaluated are discussed in the following section.

4.2 Environmental Data

4.2.1 Surface Water

In the 1998 PA/SI report, surface water samples were collected from the Level 10 adit and San Carlos Creek. Mercury concentrations ranged from 0.22 to 16.5 µg/L in the Level 10 adit and from 0.2 to 9.6 µg/L in samples taken from San Carlos Creek. Other contaminants were found at the following maximum concentrations: iron (493,000 µg/L), nickel (677 µg/L), and zinc (1,190 µg/L) (Appendix C, Tables C1 and C2). The 1998 USEPA PA/SI investigation identified elevated levels of mercury on-site and in sediment and surface water samples downgradient from the Site and documented a significant release that is attributable to the Site (three times the background level per USEPA protocol) to at least 5.7 miles downstream. The next sampling location was substantially farther downstream (17.2 miles), and all samples beyond this point showed lower contaminant concentrations compared to concentrations near the Site.

USEPA’s 2010 ESI documents that surface water samples showed the presence of hazardous substances meeting the criteria for an observed release attributable to the site to a distance of 19.9 miles downstream of the furthest downstream probable point of entry. Surface water samples in this report included 15 samples taken in upstream and downstream locations. These samples include background samples from the upper San Carlos creek, one sample from the San Carlos Creek reservoir, AMD source samples, and surface water samples at various locations up to 5.4 miles downstream from the Site. Six water samples were collected between the Level 10 adit discharge area and San Carlos Creek near the calcine tailings piles; they contained mercury concentrations ranging from 0.28 to 21.2 µg/L. Four other locations were sampled up to 5.4 miles downstream; concentrations of metals diminished at this point. Other contaminants were found at the following maximum concentrations: aluminum (135,000 µg/L), arsenic (72.4 µg/L), cadmium (1.7 µg/L), and zinc (2,610 µg/L) (Appendix C, Table C3).

4.2.2 Sediment

The 1998 PA/SI included analyses of six sediment samples for mercury along the Level 10 adit to its confluence with San Carlos Creek. Mercury levels ranged from 0.22 to 25.7 mg/kg. In addition, 14 sediment samples were collected along 5.7 miles of San Carlos and Silver Creeks to the confluence with Panoche Creek. Levels are attributable to the Site. Between 5.7 miles and 17.4 miles downstream, four additional sediment samples were collected. Other contaminants were found at the following maximum concentrations: iron (420,000 mg/kg), nickel (692 mg/kg), and zinc (949 mg/kg) (Appendix C, Table C4).

The 2010 ESI included 34 sediment samples from the Site in upstream and downstream locations. Background sediment samples were collected from San Carlos Creek approximately 3.9 miles upstream from the Site and from another tributary leading to San Carlos Creek. Mercury concentrations ranged from <0.11 to 0.19 mg/kg. Four sediment samples were taken at the Level 10 AMD discharge area, and three sediment samples were collected from San Carlos Creek adjacent to the calcine tailings piles. Mercury concentrations ranged from 9.9 to 41.3 mg/kg. A total of 17 sediment samples were collected along Silver Creek to Panoche Creek. Mercury concentrations ranged from 0.070 to 32.6 mg/kg. Other contaminants were found at the following maximum concentrations: aluminum (16,200 mg/kg), arsenic (57.1 mg/kg), cadmium (8.6j mg/kg), chromium (180 mg/kg), copper (55.9 mg/kg), iron (307,000 mg/kg), and zinc (323 mg/kg) (Appendix C, Table C5).

4.2.3 Mine Tailings

Limited calcine tailings sampling data are available from past sampling events. The 1998 PA/SI included five tailings samples that were collected between the waste rock and calcine tailings piles and the Level 10 AMD discharge area. High concentrations of mercury in processed ore were expected. The samples contained mercury concentrations ranging from 27.1 to 74.6 mg/kg, and background mercury concentrations ranged from 1.4 to 3.9 mg/kg. Nickel was detected in a background sample at 1,980 mg/kg and found on-site between 10.1 and 48.8 mg/kg. Iron was detected at a maximum concentration of 235,000 mg/kg on-site (Appendix C, Table C6).

The 2010 ESI included 10 calcine tailings samples: Four calcine tailings samples were collected from the southern tailings piles (mercury ranged from 38.7 to 446 mg/kg), and four samples were collected from the northern calcine tailings piles (mercury ranged from 3.8 to 91.6 mg/kg). Two background soil samples were collected, and the highest mercury concentration detected was 0.19 mg/kg. Other major contaminants were found at the following maximum concentrations: aluminum (14,000 mg/kg) and arsenic (27.7 mg/kg). Background concentrations of arsenic were determined in two samples (both below 1 mg/kg) (Appendix C, Table C7).

4.2.4 Ambient Air

No ambient air data are available for when the mine was in operation, but CDPH staff presumed ambient air concentration of mercury to have been high. No ambient air sampling was conducted during the 1998 PA/SI or the 2010 ESI. CDPH considers inhalation of ambient air a completed exposure pathway for past and current exposures, but it is not possible to reconstruct the ambient air concentrations, inhalation doses, or health hazards associated with past conditions. It is very likely that mine workers, residents, and visitors were exposed to high concentrations of mercury vapors while the mine and furnace operated. The only ambient air samples taken at the Site were collected with a handheld Lumex Mercury Vapor Analyzer during two CDPH program staff site visits, one of which included USEPA personnel. These data sets are not representative of long-term site conditions, but they do present two "snapshots" of current site conditions (see Exposure to Mercury Vapors in Ambient Air section below).

4.3 Identification of Contaminants of Concern

This section discusses the screening method that CDPH used to identify contaminants of concern (COCs) for further evaluation, and to determine whether levels of contaminants in various environmental media pose a health hazard from noncancer or cancer health effects.

As a preliminary step CDPH program staff compared contaminant concentrations in the environmental media with health-based media-specific comparison values. Owing to limited data sets, a statistical evaluation was not possible, so CDPH used the maximum concentrations found in the areas of likely exposure within the Site in order to provide a health-protective estimate of exposure. The areas of likely exposure are easily accessible to recreational visitors and on-site nearby residents: the Level 10 AMD and its confluence with San Carlos Creek, tailings piles, and San Carlos Creek water 1 mile downstream of the confluence.

ATSDR, USEPA, and Cal/EPA publish media-specific comparison values that estimate contaminant concentrations that are unlikely to cause noncancer health effects, or that estimate the concentrations associated with the "point-of-departure" cancer risk of 1 in a million. The following comparison values were used:

- California Human Health Screening Levels (CHHSLs). CHHSLs are screening levels for chemicals in soil used to aid in clean-up decisions based on the protection of public health and safety [10].

- Environmental Media Evaluation Guides (EMEGs). EMEGs are estimates of chemical concentrations in air, soil, and water that are not likely to cause an appreciable risk of harmful, noncancer health effects for fixed durations of exposure. EMEGs reflect several different types of exposure: acute (1–14 days), intermediate (15–364 days), and chronic (365 or more days). EMEGs are based on ATSDR's Minimal Risk Levels (MRLs) (see the glossary in Appendix A for a more complete description of EMEGs) [11].

- Reference Dose Media Evaluation Guides (RMEGs). RMEGs are estimates of chemical concentrations in soil and water that are not likely to cause an appreciable risk of harmful, noncancer health effects for chronic exposure. RMEGs are based on USEPA's Reference Doses (RfDs) (see the glossary in Appendix A for a more complete description of RMEGs) [12].

- Reference Exposure Levels (RELs) and Reference Concentrations (RfCs). Cal/EPA's Office of Environmental Health Hazard Assessment's RELs and USEPA's RfCs are estimates of chemical concentrations in air that are not likely to cause an appreciable risk of harmful, noncancer health effects for fixed durations of exposure [13].

- Maximum Contaminant Levels (MCLs). CDPH and USEPA's MCLs are the maximum concentrations of chemicals allowed in public drinking water systems. MCL values are based on concerns about preventing harmful impacts on human health and on the economic costs of applying cleanup treatment technologies [14].

- Regional Screening Levels (RSLs). USEPA's Regions III, VI and IX publish RSLs that are concentrations used in initial screening-level evaluations of environmental measurements and can be based on noncancer or cancer outcomes [15].

- Cancer Risk Evaluation Guides (CREGs). CREGs are media-specific comparison values used to identify concentrations of cancer-causing substances that are unlikely to result in a significant increase of cancer rates in a population exposed over an entire lifetime. CREGs are derived from USEPA's cancer slope factors, which indicate the relative potency of cancer-causing chemicals. Not all carcinogenic compounds have a CREG [9].

4.3.1 Iron

Iron exceeded the media-specific comparison values for water, sediment, and mine tailings and is considered a concern because of its corrosive potential for pipes and its generally unpleasant presence (undesirable taste, color, odor, staining) in water rather than on human health toxicity [26]. Iron is an essential mineral for human health [26]. Based on these factors, iron will not be considered a COC.

4.3.2 Chromium

The 1998 PA/SI and the 2010 ESI did not perform speciation for trivalent and hexavalent chromium and reported total chromium concentrations in the sampled media. To determine whether chromium is a COC, CDPH staff evaluated the evidence for the presence of tri- and hexavalent chromium. Chromium is a naturally occurring element, and chromium concentrations in surface water, sediment, and mine tailings show a high background concentration due to the presence of naturally occurring chromium in serpentine deposits located throughout the area (Appendix C, Tables C1–C7). The two most common forms of chromium are trivalent chromium and hexavalent chromium. Hexavalent chromium is a potent inhalation carcinogen and is more toxic than trivalent chromium. Hexavalent chromium compounds are thought to be strong oxidizing agents, are very corrosive, and are generally reduced to the trivalent form in the environment [16]. CDPH staff did not find evidence of anthropogenic activities on the Site that would release hexavalent chromium. One study on the aquatic cycling of chromium in the New Idria Mining District cites naturally occurring hexavalent chromium in the San Benito Mountains; however, this same study shows that the mine's AMD discharge converts the hexavalent chromium to trivalent chromium in surface water [17].

CDPH concluded that no anthropogenic hexavalent chromium is present on the Site and that naturally occurring hexavalent chromium is converted to trivalent chromium in the AMD. CDPH staff therefore used the media-specific comparison values for trivalent chromium during the screening analysis. Chromium concentrations in environmental media at the Site did not exceed screening levels, so chromium was not identified as a contaminant of concern.

Tables C1–C7 in Appendix C show the sampling results for each medium and comparison values used. A brief summary of the toxicological characteristics of the COCs identified by CDPH is presented in Appendix D. The preliminary analysis of the inhalation of mercury vapors in ambient air for current exposures is based on sampling data obtained during one site visit (see Exposure to Mercury Vapors in Ambient Air section below). Iron and chromium were detected above comparison values but were not included as COCs. Table 1 below summarizes the COCs identified in each media.

Table 1. Summary of Chemicals of Concern Evaluated for the New Idria Mercury Mine Superfund Site.

Chemical	Surface Water	Sediment	Tailings Piles (Dust)	Ambient Air
Past Exposure				
Mercury	X	X	X	X
Nickel	X			
Present and Future Exposure				
Aluminum	X			
Arsenic	X	X	X	
Cadmium	X	X	X	
Mercury	X	X	X	X
Nickel	X			

4.3.3 Surface Water

Downstream from the Site, nickel and mercury exceeded their respective media-specific comparison values in the 1998 report. Nickel only exceeded the media-specific comparison value for children and was evaluated further for a visiting child's exposure. Mercury levels exceeded the media-specific comparison value (Appendix C, Table C1).

Aluminum, arsenic, cadmium, mercury, and nickel exceeded their respective media-specific comparison values (Appendix C, Table C3) in the 2010 report and were evaluated further. Surface water was evaluated for ingestion exposure (downstream location, past exposures) and for dermal contact (on-site, current exposure).

4.3.4 Sediment

Sediment in the area of the confluence is a likely exposure medium. Mercury, arsenic, and cadmium exceeded the media-specific comparison value (Appendix C, Tables C4 and C5) and were evaluated further. Sediment was evaluated for dermal exposure in the past and present.

4.3.5 Mine Tailings and Calcine Piles

Mercury, arsenic, and cadmium found in mine tailings and calcine piles exceeded the media-specific comparison values (Appendix C, Tables C6 and C7) and are evaluated further. CDPH staff evaluated the following exposure routes: inhalation of dust, incidental ingestions of particles, and dermal contact. Arsenic was the only carcinogen evaluated further.

Standard intake rates were used for incidental sediment or tailings ingestion for adult residents and recreational visitors (100 mg of soil per day) and for children (200 mg of soil per day). In the absence of data representing the particulate matter concentrations in air, CDPH used USEPA's particulate emission factor (PEF) and the maximum concentrations found in mine tailings to estimate the concentration of COCs in air. The PEF is a calculated ratio that approximates the concentration of a contaminant in the soil (or tailings pile) that is released into the air as dust. CDPH used the default value published by DTSC [18]. The estimated concentrations of COCs in fugitive dust from mine tailings are presented in Appendix C, Table C15.

4.3.6 Ambient Air

The concentration of mercury in ambient air is influenced by temperature, humidity level, and wind conditions. During the site visit on June 13, 2011, at the request of CDPH staff, USEPA staff screened ambient air for mercury vapor using a Lumex Mercury Vapor Analyzer. The highest mercury vapor level was measured in a large hole in the flue pipe located approximately 50 feet from the rotary furnace building. This mercury level was above the analyzer's upper detection limit of 36µg/m^3. Additional measured levels around the furnace also exceeded ATSDR's chronic MRL of 0.2 µg/m^3 and the OEHHA's reference exposure level (REL) for chronic inhalation exposure of 0.03µg/m^3 [11,13]. Based on these observations, CDPH staff concluded that there was a potential threat to public health for trespassers or nearby residents from breathing high levels of mercury vapor in ambient air near the identified "hot spots," specifically the rotary furnace building, processing area, and condenser/flue (Appendix E).

On June 29, 2012, CDPH program staff conducted additional ambient air sampling of mercury vapors at selected locations around the Site with a Lumex RA 915 Plus Mercury Vapor Analyzer. In warm weather with light wind from the north, staff collected ambient air samples in 20 locations around the Site, including the areas near the rotary furnace, broken flue, and two residences on and near the Site. Figure B4, Appendix B, shows the approximate locations of all 20 sample locations. The data are summarized in Appendix C, Table C16. For three locations (rotary furnace, two residences), sufficient samples were available to do a statistical analysis to calculate the 95% UCL of the arithmetic mean using USEPA's ProUCL software (Version 5) [19]. The 2012 ambient air concentrations were consistent with the earlier information, showing the highest mercury concentrations near the rotary furnace and condenser/flue.

4.3.7 Biota

There are no fish in San Carlos Creek, and none of the current residents in the surrounding area maintain a vegetable garden. No data were available on plant or animal contamination from chemicals of concern. It is likely that local residents tended vegetable gardens during the years of active mining, but the exposure levels from this activity cannot be reconstructed. San Carlos Creek flows through grazing lands downstream of the site, and it is likely that cattle drink creek water during the time of year that the creek is flowing. However, other water sources must be provided during dry years and dry seasons. No major cattle farms are located along San Carlos Creek. CDPH considered consumption of plants or animals to be a minor exposure pathway and did not evaluate this pathway further.

4.4 Exposed Populations

4.4.1 Residents Living near the Site

Based on observations and interviews conducted during site visits, CDPH identified fewer than five residences near the Site. The houses closest to the Site are intermittently occupied, mostly on weekends during spring and summer, with typically one or two adults present and children visiting occasionally. The adult residents were adamant about supervising visiting children and prohibiting them from playing in or around potentially hazardous areas. The residents were particularly concerned about the physically hazardous conditions of the dilapidated rotary furnace building, calcine tailings piles, areas around the Level 10 AMD confluence, and other site hazards such as rattlesnakes. Residents closest to the Site have always obtained their drinking water from the San Carlos Creek reservoir while residents downstream used San Carlos Creek surface water for non-potable purposes in the past and on infrequent occasions may have used it as a drinking water source. Currently, all residents obtain their drinking water from the San Carlos Creek reservoir. CDPH concluded that, in the past, surface water from San Carlos Creek was a completed exposure pathway for residents downstream.

4.4.2 Recreational Visitors

The Site is a recognized California Historical Landmark and attracts recreational visitors, mostly for its “ghost town” appeal due to the abandoned buildings, including a general store and the rotary furnace building, a prominent structure at the Site. During site visits, CDPH staff witnessed several visitors entering abandoned buildings outside the fence and others trespassing beyond the fence, despite signs designating this as a hazardous area (Figure 3). The Site is still easily accessed, especially since the fence is about 4 feet high and there are gaps caused by the steep hills, which allow trespassers to enter without much effort. In the past, the Site was visited by metal scavengers and drivers of all-terrain vehicles and used for target shooting practice. It is reasonable to assume that people would visit for only a brief period, perhaps an hour or two per visit once or twice a year, since access is difficult (visitors must traverse a 20-mile-long dirt road to reach the Site) and no recreational facilities or potable water are available.

Figure 3. USEPA Warning Signage

4.5 Exposure Assumptions

4.5.1 Uncertainties

CDPH staff used reasonable, conservative exposure assumptions, with the understanding that these assumptions could be a major source of uncertainty in this evaluation. No site-specific exposure information is available on the frequency, duration, or specific activities conducted by populations visiting the Site. Other uncertainties include the bioavailability of metals and the particle size distribution of inhaled dust particles. Bioavailability is dependent on a number of factors, including the chemical characteristics and physical forms of the contaminant [9]. In order to be conservative and health protective, CDPH assumed 100% relative bioavailability of metals, with the exception of arsenic in soil (60% relative bioavailability for incidental ingestion) [20].

4.5.2 On-Site and Nearby Residents

CDPH calculated exposure doses for adult and child residents on the Site who occasionally come into contact with the contaminated media (sediment, surface water, mine tailings) and are exposed to the maximum concentrations of COCs in the media (see Toxicological Evaluation below) for a total of 104 days (52 weekends) per year. Contact with each medium (sediment, surface water, mine tailings) is assumed to be 2 hours/day (for 104 days per year). Exposure dose calculations assumed that an adult resident weighs 70 kilograms and that a child resident, aged 1 to 11 years, weighs 30 kilograms. CDPH used these conservative exposure assumptions to calculate doses for past and current exposures using ATSDR's Dose Calculator [21].

For sediment and surface water, CDPH assumed a wading scenario with dermal exposure to hands and feet. For mine tailings, the exposure routes are incidental ingestion (e.g., hand-to-mouth), dermal exposure to hands and feet, and inhalation of dust particles.

Inhalation exposure to mercury vapors was qualitatively evaluated in the Exposure to Mercury Vapors in Ambient Air section below due to the lack of ambient air data.

Children in particular are considered a high-risk population because they may spend more time outdoors and tend to ingest more soil than adults do through increased hand-to-mouth behaviors. Some children may also exhibit soil pica behavior, which is a craving for and ingestion of nonfood items such as soil, paint chips, and clay [9]. Since the Site is situated in a very remote area, far away from schools, daycare centers, or playgrounds, and it is unlikely that unsupervised children would spend time on the Site, CDPH did not evaluate exposures based on pica behavior.

4.5.3 Downstream Residents

CDPH estimated the exposure for downstream residents who used San Carlos Creek water mostly for nonpotable purposes (irrigation, showering) but on occasion may have used it for cooking and for drinking. Few data are available to estimate contaminant concentrations in surface water in the past. CDPH used the maximum concentrations of COCs detected in surface water near the residence to estimate exposures from ingestion.

CDPH conservatively assumed that an adult resident drank 1 liter of surface water per day for 104 days per year. Dermal exposures from showering were not considered. Although residents informed CDPH program staff that no child lives or has ever lived at the Site, CDPH considered the possibility of a child visitor and made the conservative assumption that a child would drink 1 liter of surface water per day for 104 days per year (52 weekends). Only data from the 1998 PI/SI were used for this evaluation. Exposures to aluminum, arsenic, and cadmium from past ingestion of San Carlos Creek surface water cannot be determined because these compounds were not on the list of analytes in the 1998 PI/SI report.

4.5.4 Recreational Visitors

CDPH determined that it is unlikely that recreational visitors are accidentally or intentionally ingesting large amounts of sediment, mine tailings, or San Carlos Creek surface water, particularly in areas near the Level 10 AMD, where the aesthetic conditions of the surface water (discoloration, brown to reddish hue, sulfur odor) are likely to deter a recreational visitor from drinking it. Visitors are also unlikely to accidentally swallow the water since the creek is too shallow for swimming. The on-site resident exposure assumptions are considered to be health-protective of recreational visitors since it is reasonable to expect that recreational visitors would visit the Site less frequently.

4.6 Toxicological Evaluation

When individuals are exposed to a hazardous substance, several factors determine potential harmful health effects and their type and severity. These factors include the dose (how much), the duration (how long), the route by which people are exposed (breathing, eating, drinking, or skin contact), other contaminants to which they may be exposed, and individual characteristics such as age, sex, nutrition, family traits, lifestyle, and state of health. The scientific discipline that evaluates these factors and the potential for a chemical exposure to adversely impact health is called toxicology.

In a toxicological evaluation, CDPH staff calculated the exposure doses from each COC using conservative exposure assumptions. These doses are compared with health-based comparison values. CDPH evaluated the possibility of noncancer and cancer health effects for those contaminants that exceed the health-based comparison values. Contaminants that have both cancer and noncancer health outcomes were evaluated for both endpoints. In contrast to noncancer outcomes, no safe dose is associated with carcinogens. The cancer risk is the theoretical chance of developing cancer from a lifetime of exposure. As a baseline, the “point of departure” risk is 1 additional cancer case in 1 million people. Cancer is a common disease. The National Cancer Institute’s Surveillance, Epidemiology, and End Results Program (SEER) states that the lifetime risk for both men and woman of being diagnosed with cancer at some point during their lifetime is approximately 40.4 percent (for all cancer sites, diagnosis at some point based on 2009–2011 data). This corresponds to 404,000 cases in 1,000,000 people [22].

4.6.1 Uncertainties

Many uncertainties are associated with toxicological evaluations. Toxicity studies are usually conducted with adult animals, whereas human studies often monitor adults, typically worker populations, who are often exposed to high concentrations of contaminants. Little information is available to evaluate exposure to multiple chemicals (mixtures), or evaluate adverse effects from exposure to very low levels of contaminants over long periods. To account for some of these differences (adjusting from high dose to low dose, animal to human, short-term to long-term exposures, adult to child exposure, etc.), uncertainty factors are included in the derivation of health comparison values. Given these uncertainties, it is preferable to overestimate rather than underestimate exposure. Therefore, CDPH staff used conservative values to estimate doses and calculate noncancer and cancer health outcomes.

All individuals experience many exposures throughout their lifetime, and the evaluations of potential noncancer and cancer outcomes cannot predict if an individual will develop these health effects. These health assessment calculations enable us to assess our level of concern related to the exposure and the concentration and toxicity of a substance.
CDPH program staff used the following health-based comparison values:

- Minimal Risk Levels (MRLs). MRLs are estimates of daily human exposure to a substance that is likely to be without an appreciable risk of adverse, noncancer health effects over a specified duration of exposure. MRLs are based on the no-observed-adverse-effect level (NOAEL) or the lowest-observed-adverse-effect level (LOAEL) [11]. MRLs are published by ATSDR.

- Reference Doses (RfDs). RfDs are estimates of daily human exposure to a substance that is likely to be without an appreciable risk of adverse, noncancer health effects over a specified duration of exposure. RfDs are based on the NOAEL or the LOAEL [12]. RfDs are published by USEPA.

- Reference Exposure Levels (RELs) and Reference Concentrations (RfCs). Cal/EPA's Office of Environmental Health Hazard Assessment's RELs and USEPA's RfCs are estimates of chemical concentrations in air that are unlikely to cause an appreciable risk of harmful, noncancer health effects for fixed durations of exposure [15].

- Cancer Slope Factors (CSFs) and Inhalation Unit Risks (IURs). CSFs and IURs estimate the carcinogenicity of a specific substance. To obtain lifetime risk estimate from inhalation exposure, the contaminant concentration in air is multiplied by the inhalation unit risk for that carcinogen. To obtain lifetime risk estimates for other pathways, a chronic daily exposure dose is calculated, based on the concentration, frequency, and length of exposure, which is multiplied by the cancer slope factor. The potential cancer risk for each contaminant is calculated, and cancer risks from multiple carcinogens are added. CSFs and IURs are published by USEPA.

4.6.2 Contaminants of Concern with Noncancer Health Effects

CDPH evaluated mercury and nickel for past exposures and aluminum, arsenic, cadmium, mercury, and nickel for current exposures. The individual contaminants are evaluated by calculating the dose and building the ratio of the dose over the health comparison value, termed hazard quotient (HQ). If the HQ is greater than 1, exposure may pose a noncancer health risk. If multiple COCs are present, usually their HQs are added, resulting in a hazard index (HI). Tables C8 to C15 in Appendix C show the calculations, equations used, exposure parameters, HQ, and HI. Appendix F shows the dose calculation for incidental ingestion of mercury from mine tailings for children. Following are the noncancer health effects summarized for each environmental medium.

Exposure to surface water (Appendix C, Tables C8, C9, and C10): The total hazard index for exposure to surface water from ingestion or dermal contact for all COCs was below 1 for both adult and child visitors and for both past and current exposures.

Exposure to sediment (Appendix C, Tables C11 and C12): The total hazard index for exposure to sediment from dermal contact for all COCs was below 1 for both adult and child visitors and for both past and current exposures.

4.6.2.1 Mercury

Exposure to mine tailings (Appendix C, Tables C13 - C15):

- **A child's potential current exposure to mercury in mine tailings via the ingestion route exceeded the hazard quotient of 1 (2.8).**
- A child's potential current exposures to all other COCs in mine tailings via the ingestion and dermal routes did not exceed the total hazard index of 1.
- An adult's potential current exposures to all COCs in mine tailings via the ingestion and dermal routes did not exceed the total hazard index of 1.
- For past exposure via dermal and ingestion routes to mine tailings, the total hazard index for all COCs was below 1, for both adults and children.
- The concentrations of all COCs in air from fugitive dusts (mine tailings) were below their respective noncancer comparison values, for both past and current exposures.

Exposure to ambient air (Appendix C, Table C16):

- **Exposure to mercury vapor in ambient air can be harmful to the health of residents and recreational visitors, including children who spend time near the rotary furnace or other "hot spots."**
- Ambient air concentration of mercury for residences on and near the Site did not exceed the chronic health screening level during one sampling event.

4.6.2.2 Aluminum

Aluminum is the most abundant metal in the earth's crust. Virtually all food, water, air, and soil contain some aluminum. Exposure to aluminum is usually not harmful, but exposure to high levels can affect human health. The Department of Health and Human Services (DHHS) and USEPA have not evaluated the carcinogenic potential of aluminum in humans. Aluminum has not been shown to cause cancer in animals [25].

Elevated levels of aluminum were detected in surface water near the Level 10 AMD discharge. The maximum detected in surface water was 135,000 μg/L, exceeding ATSDR's media-specific comparison values for aluminum (chronic EMEGs of 10,000 μg/L for a child and 35,000 μg/L for an adult). The exposure doses for aluminum that CDPH calculated for both children and adults who come into dermal contact with contaminated surface waters did not exceed the media-specific health comparison value for aluminum (1 mg/kg/day) (Appendix C, Table C10). Therefore, noncancer health effects would not be expected from dermal contact with surface waters near the Level 10 AMD discharge area. Furthermore, all elevated levels of aluminum detected in surface water were confined to areas near the Level 10 AMD discharge areas and near the calcine piles. The levels of aluminum detected in San Carlos Creek surface water downstream from the Site were below ATSDR's media-specific comparison values.

4.6.2.3 Nickel

Nickel was found at elevated levels in surface water taken at the off-site residence and at the confluence, for both past and current exposures. For past exposures to surface water, only the child visitor's doses were calculated, since the nickel concentration in water did not exceed the media-specific comparison value for adults. Current exposures to water for adults and the child visitor were calculated for noncancer outcomes and the hazard quotient was below 1 (Appendix C, Tables C8 and C9).

4.6.2.4 Cadmium

Cadmium was found to be slightly elevated above the media-specific comparison levels in surface water. In sediment and mine tailings it was detected above the media-specific comparison value, but below the quantitation limit (j-flagged). Cadmium doses from current exposures to surface water, sediment, and mine tailings through dermal contact or ingestion are very small and the hazard quotient is negligible (Appendix C, Tables C10, C12, and C14).

4.6.3 Exposure to Mercury and Health Effects

Metallic mercury, also known as quicksilver, is a silvery liquid. In nature, mercury is found in rocks, bound to other elements such as sulfur. Mercuric sulfide, or cinnabar, is present in the ore that was mined at the New Idria Mercury Mine. Combinations of mercury with minerals such as sulfur are referred to as inorganic mercury. Microorganisms and natural processes can convert this form of mercury into a combination of mercury and carbon, called organic mercury.
A common form or organic mercury is called methylmercury, which can accumulate in fish and is a major source of mercury for humans. Other common exposures to low levels of mercury are from ambient air and water. Specific populations may have additional exposures due to their work environment, mercury spills (thermometers, fluorescent lightbulbs), cosmetics, or cultural practices.

The major target organs of mercury are the kidneys and the central nervous system, including the brain. Mercury vapors are easily absorbed and distributed by the blood to the brain and kidneys and can be passed from a pregnant mother to the developing child. If inorganic mercury is ingested (via food or drink), a portion is absorbed in the stomach and intestines and distributed by the blood. Much less inorganic mercury is absorbed through the skin. Inorganic mercury accumulates mostly in the kidneys and, to a lesser degree, enters the brain and crosses the placenta. It can also pass into breast milk. Other symptoms of mercury poisoning from inorganic mercury (mercuric chloride) are an increased heart rate and elevated blood pressure, red gums, diarrhea, abdominal pain, cramping/twitching in arms and legs, kidney damage, development of "pink disease" (acrodynia, mostly seen in children), leg cramps, irritability, redness of skin, and peeling of skin on hands, nose, and soles of feet [23]. All forms of mercury leave the body in urine, feces, and, to a smaller degree, exhaled air over a period of weeks to months after exposure [1, 22].

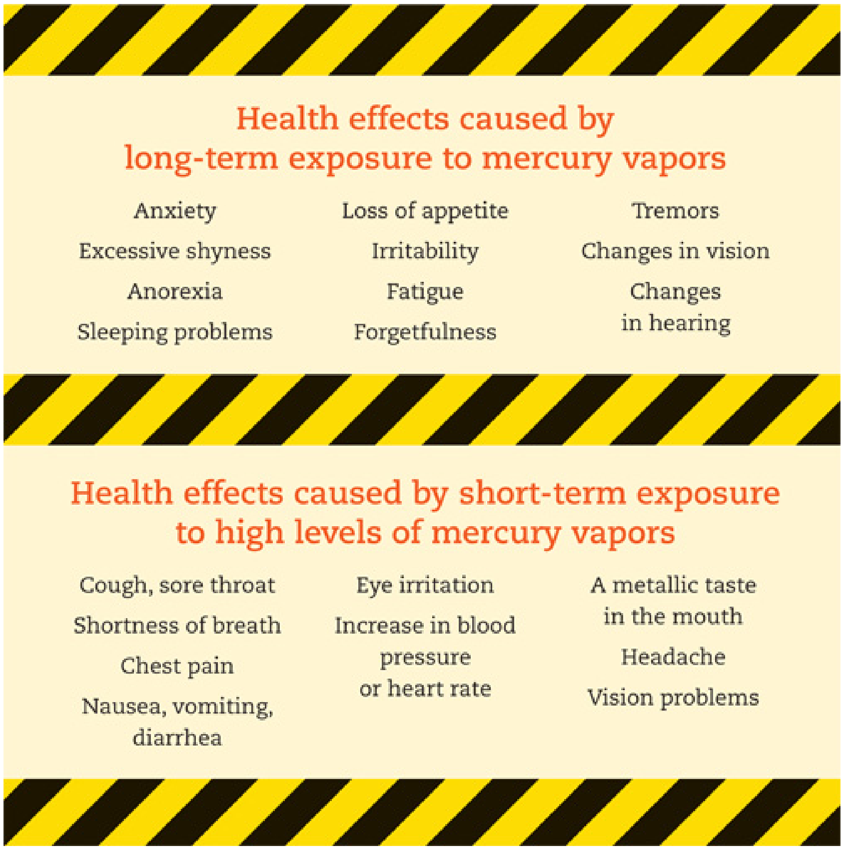


Figure 4. Health Effects Caused by Mercury Vapors [1]

Long-term exposure to mercury (especially methylmercury and mercury vapors) can result in mood swings and personality changes; a shaking (tremor) in hands, tongue, or eyelids; changes in vision; deafness; muscle incoordination; and loss of sensation and memory. Other effects may be gum problems (loose teeth and sores), skin allergies (itchiness and rashes when exposed), and discoloration of the eye lens. Exposure to large amounts of metallic mercury (or methylmercury) in a short time can lead to brain damage, especially in children, but this is less certain for exposures to inorganic mercury since it does not enter the brain as easily. All forms of mercury can cause kidney damage, which the body may repair if the damage is not too great. Inorganic mercury can damage the stomach and intestines and affect heart rate and blood pressure if ingested in large amounts, but there is little information on the effects in humans from long-term, low-level exposure [1].

Several reliable and accurate ways to measure mercury levels in the body are available: Sampling of blood, urine, hair, or breast milk can be performed in a doctor's office or health clinic. A urine test can detect exposure to mercury vapors and inorganic mercury [24]. A blood test can give information about exposure over a few days to all forms of mercury but is not a good measure of long-term exposure. A blood or hair analysis is usually used for methylmercury exposure [1].

4.6.3.1 Mercury at the Site

Mercury exposures at the Site are from inhalation of mercury vapors (elemental mercury) in ambient air and ingestion of mine tailings that contain inorganic mercury (cinnabar or HgS). CDPH further analyzed ambient air data for mercury vapors from the 2012 Site visit. The highest concentrations were measured at the hole in the flue pipe and exceeded the calibration range of the instrument (0.002 - 100 $\mu g/m^3$). The concentration of mercury in air at that location exceeded ATSDR's inhalation MRL for chronic exposure of 0.2$\mu g/m^3$, but the actual concentration is unknown and the noncancer hazard quotient cannot be calculated. These concentrations also exceed the National Institute for Occupational Safety and Health (NIOSH) recommended exposure limits (RELs) and the American Conference of Governmental Industrial Hygienists' (ACGIH) threshold limit values (TLVs) of 50 $\mu g/m^3$. For the other locations, the maximum concentration in air and the 95% upper confidence limit (UCL) for mercury in air were 0.314 $\mu g/m^3$ and 0.11 $\mu g/m^3$, respectively, near the furnace; 0.02 $\mu g/m^3$ and 0.013 $\mu g/m^3$, respectively, near Residence A; and 0.043 $\mu g/m^3$ and 0.023 $\mu g/m^3$, respectively, near Residence B (Appendix C, Table C16).

Using ATSDR's minimal risk level (MRL) of 0.2$\mu g/m^3$ [25] and OEHHA's chronic (0.03$\mu g/m^3$) reference exposure levels (RELs) for inhalation of mercury [13], CDPH determined the following:

- Mercury concentrations in air at the hole in the flue pipe exceeded ATSDR's chronic MRL.

- Mercury concentrations in air (95% UCL) near the rotary furnace building do not exceed ATSDR's chronic MRL but exceed OEHHA's chronic REL of 0.03 $\mu g/m^3$.

- Mercury concentrations in air near the residences are below ATSDR's chronic MRL and OEHHA's chronic REL.

The hazard index for children from current exposure to mercury in mine tailings via the ingestion route is 2.8, indicating the possibility for long-term noncancer health effects and the need for further evaluation (Appendix C, Table C14). Children's daily exposure to soil from incidental ingestion (200 mg/day) is considered higher than for adults (100 mg/day) because of their common hand-to-mouth behaviors and playing close to the ground.

Based on the mining history of the Site, inorganic mercury (cinnabar, HgS) is the most likely form of mercury in sediment, mine tailings and calcine piles. In the absence of a health comparison value for cinnabar (HgS), the mercury doses from exposures to sediment and mine tailings were compared to health comparison values of inorganic mercury (mercuric chloride). This RfD was also used to evaluate dermal exposures to mercury from surface water.

The RfD for mercuric chloride is based on LOAELs from three separate rat studies (0.226, 0.317, and 0.633 mg/kg/day of mercuric chloride). Although no one study was considered adequate for deriving an oral RfD, USEPA's mercury workgroup derived an oral RfD (0.0003 mg/kg/day) of high confidence using the weight of evidence from the three studies and an uncertainty factor of 1000. The estimated dose for children (0.00084 mg/kg/day) for current exposure to mercury in mine tailings is a combined dose that includes both the dermal and ingestion routes of exposures, but it is only the incidental ingestion portion of the dose (0.000833 mg/kg/day) that exceeds the RfD.

4.6.3.2 Methylmercury

Natural processes and microorganisms convert inorganic mercury into organic mercury, such as methylmercury. Methylmercury analysis was conducted on surface water samples in the 2010 ESI report to assess methylation of mercury at the Site. Methylmercury was detected in all of the surface water samples in concentrations ranging from 0.000039 µg/L (San Carlos Creek adjacent to the southern calcine tailings) to 0.0023 µg/L (Level 10 AMD discharge area).

The federal and state MCL for mercury of 2 µg/L refers to inorganic mercury. Methylmercury is considered to be more toxic than inorganic mercury. However, there is no federal or state MCL for methylmercury. ATSDR has established a child chronic EMEG of 3 µg/L and an adult chronic EMEG of 11 µg/L for methylmercury. ATSDR has also established a child RMEG of 1 µg/L and an adult RMEG of 3.5 µg/L. The California Toxics Rule (CTR) regulates discharges to surface waters and has established human health criteria for mercury that includes both organic and inorganic forms of mercury. Owing to the toxicity of methylmercury, and its tendency to bioaccumulate in fish and other animals, the CTR human health criteria for mercury consumption in water is 0.05 µg/L, lower than the MCL for inorganic mercury.

Exposure to methylmercury at the Site is unlikely due to the absence of fish/shellfish in San Carlos Creek. The highest concentration of methylmercury found in the surface water samples does not exceed ATSDR's media specific comparison values (EMEG and RMEG) and does not exceed the more stringent CTR value for organic and inorganic mercury of 0.05 µg/L. Therefore, noncancer health effects would not be expected from drinking surface water with methylmercury levels found in San Carlos Creek surface water [3]. Mercury was evaluated as inorganic mercury for surface water, sediment, and mine tailings exposure and as elemental mercury for ambient air.

On-site mercury and methylmercury sample locations for surface water, sediment, and mine tailings from the 2010 report are shown in Appendix B, Figure B5.

4.6.4 Contaminants of Concern with Cancer-Causing Health Effects

CDPH identified four COCs that are considered carcinogens: arsenic, nickel, cadmium, and aluminum. Of these, only arsenic was further evaluated. No cancer risk calculations were undertaken for nickel, cadmium or aluminum since only ingestion and dermal exposure routes are expected and oral cancer slope factors are not available for these compounds.

4.6.4.1 Arsenic

IARC has identified arsenic to be carcinogenic to humans. Arsenic was found to be elevated in surface water, sediment, and mine tailings in the 2010 ESI sampling events, but it was not analyzed in the 1999 PA/SI report. Background concentrations of arsenic were found below 1 mg/kg (Appendix C, Table C7), while the site concentrations ranged from 16.2 to 27.7 mg/kg. CDPH estimated current exposures only, based on the maximum concentration of arsenic found in each environmental medium [26]. CDPH calculated the daily dose and used the oral cancer slope factor for arsenic (1.5 mg/kg/day) to calculate the potential cancer risk for adult and child exposures, which is also protective of recreational visitors (Appendix C, Table C17). Both USPEA and Cal/EPA provide the cancer slope factor value of 1.5 mg/kg/day.

All cancer estimates for arsenic for all media and exposure routes are presented in Appendix C, Table C17. The cancer risk for arsenic was estimated for adult and child residents, which is also protective of the recreational visitor. Appendix F shows the cancer risk calculation for children (incidental ingestion of mine tailings containing arsenic).

- The overall exposure to arsenic from mine tailings is a combination of incidental ingestion, dermal contact, and fugitive dust inhalation routes. CDPH calculated the potential combined cancer risk from these three exposure routes to be 4.3 in 1 million for an adult and 6.6 in 1 million for a child. The highest risks are conferred from incidental ingestion of dust: 4.2 in 1 million for adults and 6.6 in 1 million for visiting children.

- The combined potential cancer risk from all environmental media would be 5.4 in 1 million for an adult and 7.2 in 1 million for a child. These estimates are slightly higher than the point of departure risk of 1 in a million but within USEPA's target risk range and were derived based on very health-protective assumptions.

- For dermal exposure to on-site surface waters, CDPH calculated the potential cancer risk to be 0.9 in 1 million for an adult and 0.3 in 1 million for a child.

- For dermal exposure to on-site sediments, CDPH calculated the potential cancer risk to be 0.2 in 1 million for both an adult and a child.

4.6.4.2 Nickel

Exposure to nickel and nickel compounds has been associated with human cancers [27-29], but most of the information on the carcinogenicity of nickel is based on studies of animals and workers being exposed to large amounts of nickel via inhalation. USEPA and OEHHA do not provide an oral slope factor for nickel to estimate a lifetime cancer risk from ingestion (surface water). In the absence of an oral slope factor, nickel was evaluated only as a noncancer COC.

4.6.4.3 Cadmium

Exposure to cadmium and cadmium compounds has been associated with lung cancers [30], but most of the information on carcinogenicity is based on studies of animals and workers being exposed to large amounts of cadmium via inhalation. Evidence for evaluating potential carcinogenicity of cadmium by the oral and dermal routes in both animals and humans is insufficient. USEPA and OEHHA do not provide an oral slope factor for cadmium to estimate a lifetime cancer risk via the oral or dermal route of exposure. In the absence of an oral slope factor, cadmium was evaluated only as a noncancer COC.

4.6.4.4 Aluminum

IARC considers aluminum to be carcinogenic to humans only via the inhalation route of exposure, and in particular for workers involved in the production aluminum [31]. CDPH staff considered dermal exposure from sediment as the only exposure route for aluminum. USEPA and OEHHA do not provide an oral slope factor for aluminum to estimate a lifetime cancer risk via the oral or dermal route of exposure. In the absence of an oral slope factor, a route-to-route extrapolation cannot be done. CDPH only considered noncancer health effects of aluminum from sediment exposures (see Contaminants of Concern with Noncancer Health Effects section above).

5.0 Community Outreach and Community Health and Exposure Concerns

As part of CDPH's community outreach, on May 11, 2011, CDPH staff mailed a letter to residents living closest to the mine. The letter informed residents of CDPH's planned public health activities at the Site. In addition, CDPH staff contacted residents living near the Site via telephone and e-mail between the fall of 2011 and summer of 2012 to learn if they had health or exposure concerns related to the Site or its contamination.

Several residents reported concerns about tooth loss, which they attributed to ingestion of surface water and "contamination from mercury," and the development of "mad hatter's disease" due to methylmercury contamination. One resident expressed concern about dogs dying from drinking contaminated water. Another concern was that the water quality worsened after the regulatory agency began its cleanup.

5.1 Evaluation of Community Health and Exposure Concerns

CDPH evaluated potential environmental links to the illnesses described by community members by conducting a literature search on their known causes, including environmental or chemical agents.

5.1.1 Tooth Loss

CDPH did not find an association between tooth loss and chronic mercury exposure from ingestion of low levels of mercury in drinking water. However, red gums and the loosening of teeth have been reported in untreated cases of high chronic exposures [23].

5.1.2 Mad Hatter's Disease

Mad hatter's disease and mad hatter syndrome are terms frequently used to refer to mercury poisoning. These terms date back to the 18th and 19th centuries when mercury was commonly used in the manufacture of felt hats. The workers (hatters) who were exposed to mercury by breathing in high levels of mercury vapors over a long term often suffered from erethism, a neurological disorder that affects the whole central nervous system. Irritability, tremors, excitability, loss of memory, and insomnia are the principle features and, in severe cases, delirium with hallucinations occurs [32-34].

CDPH staff was not able to find any scientific literature that associated the occasional ingestion of mercury in drinking water, from skin contact, or through dust inhalation with neurological effects such as erethism. Erethism is usually associated with high occupational inhalation exposures and not occasional exposures. CDPH's analysis was limited by the available toxicological information on mercury and our understanding of the effects from exposure to multiple chemicals. In addition to the mercury exposures associated with the Site, there were individual exposure histories, which may have occurred through the diet, occupational, and recreational exposures.

6.0 Child Health Considerations

CDPH and ATSDR recognize that infants and children may be more sensitive than adults to environmental exposures. This sensitivity is a result of several factors: (1) children may have greater exposures to environmental toxicants than do adults because, pound for pound of body weight, children drink more water, eat more food, and breathe more air than adults; (2) children play outdoors close to the ground, increasing their exposure to toxicants in dust, soil, surface water, and ambient air; (3) children have a tendency to put their hands in their mouths while playing, thereby exposing themselves to potentially contaminated soil particles at higher rates than adults (also, some children ingest nonfood items, such as soil, a behavior known as pica); (4) children are shorter than adults, meaning that they can breathe dust, soil, and any vapors close to the ground; (5) children grow and develop rapidly and can sustain permanent damage if toxic exposures occur during critical growth stages; and (6) children and teenagers may disregard "No Trespassing" signs and wander into restricted locations. Because children depend on adults for risk identification and management decisions, CDPH and ATSDR are committed to evaluating their special interests at hazardous waste sites.

CDPH attempted to identify places (e.g., parks, schools, recreational facilities, etc.) in the vicinity of the New Idria Mercury Mines where children live, play, or go to school. However, the site is remote, and based on interviews with residents living nearby; no children currently live at or near the Site. During a site visit, CDPH staff observed children on the Site, visiting with residents or recreating. Therefore, visiting children were considered in all potential and completed exposure pathways evaluated in this public health assessment. However, the pica scenario was not evaluated. Visiting children are especially at risk for noncancer effects from incidental ingestion of mercury in dusts from mine tailings (hazard index of 2.8) and from inhalation of mercury vapors near "hot spots" on the Site. Potential cancer risks from arsenic exposure in children are also from incidental ingestion of mine tailings (6.6 in 1 million). CDPH program staff concluded that children more than adults are at risk for exposure at the Site and recommends that actions be taken to reduce exposures and educate the local population and recreational visitors with children.

In the perinatal period (before children are born and the early months after birth), children are specifically sensitive to the effects of metallic mercury and methylmercury. Effects on the child can range from a small decrease in the intelligence quotient (IQ) to brain damage with mental retardation, depending on exposure. If the demographic of the surrounding area changes to include women of childbearing age, CDPH recommends that additional information be provided to the population as mercury can be passed to the developing child via the placenta or through breast milk.

7.0 Conclusions

CDPH staff evaluated the past, current, and future exposure to contaminants of concern at the New Idria Mercury Mine Site from surface water, sediment, mine tailings, and ambient air. All conclusions were based on site visits, interviews, and review of available data and reports.

CDPH program staff and ATSDR conclude that:

1. Current and future exposures from inhalation of high levels of mercury vapors in ambient air near the former processing area, furnace building, flue pipe and other “hot spots” could harm people’s health. These areas are public health hazards.

2. The dilapidated buildings on-site pose a physical hazard to residents and recreational visitors. These are public health hazards.

3. Exposure to mercury from mine tailings via ingestion could pose elevated noncancer health risks to visiting children.

4. Exposure to arsenic from mine tailings via ingestion could pose a slightly elevated cancer health risk to adults and visiting children.

5. Inhalation of mercury vapor in ambient air prior to 1972 when the mines were in operation could have harmed workers’ and residents’ health.

6. Dermal (skin) contact with, or ingestion of, surface water or sediment is not expected to harm people’s health.

7. Dermal (skin) contact with or inhalation of dust particles from mine tailings are not expected to harm people’s health.

8. CDPH and ATSDR cannot determine whether past, current, or future levels of mercury vapors near the on-site residences could harm people’s health (exposures after the mines closed in 1972).

9. CDPH and ATSDR cannot determine whether contaminants at the Site are impacting private wells and harming people’s health.

8.0 Recommendations

CDPH and ATSDR recommend that USEPA continue to take steps to address existing data gaps and to eliminate or reduce exposure of the surrounding community and recreational visitors to contaminants from the Site. Specifically:

1. Continue to restrict public access (by maintaining fencing and signage) to prevent exposure to:
    a. mercury vapor "hot spots" such as areas near the furnace building, flue pipe and former processing areas
    b. dilapidated buildings where physical hazards are present
    c. calcine piles and waste rock

2. Take measures to identify and remove sources of mercury vapor emissions on the Site to prevent future emissions of and exposures to mercury vapor in ambient air.

3. Monitor for ambient mercury vapors near the part-time residences, including during remediation activities, and promptly inform residents of the results. In addition, CDPH recommends that USEPA offer a screening of mercury levels in urine to part-time residents that may have been exposed to mercury vapors. The analyses can be used to confirm that the mercury concentrations in urine are consistent with the ambient air analyses conducted near the on-site and nearby residences by USEPA and CDPH, both of which resulted in levels that did not exceed health screening values for mercury vapor in ambient air.

4. Determine whether private wells are present in the surrounding community and, if they are, conduct sampling and analysis to determine whether they are impacted by contamination from the Site.

In addition, CDPH and ATSDR also recommend:

5. Persons who believe they were exposed to mercury vapors from the Site in the past and are concerned about their health contact their physician.

6. Close supervision of children visiting the Site and practice of proper hygiene (frequent washing of hands, arms, face) if mine tailings are accidentally touched, especially before eating and drinking, to avoid exposure to contaminants in mine tailings.

9.0 Public Health Action Plan

The Public Health Action Plan (PHAP) for this site contains a description of actions to be taken, or to be under consideration by ATSDR and CDPH or others, at or near the Site. 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 on the Site. Completed and ongoing actions are listed below.

9.1 Completed Actions

- USEPA added the New Idria Mercury Mine to the National Priorities List (September 2011).
- CDPH staff gathered information about community concerns through interviews with local residents during on-site visits in June 2011, March 2012, and May 2013.
- USEPA began remediation efforts by diverting AMD discharge from the Level 10 adit.
- USEPA installed fencing and signage in the fall of 2011.
- CDPH staff visited the Site in 2011, 2012, and 2013.

9.2 Ongoing Actions

- ATSDR and CDPH will meet with the interested community to share the content of this PHA and record and address public comments.
- To the extent that resources permit, CDPH will review new environmental data when they become available to assess the potential health risks to residents living near the Site and to recreational visitors.
- CDPH will conduct annual reviews to determine which recommendations have been implemented.
- CDPH will continue providing health education to community members regarding children’s special risks from exposure to contaminants at the Site.

Preparers of Report

California Department of Public Health
Environmental and Health Effects Assessor

Armando Chévez
Research Scientist
Environmental Health Investigations Branch

California Department of Public Health
Community Relations Coordinator

Nancy Palate
Associate Health Program Advisor
Environmental Health Investigations Branch

California Department of Public Health
Designated Reviewer

Gabriele Windgasse, DrPH
Chief, Site Assessment Section
Environmental Health Investigations Branch

Agency for Toxic Substances and Disease Registry
Regional Representatives, Region IX

CAPT Robert Knowles, MS, REHS

Agency for Toxic Substances and Disease Registry
Technical Project Officer

CDR Trent LeCoultre, MSEH, REHS
Environmental Health Scientist

Agency for Toxic Substances and Disease Registry

LCDR Kai Elgethun, PhD, MPH
Western Branch Assoc. Director for Science

References

1. Agency for Toxic Substances and Disease Registry. ATSDR Toxzine - Mercury. A publication of CDC/ATSDR. 2014. Available online at: http://www.atsdr.cdc.gov/sites/toxzine/mercury_toxzine.html
2. U.S. Environmental Protection Agency. Fact Sheet: EPA finalizes Site on the NPL. Begins Interim Cleanup Actions. New Idria Mercury Mine. October 2011. Available online at: http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/3dc283e6c5d6056f88257426007417a2/21e3bfeb7f4705c988257937006612a7/$FILE/NIMM10_11%20518kb.pdf. Last accessed April 2014. .
3. Weston Solutions Inc. Expanded Site Inspection Report. New Idria Mercury Mine, San Benito County, California. U.S. Environmental Protection Agency. Region IX. October 2010. Available online at: http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/ViewByEPAID/CA0001900463. Last accessed October 2013. .
4. Ecology and Environment Inc. Superfund Technical Assessment and Response Team. New Idria Mercury Mine Preliminary Assessment/Site Inspection. March 1998. Available to the public at San Francisco (CA); U.S. Environmental Protection Agency, Region XV
5. U.S. Environmental Protection Agency Region IX. Hazard Ranking System (HRS). New Idria Mercury Mine. San Benito, California. Available for public viewing at San Francisco (CA): U.S. Environmental Protection Agency, Region IX.
6. Weston Solutions Inc. Removal Action Final Report. New Idria Mercury Mine Superfund Site. United States Environmental Protection Agency. Region IX. April 2012. Available online at: http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/ViewByEPAID/CA0001900463. Last accessed October 2014.
7. Prija M. Ganguli, Robert P. Mason, Khali E. Abu-Saba, Robert S. Anderson, Flegal AR. Mercury speciation in drainage from the New Idria Mercury Mine, California. University of California, Santa Cruz. August 2000. .
8. Christopher S. Kim, James J. Rytuba, Gordon E. Brown Jr. Geological and anthropogenic factors influencing mercury speciation in mine wastes: an EXAFS spectroscopy study. *Applied Geochemistry*;**19**(3):379-393.
9. Agency for Toxic Substances and Disease Registry. Public Health Assessment Guidance Manual. Available online at http://www.atsdr.cdc.gov/HAC/PHAmanual/toc.html.
10. California Environmental Protection Agency, Office of Environmental Health Hazard Assessment. California Human Health Screening Levels (CHHLs). Soil screening levels. Available online at: http://www.oehha.org/risk/soil.html. Last accessed March 2014.
11. Agency for Toxic Substances and Disease Registry. Minimal risk levels for hazardous substances. 2015 Nov. Available online at http://www.atsdr.cdc.gov/mrls/.
12. U.S. Environmental Protection Agency, Office of Health and Environmental Assessment. Integrated Risk Information system. Available online at http://www.epa.gov/iris/subst/0073.html.
13. California Environmental Protection Agency, Office of Environmental Health Hazard Assessment. Reference exposure levels. Available online at: http://www.oehha.ca.gov/air/allrels.html. Last accessed June 2013.
14. California Environmental Protection Agency, State Water Resources Control Board. Chemicals and Contaminants in Drinking Water. Available online at: http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Chemicalcontaminants.shtml. Last accessed July 2014.

15. U.S. Environmental Protection Agency. Pacific Southwest, Region 9 Regional Screening Levels. November 2013. Available online at: http://www.epa.gov/region9/superfund/prg/. Last accessed February 2014. .
16. U.S. Department of Health and Human Services. National Toxicology Program. Report on Carcinogens. Chromium Hexavalent Compounds. Twelfth Edition. 2011. Available online at: http://ntp.niehs.nih.gov/ntp/roc/twelfth/profiles/chromiumhexavalentcompounds.pdf. Last accessed March 2014.
17. Abu-Saba KE. Spatial and temporal variability in the aquatic cycle of chromium. San Francisco Estuary Institute, University of California, Santa Cruz. 1998. Abstract available online at: http://www.sfei.org/node/2215. Last accessed March 2014.
18. Department of Toxic Substances Control. Human Health Ecological Risk Division (HERD). Human Health Risk Assessment (HHRA) Note Number 1. Recommended DTSC default exposure factors for use in risk assessment at California hazardous waste sites and permitted facilities. May 2011. Available online at: http://www.dtsc.ca.gov/AssessingRisk/upload/HHRA_Note1.pdf. Last accessed November 2013.
19. U.S. Environmental Protection Agency. Site Characterization and Monitoring Technical Support Center. ProUCL Software Documentation. Available online at: http://www.epa.gov/osp/hstl/tsc/software.htm. Last accessed November 2013.
20. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response (OSWER). Recommendations for Default Value for Relative Bioavailability of Arsenic in Soil. Available online at:http://www.epa.gov/superfund/bioavailability/pdfs/Arsenic%20Bioavailability%20POLICY%20 Memorandum%2012-20-12.pdf . Last accessed November 2013.
21. Agency for Toxic Substances and Disease Registry. ATSDR Dose Calculator. Version 06May2014. Available at: http://www.atsdr.cdc.gov/sites/brownfields/dose_calculator.html
22. National Cancer Institute. Surveillance, Epidemiology, and End Results (SEER) Program. Cancer statistics fact sheets. All cancer sites. Available online at: http://seer.cancer.gov/statfacts/html/all.html.
23. Oklahoma State University, Environmental Health and Safety. The health effects of mercury. Available online at: https://ehs.okstate.edu/training/mercury.htm.
24. Agency for Toxic Substances and Disease Registry, Center for Disease Control and Prevention Mercury Workgroup. Children's Exposure to Elemental Mercury: A National Review of Exposure Events. February 2009. Available online at: http://www.atsdr.cdc.gov/mercury/docs/MercuryRTCFinal2013345.pdf. Last accessed January 2015.
25. U.S. Environmental Protection Agency, Office of Health and Environmental Assessment. Integrated Risk Information System. Mercury, elemental . Available online at: http://www.epa.gov/iris/subst/0370.htm. Last accessed March 2014.
26. International Agency for Research on Cancer. Monograph. Arsenic and arsenic compounds. Available online at: http://monographs.iarc.fr/ENG/Monographs/vol100C/mono100C-6.pdf. Last accessed October 2013.
27. International Agency for Research on Cancer. Monograph. Nickel and nickel compounds. Available online at: http://monographs.iarc.fr/ENG/Monographs/vol100C/mono100C-10.pdf. Last accessed October 2013.
28. U.S. Environmental Protection Agency, Office of Health and Environmental Assessment. Integrated Risk Information System. Nickel refinery dust . Available online at:

http://cfpub.epa.gov/ncea/iris/index.cfm?fuseaction=iris.showQuickView&substance_nmbr=0272 Last accessed March 2014.
29. U.S. Environmental Protection Agency, Office of Health and Environmental Assessment. Integrated Risk Information System. Nickel subsulfide. Available online at: http://cfpub.epa.gov/ncea/iris/index.cfm?fuseaction=iris.showQuickView&substance_nmbr=0273 Last accessed March 2014.
30. International Agency for Research on Cancer. Monograph. Cadmium and cadmium compounds. Available online at: http://monographs.iarc.fr/ENG/Monographs/vol100C/mono100C-8.pdf. Last accessed October 2013.
31. Agency for Toxic Substances and Disease Registry. Toxicological profile for aluminum. Atlanta: U.S. Department of Health and Human Services; 2006 Sep. Available online at http:// www.atsdr.cdc.gov/toxprofiles/tp22.html
32. Tchounwou PB, Ayensu WK, Ninashvili N, Sutton D. Environmental exposure to mercury and its toxicopathologic implications for public health. *Environ Toxicol* 2003;**18**(3):149-75.
33. Waldron HA. Did the Mad Hatter have mercury poisoning? *Br Med J (Clin Res Ed)* 1983;**287**(6409):1961.
34. World Health Organization (WHO). Environmental Health Criteris 1. Mercury. Geneva. Available online at: http://www.inchem.org/documents/ehc/ehc/ehc001.htm. Last accessed May 2014. 1976.
35. U.S. Environmental Protection Agency. Exposure factors handbook. 1997. Available online at http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=12464.
36. U.S. Environmental Protection Agency. Risk assessment guidance for Superfund, Volume I, human health evaluation manual (part E, supplemental guidance for dermal risk assessment). 2004 Jul. Available online at http://www.epa.gov/oswer/riskassessment/ragse/index.htm.
37. Agency for Toxic Substances and Disease Registry. Toxicological profile for arsenic. Atlanta: U.S. Department of Health and Human Services; 2007 Aug. Available online at: http://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=22&tid=3. Last accessed January 2014.
38. Agency for Toxic Substances and Disease Registry. Toxicological profile for mercury. Atlanta: U.S. Department of Health and Human Services; 1999 Mar. Available online at: http://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=115&tid=24. Last accessed December 2013.
39. Agency for Toxic Substances and Disease Registry. Toxicological profile for nickel. Atlanta: U.S. Department of Health and Human Services; 2005 Aug. Available online at http://www.atsdr.cdc.gov/toxprofiles/tp15.html.

Appendix A. Glossary of Terms

Absorption
How a chemical enters a person's blood after the chemical has been swallowed, has come into contact with the skin, or has been breathed in.

Acute Exposure
Contact with a chemical that happens once or only for a limited period of time. ATSDR defines acute exposures as those that might last up to 14 days.

Adits
A type of entrance to an underground mine.

Adverse Health Effect
A change in body function or the structures of cells that can lead to disease or health problems.

ATSDR
A federal public health agency with headquarters in Atlanta, Georgia, and ten regional offices in the United States. ATSDR's mission is to serve the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and diseases related to toxic substances. ATSDR is not a regulatory agency, unlike the U.S. Environmental Protection Agency, which is the federal agency that develops and enforces environmental laws to protect the environment and human health.

Background Level
An average or expected amount of a chemical in a specific environment or amounts of chemicals that occur naturally in a specific environment.

Benchmark Dose
A dose or concentration from a modeled response rate of an adverse effect (called the benchmark response or BMR) compared to background.

California Human Health Screening Levels (CHHSLs)
Cal/EPA screening levels for chemicals in soil and soil gas used to aid in clean-up decisions based on the protection of public health and safety

Cancer Risk
The potential for exposure to a contaminant to cause cancer in an individual or population is evaluated by estimating the probability of an individual developing cancer over a lifetime as the result of the exposure. This approach is based on the assumption that there are no absolutely "safe" toxicity values for carcinogens. The U.S. Environmental Protection Agency and the California Environmental Protection Agency have developed cancer slope factors and inhalation unity risk factors for many carcinogens. A slope factor is an estimate of a chemical's carcinogenic potency, or its potential for causing cancer.

If adequate information about the level of exposure, frequency of exposure, and length of exposure to a particular carcinogen is available, an estimate of excess cancer risk associated with the exposure can be calculated using the slope factor for that carcinogen. Specifically, to obtain risk estimates, the estimated chronic exposure dose (which is averaged over a lifetime or 70 years) is multiplied by the slope factor for that carcinogen.

Cancer risk is the theoretical chance of getting cancer. In California, 41.5% of women and 45.4% of men (about 43% combined) will be diagnosed with cancer in their lifetime. This is referred to as the "background cancer risk." The term "excess cancer risk" represents the risk above and beyond the "background cancer risk." A "one-in-a-million" excess cancer risk from a given exposure to a contaminant means that if one million people are chronically exposed to a carcinogen at a certain level, over a lifetime, then one cancer above the background risk may appear in those million persons from that particular exposure. For example, in a million people, it is expected that approximately 430,000 individuals will be diagnosed with cancer from a variety of causes. If the entire population was exposed to the carcinogen at a level associated with a one-in-a-million cancer risk, 430,001 people may get cancer, instead of the expected 430,000.

Cancer risk numbers are a quantitative or numerical way to describe a biological process (development of cancer). In order to take into account the uncertainties in the science, the risk numbers used are plausible upper limits of the actual risk, based on conservative assumptions.

Chronic Exposure
A contact with a substance or chemical that happens over a long period of time. The Agency for Toxic Substances and Disease Registry considers exposures of more than 1 year to be chronic.

Concern
A belief or worry that chemicals in the environment might cause harm to people.

Concentration
How much or the amount of a substance present in a certain amount of soil, water, air, or food.

Contaminant
See Environmental Contaminant.

CREG (ATSDR's Cancer Risk Evaluation Guide for 1 in 1 million increased cancer risk)
Screening values for air, soil and water, developed by ATSDR. To derive water and soil CREGs, ATSDR uses CSFs developed by the U.S. Environmental Protection Agency and reported in the Integrated Risk Information System (IRIS). The IRIS summaries, available at http://www.epa.gov/iris, provide detailed information about the derivation and basis of the CSFs for individual substances. ATSDR derives CREGs for lifetime exposures, and therefore uses exposure parameters that represent exposures as an adult. An adult is assumed to consume 2 liters per day of water and weigh 70 kilograms. For soil, ATSDR assumes a soil swallowing rate of 100 milligram per day, for a lifetime (70 years) of exposure.

Like EMEGs, water CREGs are derived for potable water used in homes, including water used for drinking, cooking, and food preparation. Soil CREGs apply only to soil that is swallowed.

A theoretical increased cancer risk is calculated by multiplying the dose and the cancer slope factor. When developing CREGs, the target risk level (10^{-6}), which represents a theoretical risk of one excess cancer case in a population of one million, and the CSF are known. The calculation seeks to find the substance concentration and dose associated with this target risk level.

Dermal Contact
A chemical getting onto your skin. See Route of Exposure.

Dose
The amount of a substance to which a person may be exposed, usually on a daily basis. Dose is often explained as the "amount of substance(s) per body weight per day."

Dose/Response
The relationship between the amount of exposure (dose) and the change in body function or health that result.

Duration
The amount of time (days, months, and years) that a person is exposed to a chemical.

EMEG (ATSDR's Environmental Media Evaluation Guide)
Screening values based on noncancer health endpoints, developed by ATSDR. EMEGS have been developed for air, soil and water. Water EMEGs are derived for potable water used in homes. Potable water includes water used for drinking, cooking, and food preparation. Exposures to substances that volatilize from potable water and are breathing, such as volatile organic compounds, released during showering, are not considered when deriving EMEGs.

To derive water EMEGs, ATSDR uses the chronic oral MRLs from the Toxicological Profiles, available at http://www.atsdr.cdc.gov/toxpro2.html. Ideally, the MRL is based on an experiment in which the chemical was administered in water. However, in the absence of such data, an MRL based on an experiment in which the chemical was administered by gavage or in food may have been used. The Toxicological Profiles for individual substances provide detailed information about the MRL and the experiment on which it was based.

Children are usually assumed to constitute the most sensitive segment of the population. Water intake per unit of body weight is greater than the adults' rate. An EMEG for a child is calculated assuming a daily water swallowing rate of 1 liter per day for a 10-kilogram child. For adults, an EMEG is calculated assuming a daily water swallowing rate of 2 liters per day and a body weight of 70 kg.

For soil EMEGS, ATSDR uses the chronic oral MRLs from its Toxicological Profiles. Many chemicals bind tightly to organic matter or silicates in the soil. Therefore, the bioavailability of a chemical is dependent on the media in which it is administered. Ideally, an MRL for deriving a soil EMEG should be based on an experiment in which the chemical was administered in soil. However, data from this type of study is seldom available. Therefore, often ATSDR derives soil EMEGs from MRLs based on studies in which the chemical was administered in drinking water, food, or by gavage using oil or water as the vehicle. The Toxicological Profiles for individual substances provide detailed information about the MRL and the experiment on which it was based.

Children are usually assumed to be the most highly exposed segment of the population because their soil ingestion rate is greater than adults' rate. Experimental studies have reported soil ingestion rates for children ranging from approximately 40 to 270 milligrams per day, with 100 milligrams per day representing the best estimate of the average intake rate. ATSDR calculates an EMEG for a child using a daily soil ingestion rate of 200 milligrams per day for a 10-kilogram child.

Environmental Contaminant
A substance (chemical) that gets into a system (person, animal, or environment) in amounts higher than those found in Background Level, or what would be expected.

Environmental Media
Usually refers to the air, water, and soil in which chemicals of interest are found. Sometimes refers to the plants and animals that are eaten by humans. Environmental Media is the second part of an Exposure Pathway.

Exposure
Coming into contact with a chemical substance. For the three ways people can come in contact with substances, see Route of Exposure.

Exposure Assessment
The process of finding the ways people come in contact with chemicals, how often, and how long they come in contact with chemicals, and the amounts of chemicals with which they come in contact.

Exposure Frequency
How often a person is exposed to a chemical overtime; for example, every day, once a week, or twice a month.

Exposure Pathway
A description of the way that a chemical moves from its source (where it began), to where, and how people can come into contact with (or get exposed to) the chemical. ATSDR defines an exposure pathway as having five parts: 1) a source of contamination, 2) an environmental media and transport mechanism, 3) a point of exposure, 4) a route of exposure, and 5) a receptor population. When all five parts of an exposure pathway are present, it is called a Completed Exposure Pathway.

Hazard Index
The sum of the Hazard Quotients (see below) for all contaminants of concern identified, to which an individual is exposed. If the Hazard Index (HI) is calculated to be less than 1, then no adverse health effects are expected as a result of exposure. If the Hazard Index is greater than 1, then adverse health effects are possible. However, an HI greater than 1 does not necessarily suggest a likelihood of adverse effects. The HI cannot be translated to a probability that adverse effects will occur, and is not likely to be proportional to risk.

Hazard Quotient
The ratio of estimated site-specific exposure to a single chemical from a site over a specified period to the estimated daily exposure level, at which no adverse health effects are likely to occur. If the Hazard Quotient is calculated to be less than 1, then no adverse health effects are expected as a result of

exposure. If the Hazard Quotient is greater than 1, then adverse health effects are possible. The Hazard Quotient cannot be translated to a probability that adverse health effects will occur, and is unlikely to be proportional to risk. It is especially important to note that a Hazard Quotient exceeding 1 does not necessarily mean that adverse effects will occur.

Hazardous Waste
Substances that have been released or thrown away into the environment and, under certain conditions, could be harmful to people who come into contact with them.

Health Comparison Value
Media-specific concentrations that are used to screen contaminants for further evaluation.

Health Effect
ATSDR deals only with Adverse Health Effects (see definition in this glossary).

Hydrology
The science that deals with global water.

Ingestion
Swallowing something, as in eating or drinking. It is a way a chemical can enter your body (see Route of Exposure).

Inhalation
Breathing in. It is a way a chemical can enter your body (see Route of Exposure).

LOAEL (Lowest-Observed-Adverse-Effect Level)
LOAEL is the lowest dose of a chemical in a study (animals or people), or group of studies, that produces statistically or biologically significant increases in the frequency or severity of adverse effects between the exposed population and its appropriate control.

Maximum Contaminant Level (MCL)
Maximum allowable level of a contaminant in municipal drinking water.

Noncancer Evaluation, ATSDR's Minimal Risk Level (MRL), USEPA's Reference Dose (RfD) and Reference Concentration (RfC), and California EPA's Reference Exposure Level (REL)
MRL, RfD, RfC, and REL are estimates of daily exposure to the human population (including sensitive subgroups), below which noncancer adverse health effects are unlikely to occur. MRL, RfD, RfC, and REL only consider noncancer effects. Because they are based only on information currently available, some uncertainty is always associated with MRL, RfD, RfC, and REL. "Uncertainty" factors are used to account for the uncertainty in our knowledge about their danger. The greater the uncertainty, the greater the "uncertainty" factor and the lower MRL, RfD, RfC, or REL.

When there is adequate information from animal or human studies, MRLs and RfDs are developed for the ingestion exposure pathway and RELs, MRLs and RfCs are developed for the inhalation exposure pathway.

Separate noncancer toxicity values are also developed for different durations of exposure. ATSDR develops MRLs for acute exposures (less than 14 days), intermediate exposures (from 15 to 364 days), and for chronic exposures (greater than 1 year). The California EPA develops RELs for acute (less than 14 days) and chronic exposure (greater than 1 year). EPA develops RfDs and RfCs for acute exposures (less than 14 days), and chronic exposures (greater than 7 years). Both MRL and RfD for ingestion are expressed in units of milligrams of contaminant per kilograms body weight per day (mg/kg/day). REL, RfC, and MRL for inhalation are expressed in units of milligrams per cubic meter (mg/m^3).

NOAEL (No-Observed-Adverse-Effect Level)
The highest dose of a chemical at which there were no statistically or biologically significant increases in the frequency or severity of adverse effects seen between the exposed population (animals or people) and its appropriate control. Some effects may be produced at this dose, but they are not considered adverse, nor precursors to adverse effects.

PHA (Public Health Assessment)
A report or document that looks at chemicals at a hazardous waste site and determines if people could be harmed from coming into contact with those chemicals. The PHA also recommends possible further public health actions if needed.

Point of Exposure
The place where someone can come into contact with a contaminated environmental medium (air, water, food, or soil). For example, the area of a playground that has contaminated dirt, a contaminated spring used for drinking water, the location where fruits or vegetables are grown in contaminated soil, or the backyard area where someone might breathe contaminated air.

Population
A group of people living in a certain area or the number of people in a certain area.

PRP (Potentially Responsible Party)
A company, government, or person that is responsible for causing the pollution at a hazardous waste site. PRPs are expected to help pay for the cleanup of a site.

Public Health Hazard Categories (ATSDR)
Depending on the specific properties of the contaminant(s), the exposure situations, and the health status of individuals, a public health hazard may occur. Sites are classified by ATSDR by using one of the following public health hazard categories:

<u>Short-term exposure, acute hazard</u>
This category applies to sites that have certain physical hazards or evidence of short-term (two weeks or less), site-related exposure to hazardous substances that could result in adverse health effects. These sites require quick intervention to stop people from being exposed. ATSDR will expedite the release of a health advisory that includes strong recommendations to immediately stop or reduce exposure to correct or lessen the health risks posed by the site.

Public Health Hazard
This category applies to sites that have certain physical hazards or evidence of chronic (long-term, more than one year), site-related exposure to hazardous substances that could result in adverse health effects. ATSDR will make recommendations to stop or reduce exposure in a timely manner to correct or lessen the health risks posed by the site. ATSDR may recommend any of the following public health actions for sites in this category:

- Cease or further reduce exposure (as a preventive measure)
- Community health/stress education
- Health professional education
- Community health investigation

Lack of Data
This category applies to sites where critical information is lacking (missing or has not yet been gathered) to support a judgment regarding the level of public health hazard. ATSDR will make recommendations to identify the data or information needed to adequately assess the public health risks posed by this site.

Exposure, no harm expected
This category applies to sites where exposure to site-related chemicals might have occurred in the past or is still occurring, but the exposures are not at levels likely to cause adverse health effects.

No exposure, no harm expected
This category applies to sites where no exposure to site-related hazardous substances exists. ATSDR may recommend community health education for sites in this category.

Receptor Population
People who live or work in the path of one or more chemicals, and who could come into contact with them (see Exposure Pathway).

RMEG (Reference Dose Media Evaluation Guides)
ATSDR develops RMEGs using EPA's reference doses (RfDs), available at http://www.epa.gov/iris, and default exposure assumptions, which account for variations in intake rates between adults and children. EPA's reference concentrations (RfCs), available at http://www.epa.gov/iris, serve as RMEGs for air exposures. Like EMEGs, RMEGs represent concentrations of substances (in water, soil, and air) to which humans may be exposed without experiencing adverse health effects. RfDs and RfCs consider lifetime exposures, therefore RMEGs apply to chronic exposures.

RSLs (U.S. Environmental Protection Agency's Regional Screening Levels), formerly PRGs
Tools for evaluating and cleaning up contaminated sites. They are risk-based concentrations that are intended to assist risk assessors and others in initial screening-level evaluations of environmental measurements.

Route of Exposure
The way a chemical can enter the body. There are three exposure routes: 1) breathing (also called inhalation), 2) eating or drinking (also called ingestion), and 3) getting something on the skin (also called dermal contact).

Safety Factor
Also called Uncertainty Factor. When scientists do not have enough information to decide if an exposure will cause harm to people, they use uncertainty factors and formulas in place of the information that is not known. These factors and formulas can help determine the amount of a chemical that is not likely to cause harm to people.

Sensitive Populations
People who may be more sensitive to chemical exposures because of certain factors such as age, sex, occupation, a disease they already have, or certain behaviors (cigarette smoking). Children, pregnant women, and older people are often considered special populations.

Source (of Contamination)
The place where a chemical comes from, such as a smokestack, landfill, pond, creek, incinerator, tank, or drum. Contaminant source is the first point of an exposure pathway.

Toxic
Harmful. Any substance or chemical can be toxic at a certain dose (amount). The dose determines the potential harm of a chemical and whether it would cause someone to get sick.

Toxicology
The study of harmful effects of chemicals on humans or animals.

Volatile Organic Chemical (VOC)
Substances containing carbon and different proportions of other elements such as hydrogen, oxygen, fluorine, chlorine, bromine, sulfur, or nitrogen. These substances easily volatilize (become vapors or gases) into the atmosphere. A significant number of VOCs are commonly used as solvents (paint thinners, lacquer thinner, degreasers, and dry-cleaning fluids).

Appendix B. Figures

Figure B1. Site Location and Demographics, New Idria Mercury Mine, San Benito County, California.

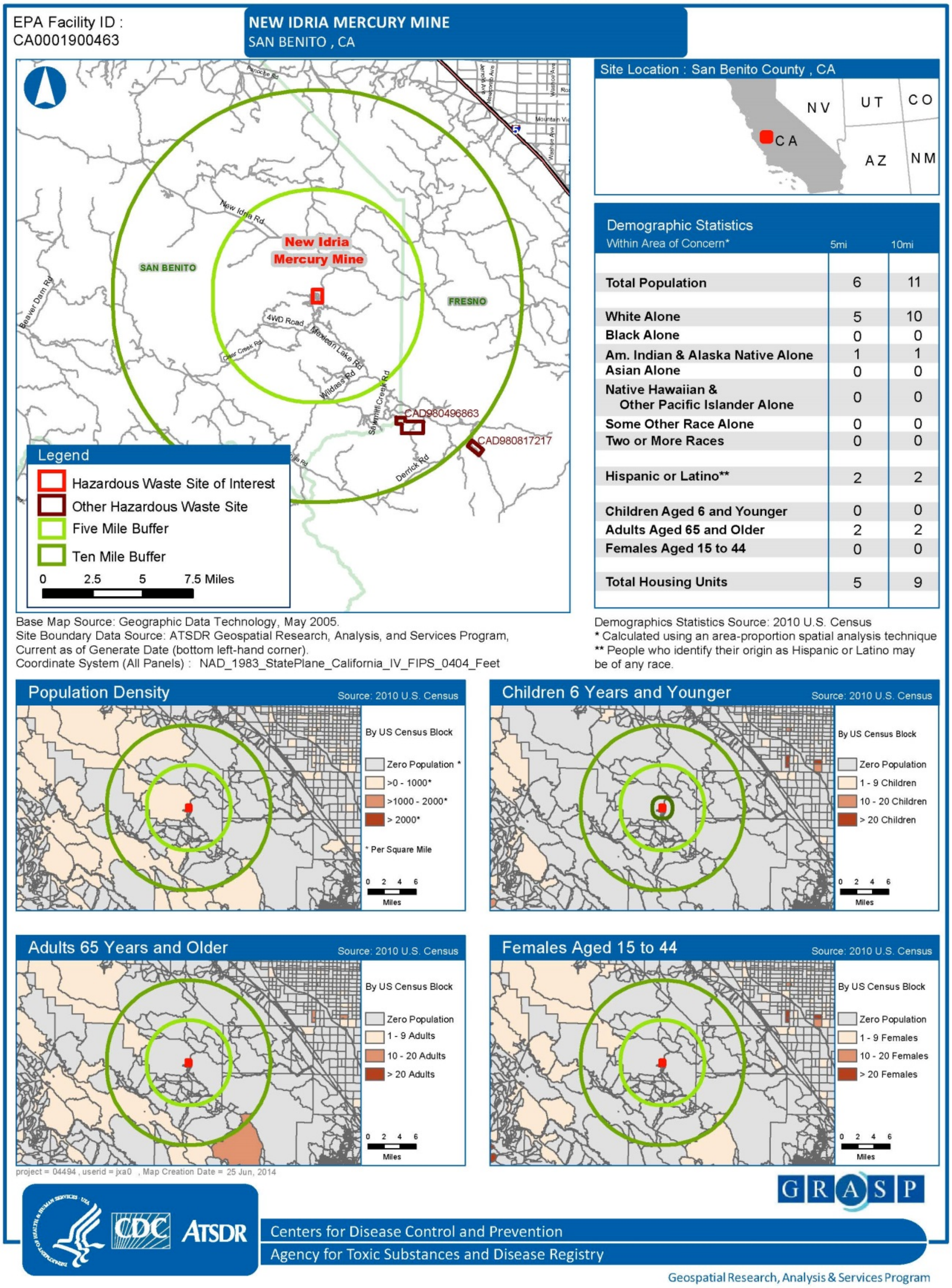
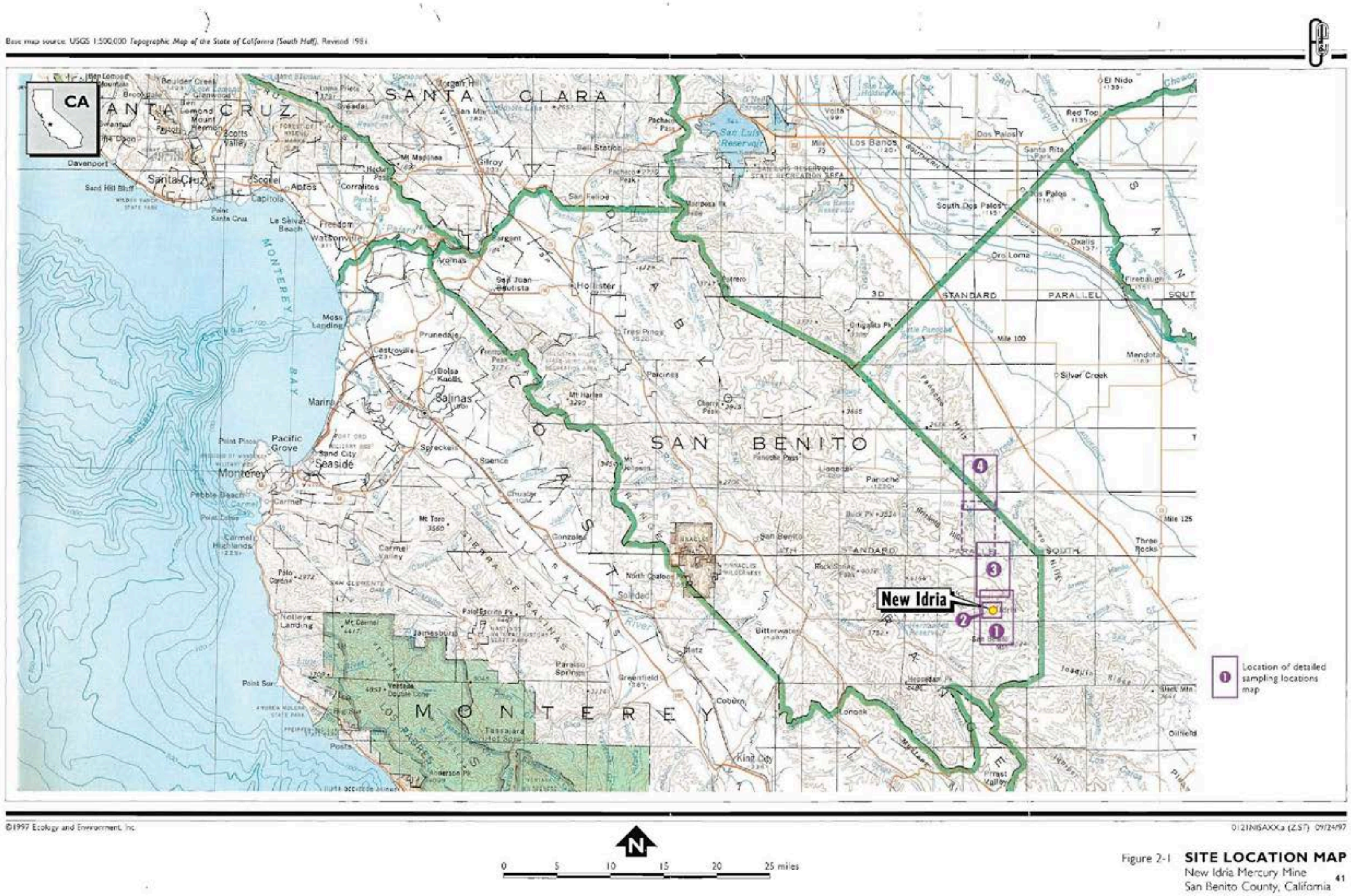
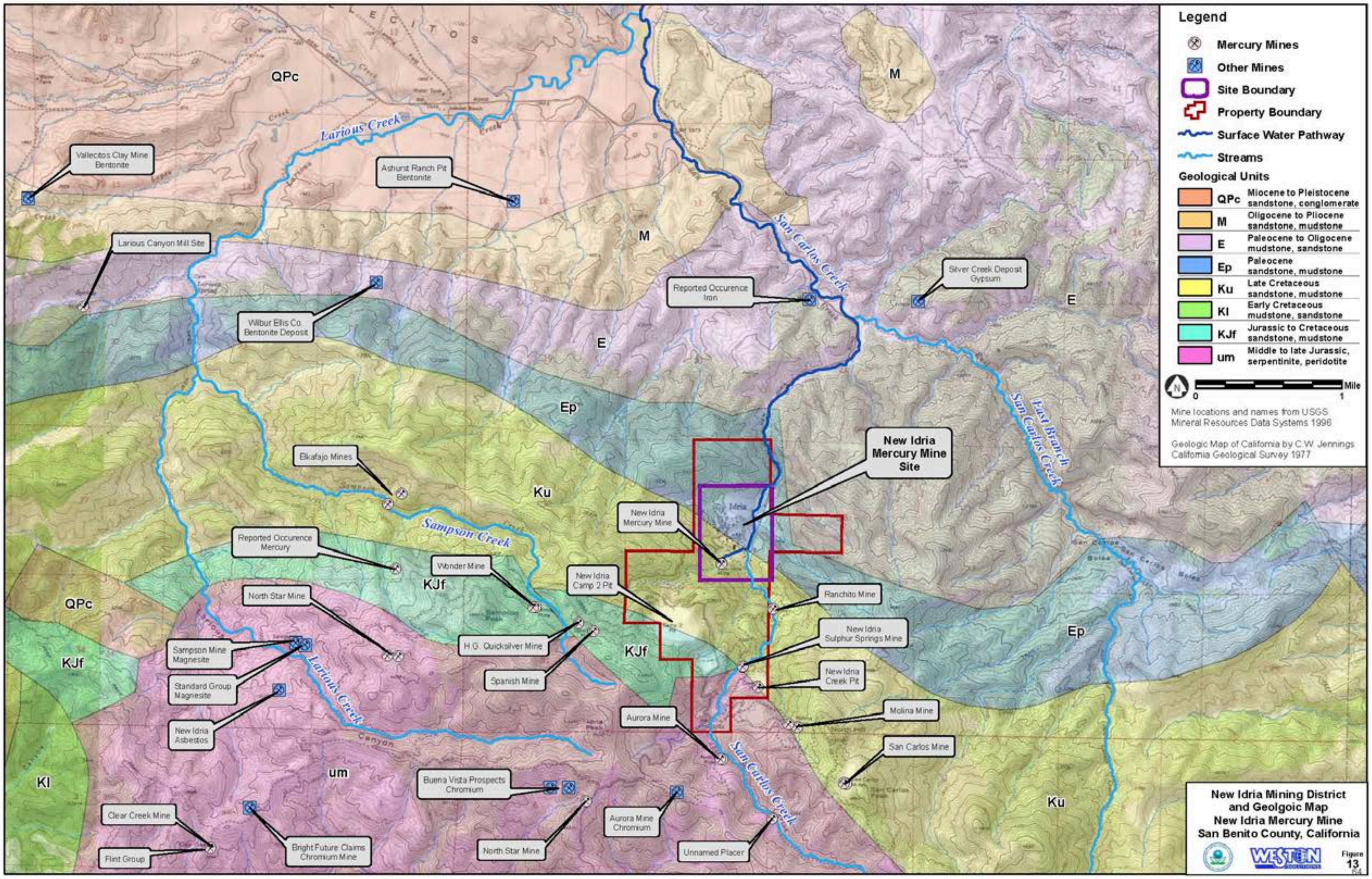


Figure B2. Site Location Map, New Idria Mercury Mine, San Benito County, California.



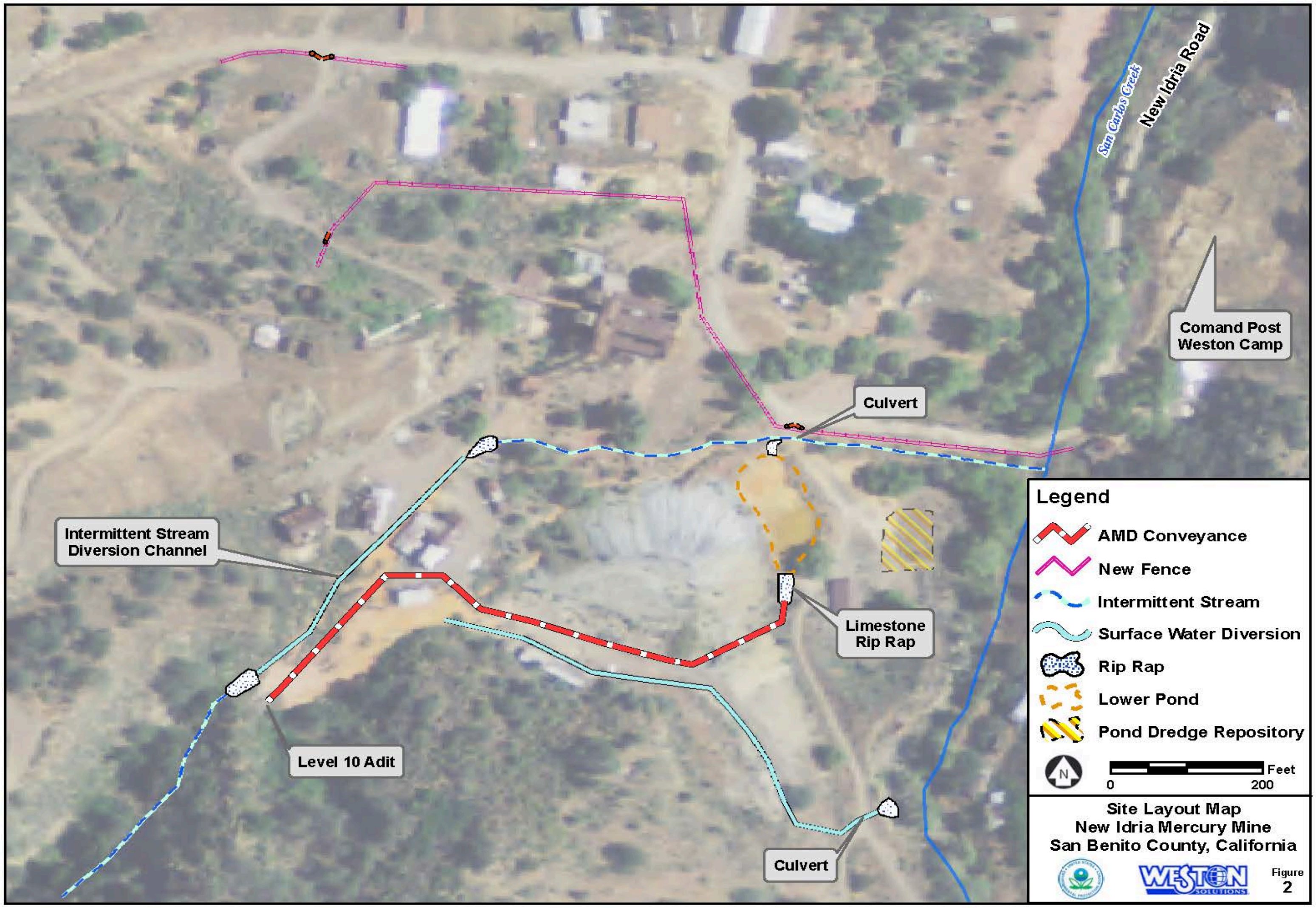
Source: [4]

Figure B3. Map of the New Idria Mining District, San Benito County, California.



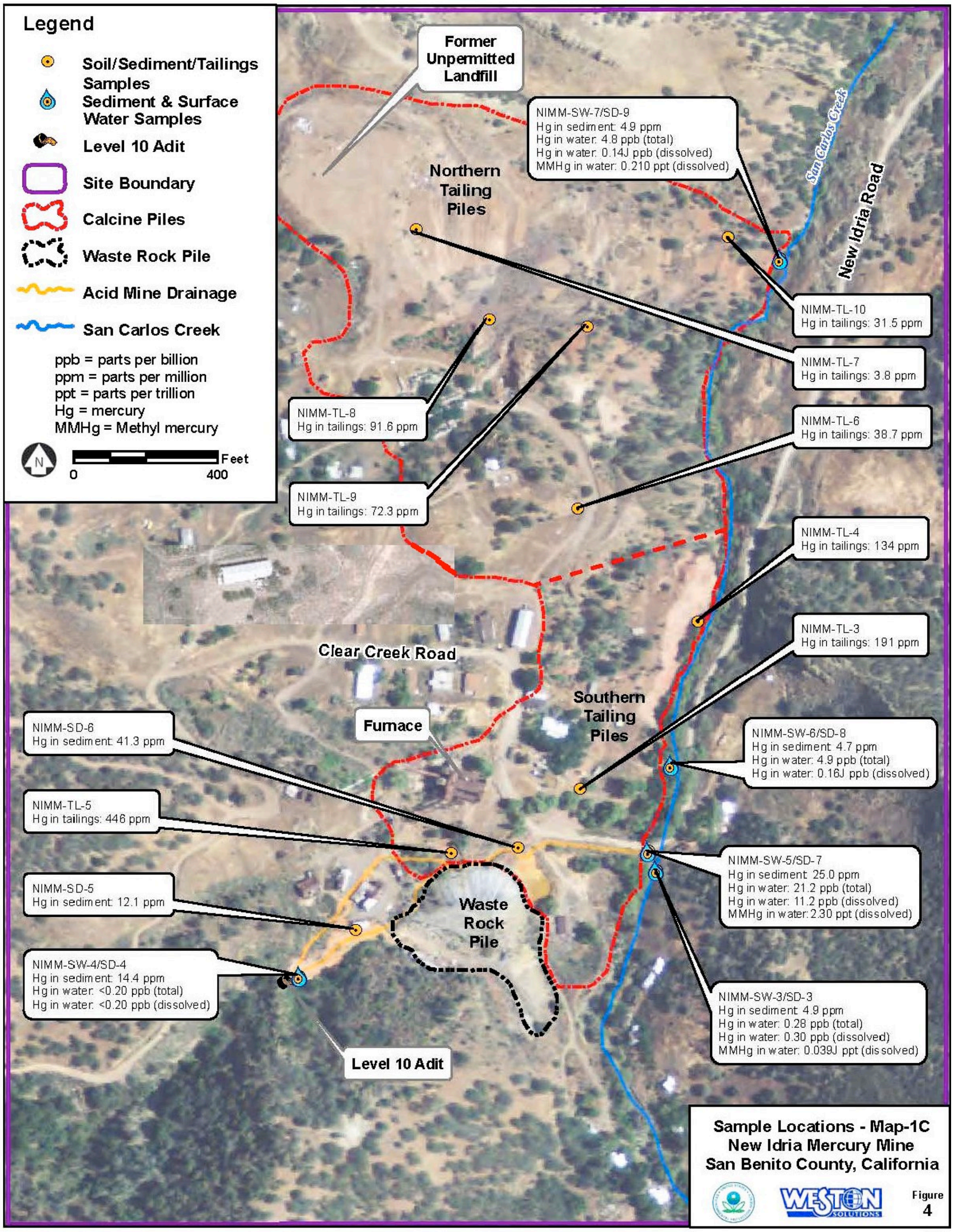
Source: [3]

Figure B4. USEPA 2011 Interim Removal Actions and Location of New Fence, New Idria Mercury Mine, San Benito County, California



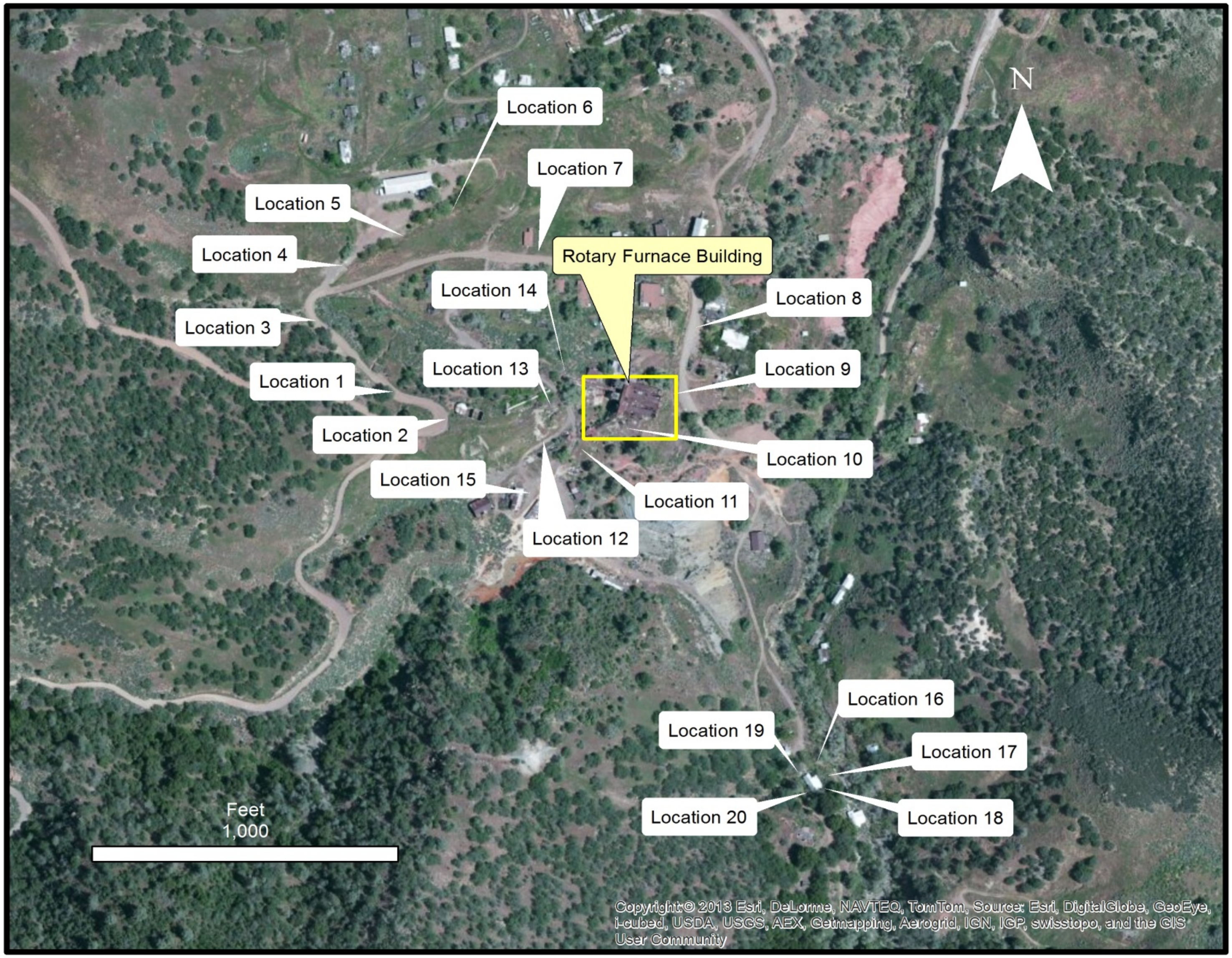
Source: [6]

Figure B5. On-site Source Sample Locations for Mercury and Methylmercury from the 2010 USEPA Expanded Site Inspection Report, New Idria Mercury Mine, San Benito County, California.



Source: [3]

Figure B6. Map of approximate locations of ambient air samples conducted by CDPH staff on June 29, 2012.



Appendix C. Tables

Table C1. Summary of Contaminants Detected in Surface Water Samples Collected between the Level 10 Adit Discharge and San Carlos Creek in 1998, New Idria Mercury Mine, San Benito County, California

	Sample Name - (Data reported in µg/L (location))						
Contaminant	NIM-1 (Level 10 Adit)	NIM-2 (near Level 10 Adit)	NIM-3 (near Level 10 Adit)	NIM-4 (Southern Tailings Pile)	NIM-5 (Settling Pond)	NIM-6 (AMD Confluence with San Carlos Creek)	Media-Specific Comparison Values (µg/L)
Chromium	1.0	27.3	7.0	1.6	1.0	1.0	15,000 RMEG (child)* 53,000 RMEG (adult)* 100 MCL
Iron	**493,000**	**566,000**	**496,000**	**479,000**	**475,000**	**443,000**	11,000 tap water RSL
Mercury	0.20	0.20	0.60	**16.5**	0.40	11.7	2 MCL
Nickel	**559**	**534**	**563**	**677**	**566**	**655**	200 chronic RMEG (child) 700 chronic EMEG (adult)
Selenium	4.0	4.0	4.0	4.0	4.0	4.0	50 chronic RMEG (child) 180 chronic EMEG (adult) 50 MCL
Zinc	990	947	993	1,990	994	1,120	3,000 chronic EMEG (child) 11,000 chronic EMEG (adult)

Data Source: [4]
Bolded detections meet or exceed media-specific comparison values
*Media-specific comparison value for trivalent chromium
µg/L: micrograms per liter
EMEG: Agency for Toxic Substances and Disease Registry's Environmental Media evaluation Guide;
RMEG: Reference Dose Media Evaluation Guide based on U.S. Environmental Protection Agency's Reference Dose
MCL: Maximum Contaminant Level for drinking water (state and federal); RSL: U.S. Environmental Protection Agency, Region IV, Regional Screening Levels (based on noncancer health effects).

Table C2. Summary of Contaminants Detected in Surface Water Samples Collected in 1998, New Idria Mercury Mine, San Benito County, California

	Sample Number / Location (Data reported in µg/L)									
Contaminant	SW-1 Background (2.3 Miles. Upstream)	SW-1 Background (1.9 Miles. Upstream)	SW-3 Background (1.1 Miles. Upstream) Drinking Reservoir	SW-4 Background (30 feet upstream.)	SW-5 (50 feet downstream)	SW-5 (filtered) (50 feet downstream)	SW-6 (1 mile downstream – Residence)**	SW-6 Downstream (1 mile downstream 0 Residence / post-treatment)	SW-7 (2 miles downstream)	Media-specific Comparison Value (µg/L)
Chromium	21	19	16.8	18.6	4.8	1	13.2	1.7	15.6	15,000 RMEG (child)* 53,000 RMEG (adult)* 100 MCL
Iron	60.1	53.8	449	62.2	**202,000**	**205,000**	**188,000**	3,300	**173,000**	11,000 tap water RSL
Mercury	0.1	0.1	0.1	0.54	5	3.1	**9.6**	0.68	**11.1**	2 MCL
Mercury (low level)*	0.277	0.0407	-	5.64	57.25	-	212.98	11.02	16.515	2 MCL
Nickel	5.8	4.9	7.7	1.9	**345**	**391**	**456**	**363**	**433**	200 chronic RMEG (child) 700 chronic RMEG (adult)
Selenium	3	3	3	4	4	3	3	3	3	50 chronic EMEG (child) 180 chronic EMEG (adult)
Zinc	1	1	1	1	529	463	1,360	358	1,250	3,000 chronic EMEG (child), 11,000 chronic EMEG (adult

Table C2 (continued) Summary of Contaminants Detected in Surface Water Samples Collected in 1998, New Idria Mercury Mine, San Benito County, California

	Sample Number / Location (Data reported in µg/L)					
Contaminant	SW-9 (2.2 miles downstream)	SW-10 (3.7 miles downstream)	SW-12 (3.9 miles downstream)	SW-13 (4.7 miles downstream)	SW-14 (5.7 miles downstream)	Media-specific Comparison Value (µg/L)
Chromium	13.7	5.3	14.4	11.4	2.5	15,000 RMEG (child) 53,000 RMEG (adult) 100 MCL
Iron	**166,000**	**71,100**	**256,000**	**197,000**	**11,900**	11,000 tap water RSL
Mercury	**12.0**	**3.8**	**11.4**	**6.9**	0.47	2 MCL
Mercury (low level)*	212.28	43.49	142.59	121.52	6.7	2 MCL
Nickel	**439**	168	**471**	**319**	50	200 chronic RMEG (child) 700 chronic RMEG (adult)
Selenium	3.0	3.0	3.0	5.4	30.6	50 chronic EMEG (child) 180 chronic EMEG (adult)
Zinc	1,230	565	1,920	1,520	81.6	3,000 chronic EMEG (child) 11,000 chronic EMEG (adult)

Table C2 (continued). Summary of Contaminants Detected in Surface Water Samples Collected in 1998, New Idria Mercury Mine, San Benito County, California

	Sample Number / Location (Data reported in µg/L)				
Contaminant	SW-16 (17.2 miles downstream)	SW-17 (17.4 miles downstream)	SW-17 (17.4 miles downstream)	SW-18*** (17.4 miles downstream)	Media-specific Comparison Value (µg/L)
Chromium	1	1	1	-	15,000 RMEG (child) 53,000 RMEG (adult) 100 MCL
Iron	42	23.2	29.5	-	11,000 tap water RSL
Mercury	0.2	0.2	0.2	-	2 MCL
Mercury (low level)*	0.262	0.184	-	**14.93**	2 MCL
Nickel	13.6	12.3	13.7	-	200 chronic RMEG (child) 700 chronic RMEG (adult)
Selenium	19.2	17	21.2	-	50 chronic EMEG (child) 180 chronic EMEG (adult)
Zinc	1	1	1	-	3,000 chronic EMEG (child) 11,000 chronic EMEG (adult)

Data Source: [4]
Bolded detections meet or exceed media-specific comparison values
µg/L: micrograms per liter
EMEG: Agency for Toxic Substances and Disease Registry's Environmental Media evaluation Guide; RMEG: Reference Dose Media Evaluation Guide based on U.S. Environmental Protection Agency's Reference Dose
MCL: Maximum Contaminant Level for drinking water (state and federal); RSL: U.S. Environmental Protection Agency, Region IV, Regional Screening Levels (based on noncancer health effects)
* Shown for completeness of data set. CDPH concludes that the higher concentrations found with method 1631 (low level mercury) are outside the targeted calibration range: This method is meant for low concentrations of mercury in water. High concentrations of mercury are not reliably detected with this method. The lowest calibration concentration is 0.6 ng/L, almost 1000 times lower than the lowest concentration detected with the high level method used by USEPA.
** Post-treatment residence's sampling results of contaminants detected are shown for completeness. Values were not used to calculate estimated exposure doses.
***Only a low-level mercury sample was collected at this location due to lack of water volume

Table C3. Summary of Contaminants Detected in Surface Waters in 2010, New Idria Mercury Mine, San Benito County, California

	Sample Number / Location (Data reported in µg/L)					
Contaminant	NIMM-SW-1 Background (Upper San Carlos Creek)	NIMM-SW-9 Background (Tributary to East Fork San Carlos Creek)	NIMM-SW-4 AMD (Level 10 Adit)	NIMM-SW-5 AMD (near San Carlos Creek)	NIMM-SW-5 AMD (duplicate)	Media-specific Comparison Value (ug/L)
Aluminum	<200	1,150	**135,000**	**128,000**	**127,000**	10,000 chronic EMEG (child) 35,000 chronic EMEG (adult)
Arsenic	<1.0	<1.0	**72.4**	**7.2**	**6.7**	3 chronic EMEG (child) 11 chronic EMEG (adult) 0.023 CREG
Cadmium	<1.0	<1.0	**1.7**	**1.7**	**1.6**	1 chronic EMEG (child) 3.5 chronic EMEG (adult)
Chromium	31.6	199	1.7	1.7	1.6	100 MCL*
Copper	<2.0	4.0	3.4	7.1	6.6	100 intermediate EMEG (child) 350 intermediate EMEG (adult)
Iron	35.4 j	12,500	**502,000**	**325,000**	**322,000**	11,000 tap water RSL
Lead	<1.0	0.54 j	<1.0	<1.0	<1.0	15 MCL
Mercury	0.084 j	0.10 j	<0.20	**21.2**	**20.1**	2 MCL
Nickel	10.3	800	**1,530**	**1,640**	**1,610**	200 chronic RMEG (child) 700 chronic RMEG (adult)
Selenium	<5.0 j	<5.0 j	11.2 j	12.0 j	12.4 j	50 chronic EMEG (child) 180 chronic EMEG (adult)
Zinc	1.4 j	9.5 j	2,500	2,610	2,540	3,000 chronic EMEG (child) 11,000 chronic EMEG (adult)

Table C3 (continued). Summary of Contaminants Detected in Surface Waters in 2010, New Idria Mercury Mine, San Benito County, California

	Sample Numbers / Locations (Data reported in µg/L)								
Contaminant	NIMM-SW-3 San Carlos Creek (Southern calcine pile)	NIMM-SW-6 San Carlos Creek (Southern calcine pile)	NIMM-SW-7 San Carlos Creek (Northern calcine pile)	NIMM-SW-7 San Carlos Creek (Duplicate)	NIMM-SW-8 San Carlos Creek (0.6 miles down-stream)	NIMM-SW-10 San Carlos Creek (2.4 miles down-stream)	NIMM-SW-12 Larious Creek Attribution	NIMM-SW-14 Silver Creek (5.4 miles downstream)	Media-specific Comparison Value (ug/L)
Aluminum	<200	**20,700**	**23,500**	**24,900**	**23,800**	4,970	62.3 j	<200	10,000 chronic EMEG (child) 35,000 chronic EMEG (adult)
Arsenic	<1.0	1.3	1.9	1.3	1.8	0.21 j	3.5	2.6	3 chronic EMEG (child) 11 chronic EMEG (adult) 0.023 CREG
Cadmium	<1.0	0.20 j	1.2	0.99 j	0.68 j	0.20 j	<1.0	<1.0	1 chronic EMEG (child) 3.5 chronic EMEG (adult)
Chromium	18.5	16.4	15.4	17.4	17.7	6.2	23.2	8.9	100 MCL*
Copper	0.66 j	2.3	17.2	18.0	13.6	4.1	6.1	6.8	100 intermediate EMEG (child) 350 intermediate EMEG (adult)
Iron	<200	**53,200**	**43,500**	**46,100**	**52,300**	**11,300**	<87.6 j	583	11,000 tap water RSL
Lead	<1.0	<1.0	0.26 j	<1.0	<1.0	<1.0	<1.0	<1.0	15 MCL
Mercury	0.28	**4.9**	**4.8**	**4.7**	**4.6**	0.79	<0.20	<0.20	2 MCL
Nickel	1.8	**277**	**325**	**349**	**298**	144	10.9	17.2	200 chronic RMEG (child) 700 chronic RMEG (adult)
Selenium	0.53 j	2.2 j	8.2 j	8.7 j	6.1 j	3.5 j	165 j	113 j	50 chronic EMEG (child) 180 chronic EMEG (adult)
Zinc	2.3 j	396 j	1,150 j	1,270 j	987 j	176 j	4.6 j	6.8 j	3,000 chronic EMEG (child) 11,000 chronic EMEG (adult)

Data Source: [3]
*Media-specific comparison value for trivalent chromium
µg/L: micrograms per liter
EMEG: Agency for Toxic Substances and Disease Registry's Environmental Media evaluation Guide
RMEG: Reference Dose Media Evaluation Guide based on U.S. Environmental Protection Agency's Reference Dose
CREG: Agency for Toxic Substances and Disease Registry's Cancer Risk Evaluation Guide for 1 in 1 million increased cancer risk
MCL: Maximum Contaminant Level for drinking water (state and federal); RSL: U.S. Environmental Protection Agency, Region IV, Regional Screening Levels (based on noncancer health effects)

Table C4. Summary of Contaminants Detected in Sediments in 1998, New Idria Mercury Mine, San Benito County, California

	Sample Number / Location (Data reported in mg/kg)						
Contaminant	NIM-7 (Level 10 Adit)	NIM-8 (near Level 10 Adit)	NIM-9 (near Level 10 Adit)	NIM-10 (near Southern Calcine Tailings Pile)	NIM-11 (near Southern Calcine Tailings Pile)	NIM-12 (near Southern Calcine Tailings Pile)	Media-Specific Comparison Value (mg/kg)
Chromium	329	269	267	134	72.2	34.2	75,000 chronic RMEG (child)* 1,100,000 chronic RMEG (adult)*
Iron	**284,000**	**419,000**	**336,000**	**256,000**	**152,000**	**106,000**	55,000 residential RSL
Mercury	1.2	0.22	4.2	13.7	8.5	**25.7**	18 residential CHHSL
Nickel	0.45	0.47	11.1	18.0	22.3	20.4	1,000 RMEG (child) 14,000 RMEG (adult)
Selenium	4.9	7.7	6.6	1.1	0.91	0.93	250 chronic EMEG (child) 3,500 chronic EMEG (adult)
Zinc	20.2	39.6	39.4	43.9	70.1	33.4	15,000 chronic EMEG (child) 210,000 chronic EMEG (adult)

Table C4 (continued). Summary of Contaminants Detected in Sediments in 1998, New Idria Mercury Mine, San Benito County, California.

	Sample Number / Location (Data reported in mg/kg)									
Contaminant	SW-1 (Upstream Background)	SW-2 (Upstream Background)	SW-3 (Upstream Background)	SW-4 (Upstream Background)	SW-5 (50 ft. downstream)	SW-6 (1 mile downstream)	SW-7 (2 miles downstream)	SW-8 (2 miles downstream)	SW-9 (2.2 miles downstream)	Media-Specific Comparison Value (mg/kg)
Chromium	1,100	1,180	988	95.5	10.1	32.8	18	67.8	15.5	75,000 chronic EMEG (child)* 1,000,000 chronic EMEG (adult)*
Iron	41,200	41,900	35,800	24,100	**420,000**	**164,000**	79,500	16,000	**62,000**	55,000 residential RSL
Mercury	1.5	1.6	2.6	**19.7**	8.4	10.0	9.0	1.6	2.2	18 residential CHHSL
Mercury (low-level)	-	9.67	-	-	-	-	-	-	-	
Nickel	**1,860**	1,880	75.9	130	195	478	281	88.3	215	1,000 RMEG (child) 14,000 RMEG (adult)
Selenium	1.0	0.81	1.0	1.9	3.4	3.6	1.6	0.60	1.8	250 chronic EMEG (child) 3,500 chronic EMEG (adult
Zinc	25.5	24.8	19.7	71.9	935	949	500	41.8	335	15,000 chronic EMEG (child) 210,000 chronic EMEG (adult)

Table C4 (continued). Summary of Contaminants Detected in Downstream Sediments in 1998, New Idria Mercury Mine, San Benito County, California

	Sample Number / (Location) - Data reported in mg/kg									
Contaminant	SW-10 (3.7 miles downstream)	SW-11 (3.8 miles downstream)	SW-12 (3.9 miles downstream)	SW-13 (4.7 miles downstream)	SW-14 (5.7 miles downstream)	SW-15 (7.2 miles downstream)	SW-16 (17.2 miles downstream)	SW-17 (17.4 miles downstream)	SW-18 (17.4 miles downstream)	Media-Specific Comparison Value (mg/kg)
Chromium	31.4	20.1	33.1	34.9	48.6	66.8	99.1	326	9.0	75,000 chronic EMEG (child)* 1,000,000 chronic EMEG (adult)*
Iron	**222,000**	**28,400**	**294,000**	88,600	**210,000**	17,900	18,200	18,500	11,900	55,000 residential RSL
Mercury	**22.5**	0.11	13.4	5.6	9.7	1.5	1.5	0.14	0.13	18 residential CHHSL
Mercury (low-level)	-	-	-	-	-	-	-	-	-	
Nickel	560	37.5	692	191	315	107	103	245	21.7	1,000 RMEG (child) 14,000 RMEG (adult)
Selenium	**560**	1.1	4.8	2.6	10.9	0.92	0.99	1.8	0.79	250 chronic EMEG (child) 3,500 chronic EMEG (adult
Zinc	5.3	72.2	2,070	543	1,310	35.0	1.0	33.3	31.0	15,000 chronic EMEG (child) 210,000 chronic EMEG (adult)

Data Source: [4]
Bolded detections meet or exceed media-specific comparison values*Media-specific comparison value for trivalent chromium
mg/kg: milligrams per kilograms
EMEG: Agency for Toxic Substances and Disease Registry’s Environmental Media evaluation Guide
RMEG: Reference Dose Media Evaluation Guide based on U.S. Environmental Protection Agency’s Reference Dose
RSL: U.S. Environmental Protection Agency, Region IV, Regional Screening Levels (based on noncancer health effects)
CHHSL: Office of Environmental Health Hazard Assessment (OEHHA) California Human Health Screening Level

Table C5. Summary of Contaminants Detected in Sediments in 2010, New Idria Mercury Mine, San Benito County, California

	Sample Number / Location (Data reported in mg/kg)							
Contaminant	NIMM-SD-1 Background (San Carlos Creek)	NIMM-SD-11 Background (Tributary to East Fork San Carlos Creek)	NIMM-SD-4 AMD (Level 10 Adit)	NIMM-SD-5 AMD (Level 10 Adit)	NIMM-SD-5 AMD (duplicate)	NIMM-SD-6 AMD (below waste pile)	NIMM-SD-7 AMD (near San Carlos Creek)	Media-specific Comparison Values (mg/kg)
Aluminum	1,930	3,180	15,100	16,200	13,800	8,600	8,070	50,000 chronic EMEG (child) 700,000 chronic EMEG (adult)
Arsenic	<1.0	<1.1	10.4	42.3	38.3	14.4	57.1	15 chronic EMEG (child) 210 chronic EMEG (adult) 0.47 CREG 0.07 CHHSL
Cadmium	1.5 j	1.2 j	1.2 j	**5.4 j**	**5.8 j**	1.6 j	**8.6 j**	1.7 CHHSL 5 Chronic EMEG (child) 70 – Chronic EMEG (adult)
Chromium	1,400	1,200	43.8	38.3	34.1 j	31.5 j	50.8	75,000 chronic EMEG (child)* 1,000,000 chronic EMEG (adult)*
Copper	6.2	8.6	48.1	25.8	20.7	28.1	18.9	500 Intermediate EMEG (child) 7,000 Intermediate EMEG (adult)
Iron	47,200	47,700	46,600	**204,000**	**241,000**	**59,300**	**307,000**	55,000 residential RSL
Lead	3.9	4.1	12.1	18.6	20.4 j	20.5 j	22.4	80 CHHSL
Mercury	0.19	<0.11	14.4	9.9	12.1	**41.3**	**25.0**	18 residential CHHSL
Nickel	2,340	2,130	61.8	112	101	68.5	55.3	1,000 RMEG (child) 14,000 RMEG (adult)
Selenium	<3.5 j	<3.7 j	<3.7 j	<5.3 j	<5.5 j	<3.8 j	<4.8	250 chronic EMEG (child) 3,500 chronic EMEG (adult
Zinc	35.6	21.6	98.5	142	136	323	119 j	15,000 chronic EMEG (child) 210,000 chronic EMEG (adult)

Table C5 (continued). Summary of Contaminants Detected in Sediments in 2010, New Idria Mercury Mine, San Benito County, California

	Sample Number / Location (Data reported in mg/kg)									
Contaminant	NIMM-SD-3 San Carlos Creek (Southern calcine pile)	NIMM-SD-8 San Carlos Creek (Southern calcine pile)	NIMM-SD-9 San Carlos Creek (Northern calcine pile)	NIMM-SD-10 San Carlos Creek (0.6 miles down-stream)	NIMM-SD-12 San Carlos Creek (2.4 miles down-stream)	NIMM-SD-13 San Carlos Creek (4.1 miles down-stream)	NIMM-SD-15 San Carlos Creek (4.7 miles down-stream)	NIMM-SD-15 San Carlos Creek (duplicate)	NIMM-SD-16 Silver Creek (5.4 mil. downstream)	Media-Specific Comparison Value (mg/kg)
Aluminum	14,100	13,700	11,800	7,800	6,150	10,600	5,540	5,650	4,400	50,000 chronic EMEG (child) 700,000 chronic EMEG (adult)
Arsenic	**9.0**	**10**	**14.1**	**8.7**	**8.3**	**11.9**	**5.7**	**5.9**	**6.3**	15 chronic EMEG (child) 210 chronic EMEG (adult) 0.47 CREG 0.07 CHHSL
Cadmium	1.1 j	1.1 j	1.3 j	0.59 j	0.44 j	**3.3 j**	0.59 j	0.66 j	0.49 j	1.7 CHHL 5 chronic EMEG (child) 70 chronic EMEG (adult)
Chromium	133	180	49.3	110	58.2	41.8	49.8	65.8 j	50.6	75,000 chronic EMEG (child)* 1,000,000 chronic EMEG (adult)*
Copper	44.6	40.3	55.9	30.7	25.2	12.8	15.7	15.4	17.0	500 Intermediate EMEG (child) 7,000 Intermediate EMEG (adult)
Iron	36,700	37,000	37,300	26,500	20,100	13,700	18,700	20,200	14,200	55,000 residential RSL
Lead	11.1	11.8	16.0	11.3	8.5	6.4	6.4	6.4 j	5.6	80 CHHL
Mercury	4.9	4.7	4.9	**32.6**	8.9 j	2.0 j	4.6 j	4.0	1.8 j	18 residential CHHSL
Nickel	170	194	85.1	148	86.2	40.4	98.8	97.1	79.0	1,000 RMEG (child) 14,000 RMEG (adult)
Selenium	<3.5 j	<3.6 j	0.59 j	<3.5	<3.6	0.89 j	<3.5	<3.4	2.8 j	250 chronic EMEG (child) 3,500 chronic EMEG (adult
Zinc	80.7	82.4	106	91.4	68.5	53.8	102	101	56.0	15,000 chronic EMEG (child) 210,000 chronic EMEG (adult)

Table C5 (continued). Summary of Contaminants Detected in Sediments in 2010, New Idria Mercury Mine, San Benito County, California

	Sample Number / Location (Data reported in mg/kg)									
Contaminant	NIMM-SD-17 Silver Creek (6.4 miles downstream)	NIMM-SD-18 Silver Creek (7.4 miles downstream)	NIMM-SD-19 Silver Creek (8.4 miles downstream)	NIMM-SD-20 Silver Creek (9.2 miles down-stream)	NIMM-SD-21 Silver Creek (10.2 miles down-stream)	NIMM-SD-22 Silver Creek (11.2 miles down-stream)	NIMM-SD-23 Silver Creek (12.2 miles down-stream)	NIMM-SD-24 Silver Creek (13.0 miles downstream)	NIMM-SD-25 Silver Creek (14.0 miles downstream)	Media-Specific Comparison Value (mg/kg)
Aluminum	6,490	5,400	13,800	5,520	5,370	5,080	2,490	6,250	3,600	50,000 chronic EMEG (child) 700,000 chronic EMEG (adult)
Arsenic	**6.4**	**6.2**	**6.8**	**4.9**	**5.4**	**5.5**	**4.3**	**7.1**	**5.8**	15 chronic EMEG (child) 210 chronic EMEG (adult) 0.47 CREG 0.07 CHHSL
Cadmium	0.58J	0.48j	0.77j	0.37j	0.46j	0.45j	0.37j	0.51j	0.40j	1.7 CHHL 5 chronic EMEG (child) 70 chronic EMEG (adult)
Chromium	76.4	59.5	61.2	40.9	32.2	27.5	77.1	61.8	60.2	75,000 chronic EMEG (child)* 1,000,000 chronic EMEG (adult)*
Copper	21.2	14.8	27.6	16.4	16.4	16.4	9.6	16.9	13.9	500 Intermediate EMEG (child) 7,000 Intermediate EMEG (adult)
Iron	18,400	16,500	25,200	14,000	15,000	15,400	15,000	17,000	15,100	55,000 residential RSL
Lead	7.6	6.2	11.3	6.0	6.9	6.9	4.6	8.5	5.0	80 CHHL
Mercury	3.9j	2.7j	0.070j	11.2j	1.3j	0.60j	0.38j	4.2j	2.4j	18 residential CHHSL 9.4 Residential RSL
Nickel	113	63.1	81.3	56.9	49.3	42.0	82.4	83.9	78.7	1,000 RMEG (child) 14,000 RMEG (adult)
Selenium	1.2j	<3.5	<3.5	3.4j	0.85j	1.4j	1.2j	1.7j	1.5j	250 chronic EMEG (child) 3,500 chronic EMEG (adult
Zinc	65.4	42.4	71.0	48.6	50.1	56.0	35.7	62.2	55.1	15,000 chronic EMEG (child) 210,000 chronic EMEG (adult)

Table C5 (continued). Summary of Contaminants Detected in Sediments in 2010, New Idria Mercury Mine, San Benito County, California

	Sample Number / Location (Data reported in mg/kg)									
Contaminant	NIMM-SD-26 Silver Creek (15 miles downstream)	NIMM-SD-27 Silver Creek (15.8 miles downstream)	NIMM-SD-28 Silver Creek (16.2 miles downstream)	NIMM-SD-29 Silver Creek (16.9 miles down-stream)	NIMM-SD-30 Silver Creek (17.8 miles down-stream)	NIMM-SD-31 Silver Creek (18.7 miles down-stream)	NIMM-SD-32 Silver Creek (19.5 miles down-stream)	NIMM-SD-33 Panoche Creek (Attribution)	NIMM-SD-34 Panoche Creek (19.9 miles downstream)	Media-Specific Comparison Value (mg/kg)
Aluminum	4,700	6,130	5,060	3,290	4,450	4,230	3,420	3,140	6,640	50,000 chronic EMEG (child) 700,000 chronic EMEG (adult)
Arsenic	**5.0**	**5.4**	**5.9**	**4.7**	**5.9**	**4.7**	**5.5**	**3.9**	**5.5**	15 chronic EMEG (child) 210 chronic EMEG (adult) 0.47 CREG 0.07 CHHSL
Cadmium	0.34j	0.44j	0.40j	0.39j	0.58j	0.39j	0.46j	0.34j	0.51j	1.7 CHHL 5 chronic EMEG (child) 70 chronic EMEG (adult)
Chromium	28.9	46.0	29.4	67.4	113j	41.7j	62.1j	8.6j	25.8j	75,000 chronic EMEG (child)* 1,000,000 chronic EMEG (adult)*
Copper	13.5	15.9	15.6	9.9	14.9	11.1	10.6	8.1	18.1	500 Intermediate EMEG (child) 7,000 Intermediate EMEG (adult)
Iron	13,800	16,100	14,800	14,100	17,700	12,800	14,500	10,700	16,000	55,000 residential RSL
Lead	6.4	6.9	6.9	4.3	6.4j	5.5j	5.3j	4.0j	7.9j	80 CHHL
Mercury	1.7j	1.5j	1.1j	2.3j	1.2	1.0	1.0	<0.10	1.1	18 residential CHHSL
Nickel	43.5	57.7	47.2	72.6	84.6	38.5	64.8	12.9	38.9	1,000 RMEG (child) 14,000 RMEG (adult)
Selenium	0.61j	<3.5	1.3j	1.oj	1.6j	0.58j	0.89j	<3.5	1.2j	250 chronic EMEG (child) 3,500 chronic EMEG (adult
Zinc	46.3	48.2	58.9	42.5	48.7	39.2	45.9	24.4	58.0	15,000 chronic EMEG (child) 210,000 chronic EMEG (adult)

Data Source: [2]
Bolded detections meet or exceed media-specific comparison values
*Media-specific comparison value for trivalent chromium
j = the associated numerical value is qualified and is an estimated quantity
mg/kg: milligrams per kilograms
EMEG: Agency for Toxic Substances and Disease Registry's Environmental Media evaluation Guide
RMEG: Reference Dose Media Evaluation Guide based on U.S. Environmental Protection Agency's Reference Dose
CREG: Agency for Toxic Substances and Disease Registry's Cancer Risk Evaluation Guide for 1 in 1 million increased cancer risk
RSL: U.S. Environmental Protection Agency, Region IV, Regional Screening Levels (based on noncancer health effects)
CHHSL: Office of Environmental Health Hazard Assessment (OEHHA) California Human Health Screening Levels

Table C6. Summary of Contaminants Detected in Mine Tailings in 1998, New Idria Mercury Mine, San Benito County, California

	Sample Number (Data reported in mg/kg)							
Contaminant	NIM-13 (Southern Calcine Ple)	NIM-14 (below Waste Pile)	NIM-15 (below Waste Pile)	NIM-16 (Settling Pond)	NIM-17 (near confluence with San Carlos Creek)	NIM-18 (Background) Upstream	NIM-19 (Background) Upstream	Media-Specific Comparison Value (mg/kg)
Chromium	52.7	22.5	10.7	39.1	68.0	907	64.3	75,000 chronic EMEG (child)* 1,000,000 chronic EMEG (Adult)*
Iron	83,000	26,800	9,330	**207,000**	**235,000**	43,500	29,700	55,000 residential RSL
Mercury	**40.7**	**74.6**	**27.1**	**42.2**	**43.0**	1.4	3.9	18 residential CHHSL
Nickel	48.8	10.5	10.1	21.7	35.8	**1,980**	80.9	1,000 RMEG (child) 14,000 RMEG (adult)
Selenium	0.20	0.60	1.6	1.4	1.3	0.62	0.69	250 chronic EMEG (child) 3,500 chronic EMEG (adult)
Zinc	105	28.4	9.5	52.4	68.7	24.0	78.0	15,000 chronic EMEG (child) 210,000 chronic EMEG (adult)

Data Source: [4]
*Media-specific comparison value for trivalent chromium
Bolded detections meet or exceed media-specific comparison values
mg/kg: milligrams per kilograms
EMEG: Agency for Toxic Substances and Disease Registry's Environmental Media evaluation Guide
RMEG: Reference Dose Media Evaluation Guide based on U.S. Environmental Protection Agency's Reference Dose
RSL: U.S. Environmental Protection Agency, Region IV, Regional Screening Levels (based on noncancer health effects)
CHHSL: Office of Environmental Health Hazard Assessment (OEHHA) California Human Health Screening Levels

Table C7. Summary of Contaminants Detected in On-Site Mine Tailings 2010, New Idria Mercury Mine, San Benito County, California

	Sample Number / Location						
Contaminant	NIMM-SS-1 (Background)	NIMM-SS-2 (Background)	NIMM-TL-3 (Southern Calcine Tailings Piles)	NIMM-TL-4 (Southern Calcine Tailings Piles)	NIMM-TL-5 (Southern Calcine Tailings Piles)	NIMM-TL-6 (Southern Calcine Tailings Piles)	Media-Specific Comparison Value (mg/kg)
Aluminum	3,630	39,900	11,700	7,080	8,440	14,000	50,000 chronic EMEG (child) 700,000 chronic EMEG (adult)
Antinomy	<6.2 j	<6.2 j	5.2 j	7.9 j	3.9 j	5.4 j	20 RMEG (child) 280 RMEG (adult)
Arsenic	**0.63 j**	<1.0	**22.7**	**17.7**	**16.2**	**17.2**	15 chronic EMEG (child) 210 chronic EMEG (adult) 0.5 CREG 0.07 CHHSL
Barium	29.8	20.8	173	119	263	242	10,000 chronic EMEG (child) 140,000 chronic EMEG (adult)
Beryllium	<0.52	<0.51	0.31 j	0.23 j	0.34 j	0.42 j	100 chronic EMEG (child) 1,400 chronic EMEG (adult)
Cadmium	**2.1 j**	**1.7 j**	1.2 j	0.51 j	1.3 j	0.99 j	1.7 CHHSL 5 chronic EMEG (child) 70 chronic EMEG (adult)
Chromium	911	988	45.0	23.5	40.4	74.8	75,000 chronic EMEG (child)* 1,000,000 chronic EMEG (adult)*
Cobalt	126	106	10	5.6	10.1	21.1	500 Intermediate EMEG (child) 7,000 Intermediate EMEG
Copper	12	11.2	59.9	39.2	48.5	47.1	500 Intermediate EMEG (child) 7,000 Intermediate EMEG (adult)
Iron	**61,700**	53,100	46,600	23,800	36,000	38,100	55,000 residential RSL
Lead	7.7	22.8	18.1	9.0	49.5	61.5	80 CHHSL
Manganese	1,010	844	138	60.3	237	314	2,500 RMEG (child) 35,000 RMEG (adult)

Table C7. Summary of Contaminants Detected in On-Site Mine Tailings 2010, New Idria Mercury Mine, San Benito County, California

	Sample Number / Location						
Contaminant	NIMM-SS-1 (Background)	NIMM-SS-2 (Background)	NIMM-TL-3 (Southern Calcine Tailings Piles)	NIMM-TL-4 (Southern Calcine Tailings Piles)	NIMM-TL-5 (Southern Calcine Tailings Piles)	NIMM-TL-6 (Southern Calcine Tailings Piles)	Media-Specific Comparison Value (mg/kg)
Mercury	0.19	<0.10	**191**	**134**	**446**	**38.7**	18 residential CHHSL
Nickel	**2,370**	**2,210**	31.3	20.4	67.7	159	1,000 RMEG (child) 14,000 RMEG (adult)
Selenium	<3.6 j	<3.6 j	1.3 j	0.78 j	0.94 j	0.70 j	250 chronic EMEG (child) 3,500 chronic EMEG (adult
Silver	0.084 j	<1.0	0.17 j	<1.0	0.18 j	0.082 j	250 RMEG (child) 3,500 RMEG (adult)
Vanadium	18.5	20.3	70.2	59.0	50.5	54.0	500 Intermediate EMEG (child) 7,000 Intermediate EMEG (adult)
Zinc	49.5	28.7	56.2	39.3	396	104	15,000 chronic EMEG (child) 7,000 chronic EMEG (adult)

Table C7 (continued). Summary of Contaminants Detected in On-Site Mine Tailings 2010, New Idria Mercury Mine, San Benito County

	Sample Number / Location (Data reported in mg/kg)					
Contaminant	NIMM-TL-7 (Northern calcine tailings pile)	NIMM-TL-8 (Northern calcine tailings pile)	NIMM-TL-9 (Northern Calcine Tailings Pile)	NIMM-TL-10 (Northern Calcine Tailings Pile)	NIMM-TL-10 (Northern Calcine Tailings Piles) (duplicate)	Media-Specific Comparison Value (mg/kg)
Aluminum	11,300	13,900	12,400	13,200	13,800	50,000 chronic EMEG (child) 70,000 chronic EMEG (adult)
Antinomy	7.0 j	5.4 j	5.7 j	5.5 j	5.6 j	20 RMEG (child) 280 RMEG (adult)
Arsenic	**23.3**	**18.8**	**27.7**	**26.0**	**26.7**	15 chronic EMEG (child) 210 chronic EMEG (adult) 0.47 CREG 0.07 CHHSL
Barium	146	144	163	197	211	10,000 chronic EMEG (child) 140,000 chronic EMEG (adult)
Beryllium	0.26 j	0.42 j	0.34 j	0.34 j	0.34 j	100 chronic EMEG (child) 1,400 chronic EMEG (adult)
Cadmium	1.5 j	1.3 j	1.6 j	**1.8 j**	**1.8 j**	1.7 CHHSL EMEG 5 chronic EMEG (child) 70 chronic EMEG (adult)
Chromium	65.6	59.2	130	133	135	75,000 chronic EMEG (child)* 1,000,000 chronic EMEG (adult)*
Cobalt	7.6	22.7	16.3	18.5	18.4	500 Intermediate EMEG (child) 7,000 Intermediate EMEG
Cooper	69.0	60.3	79.8	73.7	74.2	500 Intermediate EMEG (child) 7,000 Intermediate EMEG (adult)
Iron	**57,700**	48,200	**65,000**	**73,800**	**68,800**	55,000 residential RSL
Lead	23.5	18.2	22.5	26.2	25	80 CHHSL

Table C7 (continued). Summary of Contaminants Detected in On-Site Mine Tailings 2010, New Idria Mercury Mine, San Benito County

	Sample Number / Location (Data reported in mg/kg)					
Contaminant	NIMM-TL-7 (Northern calcine tailings pile)	NIMM-TL-8 (Northern calcine tailings pile)	NIMM-TL-9 (Northern Calcine Tailings Pile)	NIMM-TL-10 (Northern Calcine Tailings Pile)	NIMM-TL-10 (Northern Calcine Tailings Piles) (duplicate)	Media-Specific Comparison Value (mg/kg)
Manganese	110	301	146	174	173	2,500 RMEG (child) 35,000 RMEG (adult)
Mercury	3.8	**91.6**	**72.3**	**28.9**	**31.5**	18 residential CHHSL
Nickel	66.1	99.8	203	228	231	1,000 RMEG (child) 14,000 RMEG (adult)
Selenium	1.2 j	1.3 j	1.6 j	1.0 j	1.2 j	250 chronic EMEG (child) 3,500 chronic EMEG (adult
Silver	0.0075 j	0.24 j	0.19 j	0.16 j	0.12 j	250 RMEG (child) 3,500 RMEG (adult)
Vanadium	55.9	55.0	56.4	54.4	55.4	500 Intermediate EMEG (child) 7,000 Intermediate EMEG (adult)
Zinc	50.8	98.7	71.3	88.4	90.3	15,000 chronic EMEG (child) 210,000 chronic EMEG (adult)

Data Source: [3]
Bolded detections meet or exceed media-specific comparison values
*Media-specific comparison value for trivalent chromium
EMEG: Agency for Toxic Substances and Disease Registry's Environmental Media evaluation Guide
Bolded detections meet or exceed media-specific comparison values
RMEG: Reference Dose Media Evaluation Guide based on U.S. Environmental Protection Agency's Reference Dose
mg/kg: milligrams per kilograms
RSL: U.S. Environmental Protection Agency, Region IV, Regional Screening Levels (based on noncancer health effects)
CHHSL: Office of Environmental Health Hazard Assessment (OEHHA) California Human Health Screening Levels
CREG: Agency for Toxic Substances and Disease Registry's Cancer Risk Evaluation Guide for 1 in 1 million increased cancer risk

Table C8. Noncancer Ingestion Dose Estimates for Downstream Residents for Past Exposure to Contaminants in Surface Water, New Idria Mercury Mine, San Benito County, California

Contaminant of Concern	**Maximum Detected Concentration (Sample ID)** (µg/L)	**Comparison Value (Source)** (µg/L)	**Estimated Dose Adult** (mg/kg/day)	**Estimated Dose Child** (mg/kg/day)	**Health Comparison Value (Source)** (mg/kg/day)	**Hazard Quotient** (unitless)
Mercury	9.6 (SW-6)	2 (MCL)	0.0000768	0.0000896	0.0003 (RfD)*	0.256 (adult) 0.299 (child)
Nickel	456 (SW-6)	200 chronic (RMEG, child) 700 chronic (RMEG, adult)	N/A**	0.00426	0.02 (RfD)	0.213(child)
Total Hazard Index from exposure to all metals measured in surface water						0.256 (adult) 0.512 (child)

µg/L: micrograms per liter
mg/kg/day: milligram per kilogram per day
*RfD for mercuric chloride
** Adult estimated exposure dose for Nickel was not calculated because levels in surface water did not exceed the adult media-specific comparison value
RfD: U.S. Environmental Protection Agency's Reference Dose.
EMEG: Agency for Toxic Substances and Disease Registry's Environmental Media evaluation Guide; RMEG: Reference Dose Media Evaluation Guide based on U.S. Environmental Protection Agency's Reference Dose
MCL: Maximum Contaminant Level for drinking water (state and federal); RSL: U.S. Environmental Protection Agency, Region IV, Regional Screening Levels (based on noncancer health effects)

Equation and assumptions used in estimating ingestion dose from contaminants in surface water [9,35,36]

Dose = (CW) (IR) (EF) (CF) / (BW)

CW = contaminant concentration in water (µg/L)
IR = ingestion rate (1 liter/day for child, 2 liter/day for adult) Values taken from ATSDR Dose Calculator (2014), based on default values taken from ATSDR's Public Health Assessment Guidance Manual and USEPA Exposure Factor Handbook
EF = exposure frequency (days/year); adult resident = 104 days/365 days, child visitor = 104 days/ 365 days
CF = volumetric conversion factor, 0.001 (1 liter/1000 cm^3)
BW = body weight; adult 70kg, child 30 kg

Table C9. Noncancer Dermal Dose Estimates for On-site and Nearby Residents for Past Exposure to On-Site Contaminants in Surface Water, New Idria Mercury Mine, San Benito County, California

Contaminant of Concern	**Maximum Detected Concentration (Sample ID)** (µg/L)	**Comparison Value (Source)** (µg/L)	**Estimated Dose Adult** (mg/kg/day)	**Estimated Dose Child** (mg/kg/day)	**Health Comparison Value (Source)** (mg/kg/day)	**Hazard Quotient** (unitless)
Mercury	16.5 (NIMM-4)	2 (MCL)	0.000000324	0.000000345	0.0003 (RfD)*	0.00115 (child) 0.001 (adult)
Nickel	677 (NIMM-4)	200 (chronic RMEG, child) 700 (chronic RMEG, adult)	N/A**	0.00000283	0.02 (RfD)	0.00014 (child)
Total Hazard Index for Child Visitor from exposure to all metals measured in surface water						0.0013 (child) 0.001 (adult)

µg/L: micrograms per liter
mg/kg/day: milligram per kilogram per day
*RfD for mercuric chloride
** Adult estimated exposure dose for Nickel was not calculated because levels in surface water did not exceed the adult media-specific comparison value
RfD: U.S. Environmental Protection Agency's Reference Dose.
EMEG: Agency for Toxic Substances and Disease Registry's Environmental Media Evaluation Guide

Equation and assumptions used in estimating dermal dose from contaminants in surface water [9,35,36]

Dose = (CW)(SA)(PC)(ET)(EF)(CF) / (BW)

CW = contaminant concentration in water (µg/L))
SA = expose skin surface area (cm^2) adult = 2352 cm^2; child 1076 cm^2. Skin surface areas includes exposed hands and feet for light wading for adult and child, taken from ATSDR Dose Calculator (2014), based on default values taken from ATSDR's Public Health Assessment Guidance Manual and USEPA Exposure Factor Handbook
PC = permeability constant (cm/hr) for COCs (chemical specific: mercury 0.001, nickel 0.0002)
ET = exposure time (min/day); 2 hours per day for 104 days/ 365 days for adult and child = 35 min/day (120*104/ 365= 35)
CF = volumetric conversion factor for water (1 liter/1000 cm^3)
BW = body weight (kg); adult 70kg, child 30 kg

Table C10. Noncancer Dermal Dose Estimates for On-site and Nearby Residents for Current Exposure to On-Site Contaminants in Surface Water, New Idria Mercury Mine, San Benito County, California

Contaminant of Concern	**Maximum Concentration (Sample ID)** (µg/L)	**Comparison Value (Source)** (µg/L)	**Estimated Dose Adult** (mg/kg/day)	**Estimated Dose Child** (mg/kg/day)	**Health Comparison Value (Source)** (mg/kg/day)	**Hazard Quotient** (unitless)
Aluminum	135,000 (NIMM-SW-4)	10,000 (chronic EMEG, child) 35,000 (chronic EMEG, adult)	0.00265	0.00283	1.0 Chronic MRL	0.00265 (adult) 0.00283 (child)
Arsenic	72.4 (NIMM-SW-4)	3 (chronic EMEG, child) 11 (chronic EMEG, adult) 0.023 (CREG)	0.00000142	0.00000152	0.0003 RfD	0.00473 (adult) 0.005 (child)
Cadmium	1.7 (NIMM-SW-5)	1 (chronic EMEG, child) 3.5 (chronic EMEG, adult)	0.0000000333	0.0000000356	0.0001 Chronic MRL	0.0003 (adult) 0.00035 (child)
Mercury	21.2 (NIMM-SW-5)	2 (MCL)	0.000000416	0.000000444	0.0003 (RfD)*	0.00138 (adult) 0.00148 (child)
Nickel	1,640 (NIMM-SW-5)	200 (chronic RMEG, child) 700 (chronic RMEG, adult)	0.00000643	0.00000686	0.02 (RfD)	0.00032 (adult) 0.00034 (child)
Total Hazard Index from exposure to all metals measured in surface water						0.009 (adult) 0.01 (child)

µg/L: micrograms per liter
mg/kg/day: milligram per kilogram per day
*RfD for mercuric chloride
MRL: Agency for Toxic Substances and Disease Registry's Minimal Risk Level
RfD: U.S. Environmental Protection Agency's Reference Dose.
EMEG, RMEG: Agency for Toxic Substances and Disease Registry: Environmental Media Evaluation Guide and Reference Dose Media Evaluation Guide
MCL: Maximum Contaminant Level for drinking water (state and federal);
RSL: U.S. Environmental Protection Agency, Region IV, Regional Screening Levels (based on noncancer health effects)

Equation and assumptions used in estimating current dermal dose from contaminants in surface water [9,35,36]

Dose = (CW)(SA)(PC)(ET)(EF)(CF) / (BW)

CW = contaminant concentration in water (µg/L))
SA = expose skin surface area (cm^2) adult = 2352 cm^2; child 1076 cm^2. Skin surface areas includes exposed hands and feet for light wading for adult and child, taken from ATSDR Dose Calculator (2014), based on default values taken from ATSDR's Public Health Assessment Guidance Manual and USEPA Exposure Factor Handbook.
PC = permeability constant (cm/hr) for COCs (chemical specific: aluminum 0.001, arsenic 0.001, cadmium 0.001, mercury 0.001, nickel 0.0002)
ET = exposure time (min/day); 2 hours per day for 104 days/ 365 days for adult and child = 35 min/day (120*104/ 365= 35)
CF = volumetric conversion factor for water (1 liter/1000 cm^3)
BW = body weight (kg); adult 70kg, child 30 kg

Table C11. Noncancer Dermal Dose Estimates for On-site and Nearby Residents for Past Exposure to On-Site Contaminants in Sediments, New Idria Mercury Mine, San Benito County, California

Contaminant of Concern	**Maximum Detected Concentration (Sample ID)** (mg/kg)	**Comparison Value (Source)** (mg/kg)	**Estimated Dose Adult** (mg/kg/day)	**Estimated Dose Child** (mg/kg/day)	**Health Comparison Value (Source)** (mg/kg/day)	**Hazard Quotient**
Mercury	25.7 (NIMM-12)	18 (Residential CHHSL)	0.0000000144	0.0000000438	0.0003 (RfD)*	0.000047 (Adult) 0.00014 (Child)

mg/kg/day: milligram per kilogram per day
*RfD for mercuric chloride
RfD: Reference Dose, USEPA
CHHSL: California Human Health Screening Levels, Cal/EPA

Equation and assumptions used in estimating past dermal dose from contaminants in sediments (soil) [9,35,36]

Dose = (CS) (A) (AF) (EF) (CF) /(BW)

CS = contaminant concentration in soil (mg/kg)
A = total soil adherence to skin (derived by multiplying the sum total of exposed skin surface area by the default soil adherence concentration of 0.2 mg/cm^2 for a child , and 0.07 mg/cm^2 for an adult. Sum total of exposed skin surface areas (cm^2) adult = 2352 cm^2; child 1076 cm^2 (for hands and feet for light wading) taken from ATSDR Dose Calculator (2014), based on default values taken from ATSDR's Public Health Assessment Guidance Manual and USEPA Exposure Factor Handbook
AF = absorption factor (unitless) chemical specific for mercury: 0.01)
EF = exposure frequency (days/year); adult and child resident 104 days/ 365 days. Input in ATSDR Dose Calculator: 8.667 days/ year, to account for a fractional day (120 min / day) and a fractional year (104 days / year). CDPH program staff calculated the days per year:104 days x 120 min = 12480 min/yr or 8.667 days/year (12480/60/24) for 30 years for adults and 10 years for children
CF = conversion factor (10^{-6} kg/mg)
BW = body weight (kg); adult 70kg, child 30 kg

Table C12. Noncancer Dermal Dose Estimates for On-site and Nearby Residents for Current Exposure to On-Site Contaminants in Sediments, New Idria Mercury Mine, San Benito County, California.

Contaminant of Concern	**Maximum Detected Concentration (Sample ID)** (mg/kg)	**Comparison Value (Source)** (mg/kg)	**Estimated Dose Adult** (mg/kg/day)	**Estimated Dose Child** (mg/kg/day)	**Health Comparison Value (Source)** (mg/kg/day)	**Hazard Quotient** (unitless)
Arsenic	57.1 (NIMM-SD-7)	15 (chronic EMEG, child) 210 (chronic EMEG, adult) 0.47 (CREG) 0.07 (CHHSL)	0.0000000095	0.000000029	0.0003 RfD	0.00003 (adult) 0.0001 (child)
Cadmium	8.6 j (NIMM-SD-7)	1.7 (CHHSL) 5 (chronic EMEG, child) 70 (chronic EMEG, adult)	0.0000000048	0.0000000147	0.0001 Chronic MRL	0.000048 (adult) 0.000147 (child)
Mercury	41.3 (NIMM-SW-5)	18 (CHHSL)	0.0000000231	0.00000007	0.0003 (RfD)*	0.000077 (adult) 0.00023 (child)
Total Hazard Index from exposure to all metals measured in sediments						0.00015 (adult) 0.00048 (child)

mg/kg/day: milligram per kilogram per day
*RfD for mercuric chloride
MRL: Agency for Toxic Substances and Disease Registry's Minimal Risk Level
RfD: U.S. Environmental Protection Agency's Reference Dose.
EMEG: Agency for Toxic Substances and Disease Registry's Environmental Media evaluation Guide
CHHSL: Office of Environmental Health Hazard Assessment (OEHHA) California Human Health Screening Levels

Equation and assumptions used in estimating past dermal dose from contaminants in sediments (soil) [9,35,36]

Dose = (CS) (A) (AF) (EF) (CF) / (BW)

CS = contaminant concentration in soil (mg/kg)
A = total soil adherence to skin (derived by multiplying the sum total of exposed skin surface area by the default soil adherence concentration of 0.2 mg/cm^2 for a child , and 0.07 mg/cm^2 for an adult. Sum total of exposed skin surface areas (cm^2) adult = 2352 cm^2; child 1076 cm^2 (for hands and feet for light wading) taken from ATSDR Dose Calculator (2014), based on default values taken from ATSDR's Public Health Assessment Guidance Manual and Exposure Factor Handbook
AF = absorption fraction (unitless) for contaminants of concern (chemical specific: arsenic 0.03, cadmium 0.01, mercury, 0.01)
EF = exposure frequency (days/year); adult and child resident 104 days/ 365 days. Input in ATSDR Dose Calculator: 8.667 days/ year, to account for a fractional day (120 min / day) and a fractional year (104 days / year). CDPH program staff calculated the days per year:104 days x 120 min = 12480 min/yr or 8.667 days/year (12480/60/24) for 30 years for adults and 10 years for children
CF = conversion factor (10^{-6} kg/mg)
BW = body weight (kg); adult 70kg, child 30 kg

Table C13. Noncancer Dose Estimates for On-site and Nearby Residents for Dermal Exposure and Ingestion from Past Exposure to Contaminants in On-Site Mine Tailings , New Idria Mercury Mine, San Benito County, California

Contaminant of Concern	**Maximum Detected Concentration (Sample ID)** (mg/kg)	**Comparison Value (Source)** (mg/kg)	**Estimated Dose Adult** (mg/kg/day)	**Estimated Dose Child** (mg/kg/day)	**Health Comparison Value (Source)** (mg/kg/day)	**Hazard Quotient**
Mercury	74.6 (NIMM-14) 74.6	18 (CHHSL)	0.0000000417 (dermal)	0.000000127 (dermal)	0.0003(RfD)*	0.00139 (Adult) 0.00042 (Child)
			0.0000298 (ingestion)	0.000139 (ingestion)		0.1 (Adult) 0.468 (Child)
			0.00003 (ingestion and dermal)	0.00014 (ingestion and dermal)		0.1 (Adult) 0.468 (Child)

mg/kg/day: milligram per kilogram per day
*RfD for mercuric chloride
RfD: U.S. Environmental Protection Agency's Reference Dose.
CHHSL: Office of Environmental Health Hazard Assessment (OEHHA) California Human Health Screening Levels

Equation and assumptions used in estimating past dermal dose from contaminants in mine tailings (soil) [9,35,36]

Dose = (CS) (A) (AF) (EF) (CF) / (BW)

CS = contaminant concentration in soil (mg/kg)
A = total soil adherence to skin (derived by multiplying the sum total of exposed skin surface area by the default soil adherence concentration of 0.2 mg/cm^2 for a child , and 0.07 mg/cm^2 for an adult. Sum total of exposed skin surface areas (cm^2) adult = 2352 cm^2; child 1076 cm^2 (hands and feet) taken from ATSDR Dose Calculator (2014), based on default values taken from ATSDR's Public Health Assessment Guidance Manual and USEPA Exposure Factor Handbook
AF = absorption factor (unitless) for contaminants of concern (chemical specific: mercury, 0.01)
EF = exposure frequency (days/year); adult resident 104 events/year, child resident 104 events/year. Input in ATSDR Dose Calculator: 8.667 days/ year, to account for a fractional day (120 min / day) and a fractional year (104 days / year). CDPH program staff calculated the days per year:104 days x 120 min = 12480 min/yr or 8.667 days/year (12480/60/24) for 30 years for adults and 10 years for children
CF = conversion factor (10^{-6} kg/mg)
BW = body weight (kg); adult 70kg, child 30 kg

Equation and assumptions used in estimating past ingestion dose from contaminants in mine tailings (soil) [9,35,36]

Dose = (CS) (IR) (EF) (CF) /(BW)

CS = contaminant concentration in soil (mg/kg)
IR = intake rate: (adult - 100 mg/day, child - 200 mg/day) Values taken from ATSDR Dose Calculator (2014), based on default values taken from ATSDR's Public Health Assessment Guidance Manual and USEPA Exposure Factor Handbook
EF = exposure frequency (days/year); adult resident 104 events/year, child resident 104 events/year.
CF = conversion factor (10^{-6} kg/mg)
BW = body weight (kg); adult 70kg, child 30 kg

Table C14. Noncancer Dose Estimates for On-site and Nearby Residents for Dermal Exposure and Ingestion from Current and Future Exposure to On-Site Residents and Recreational Visitors to On-Site Contaminants in Mine Tailings , New Idria Mercury Mine, San Benito County, California

Contaminant of Concern	**Maximum Concentration (Sample ID)** (mg/kg)	**Comparison Value (Source)** (mg/kg)	**Estimated Dose Adult** (mg/kg/day)	**Estimated Dose Child** (mg/kg/day)	**Health Comparison Value (Source)** (mg/kg/day)	**Hazard Quotient** (unitless)
Arsenic	27.7 (NIMM-TL-9)	15 (chronic EMEG, child) 210 (chronic EMEG, adult) 0.5 (CREG) 0.07 (CHHSL)	**Total:** 0.00000071 Dermal: 0.0000000464 Ingestion: 0.00000665	**Total:** 0.00003 Dermal: 0.000000142 Ingestion: 0.000031	0.0003 (Chronic MRL)	**Total:** 0.0023 (adult) 0.100 (child)
Cadmium	1.8 j (NIMM-TL-10)	1.7 (CHHSL) 5 (chronic EMEG, child) 70 (chronic EMEG, adult)	**Total:** 0.00000073 Dermal: 0.000000001 Ingestion: 0.00000072	**Total:** 0.0000033 Dermal: 0.000000003 Ingestion: 0.0000033	0.0001 (Chronic MRL)	**Total:** 0.0073 (adult) 0.033 (child)
Mercury	446 (NIMM-TL-5)	18 (CHHSL)	**Total:** 0.00018 Dermal: 0.00000249 Ingestion: 0.000178	**Total:** 0.00084 Dermal: 0.00000076 Ingestion: 0.000833	0.0003 (RfD)*	**Total:** 0.6 (adult) 2.8 (child)
Total Hazard Index from exposure to all metals measured in mine tailings						0.61 (adult) **2.93 (child)**

mg/kg/day: milligram per kilogram per day
*RfD for mercuric chloride
MRL: Agency for Toxic Substances and Disease Registry's Minimal Risk Level
RfD: U.S. Environmental Protection Agency's Reference Dose.
EMEG: Agency for Toxic Substances and Disease Registry's Environmental Media Evaluation Guide
CREG: Agency for Toxic Substances and Disease Registry's Cancer Risk Evaluation Guide for 1 in 1 million increased cancer risk
CHHSL: Office of Environmental Health Hazard Assessment (OEHHA) California Human Health Screening Levels

Equation and assumptions used in estimating past dermal dose from contaminants in mine tailings (soil) [9,35,36]

Dose = (CS) (A) (AF) (EF) (CF) / (BW)

CS = contaminant concentration in soil (mg/kg)
A = total soil adherence to skin (derived by multiplying the sum total of exposed skin surface area by the default soil adherence concentration of 0.2 mg/cm^2 for a child , and 0.07 mg/cm^2 for an adult. Sum total of exposed skin surface areas (cm^2) adult = 2352 cm^2; child 1076 cm^2 (hands and feet) taken from ATSDR Dose Calculator (2014), based on default values taken from ATSDR's Public Health Assessment Guidance Manual and USEPA Exposure Factor Handbook
AF = absorption factor (unitless) for contaminants of concern (chemical specific: arsenic 0.03, cadmium 0.01, mercury, 0.01)
EF = exposure frequency (days/year); adult resident 104 events/year, child resident 104 events/year Input in ATSDR Dose Calculator: 8.667 days/ year, to account for a fractional day (120 min / day) and a fractional year (104 days / year). CDPH program staff calculated the days per year: 104 days x 120 min = 12480 min/yr or 8.667 days/year (12480/60/24) for 30 years for adults and 10 years for children
CF = conversion factor (10^{-6} kg/mg)
BW = body weight (kg); adult 70kg, child 30 kg

Equation and assumptions used in estimating past ingestion dose from contaminants in mine tailings (soil) [9,35,36]
Bioavailability of arsenic: per USEPA the bioavailability of arsenic for ingestion is 60% [9]. In the ASTDR Dose Calculator, CDPH program staff adjusted the Bioavailability Factor to 0.6.

Dose = (CS) (IR) (EF) (CF) /(BW)

CS = contaminant concentration in soil (mg/kg)
IR = intake rate: (adult - 100 mg/day, child - 200 mg/day) Values taken from ATSDR Dose Calculator (2014), based on default values taken from ATSDR's Public Health Assessment Guidance Manual and USEPA Exposure Factor Handbook
EF = exposure frequency (days/year); adult and child resident 104 days/ 365 days
CF = conversion factor (10^{-6} kg/mg)
BW = body weight (kg); adult 70kg, child 30 kg

Table C15. Estimated Contaminant Air Concentrations of COCs in Fugitive Dust Derived from Mine Tailings Sample Concentrations Compared to Media-Specific Human Health Comparison Values, New Idria, San Benito County, California

Exposure Timeframe	Contaminant of Concern	Maximum Concentration (Sample ID) (mg/kg)	Estimated Concentration in Air* (µg/m^3)	Noncancer Health Comparison Values (Source) (µg/m^3)	Cancer Health Comparison Values (Source) (µg/m^3)
Present	Mercury	446 (NIMM-TL-5)	0.00033891	0.2 (Chronic MRL) 0.03 (REL) 0.3 (RfC)	N/A
	Cadmium	1.8 j (NIMM-TL-10)	0.00000137	0.01 (Chronic MRL)	0.00056 (CREG)
	Arsenic	27.7 (NIMM-TL-9)	0.0000210	0.015 (REL)	0.00023 (CREG)
Past	Mercury	74.6 (NIMM-14)	0.00005669	0.03 (REL)	N/A

mg/kg: milligrams per kilograms
µg/m3: micrograms per cubic meter
REL: California’s Office of Environmental Health Hazard Assessment’s Reference Exposure Level
RfC: U.S. Environmental Protection Agency’s Reference Concentration
MRL: Agency for Toxic Substances and Disease Registry’s Minimal Risk Level
CREG:Agency for Toxic Substances and Disease Registry’s Cancer Risk Evaluation Guide for 1 in 1 million increased cancer risk

*Estimated concentration in air (CA) was derived from the concentration of soil by using the following equation: CA = (CS/PEF) * (1000 µg/mg)

Where:

CA = Estimated Concentration in air (µg/m3)
CS = Concentration in Soil (mg/kg)
PEF = Particulate Emission Factor (m^3/kg) – 1.316E+09 was used per Cal/EPA’s Department of Toxic Substances Control guidance [18].

Table C16. Summary of Ambient Mercury Vapor Concentrations Measured on June 29, 2012, New Idria Mercury Mine, San Benito County, California

Site Location	No. of Samples	Mercury Vapor Concentration Range (µg/m³)	95% UCL (µg/m³)	OEHHA's Chronic REL (µg/m³)	ATSDR Chronic MRL (µg/m³)
Residence Location A (sample locations 4 through 6)	9	0.006 - 0.02 (µg/m³)	0.013 (µg/m³)	0.030 (µg/m³)	0.20 (µg/m³)
Residence Location B (sample locations 16 through 20)	30	0.009 - 0.043 (µg/m³)	0.023 (µg/m³)		
Area around rotary furnace building (sample locations 9 through 13)	36	0.005 – > 0.314 (µg/m³)	0.11 (µg/m³)		

Note: A map of the approximate locations of samples taken is provided on Appendix B, Figure B5
µg/m³: micrograms per cubic meter
REL: California's Office of Environmental Health Hazard Assessment's Reference Exposure Level
MRL: Agency for Toxic Substances and Disease Registry's Minimal Risk Level
95% UCL: 95% upper confidence limit of the arithmetic mean using USEPA's ProUCL software (Version 5) [19].

Table C17. Cancer Risk Estimates, New Idria Mercury Mine, San Benito County, California.

Contaminant of Concern	Medium Max. concentration Sample ID	Exposure Pathway	Adult Risk	Child Risk*
Arsenic	Surface Water 72.4 µg/L NIMM-SW-4	Current : Dermal exposure to surface water	0.9 in 1million	0.3 in 1million
	Sediment 57.1 mg/kg NIMM-SD-7	Current : Dermal exposure to sediment*	0.2 in 1million	0.2 in 1million
	On-Site Combined Cancer Risk from light wading in San Carlos Creek		**1.1 in 1million**	**0.5 in1million**
	Mine Tailings 27.7 mg/kg NIMM-TL-9	Current: Incidental ingestion from mine tailings**	4.2 in 1million	6.6 in 1million
		Current: Dermal exposure to mine tailings	0.1 in 1million	0.1 in 1million
		Current: Inhalation of fugitive dust from mine tailings	0.002 in 1 million***	0.001 in 1 million***
	On-Site Combined Cancer Risk from incidental ingestion, dermal contact, and inhalation of mine tailings		**4.3 in 1 million**	**6.6 in 1 million**
	On-Site Total Cancer Risk from surface water, sediments, and mine tailings		**5.4 in 1 million**	**7.1 in 1 million**

* assuming 104 days of exposure with 2 hours (120 min) each, or 35 min/day, or 0.0243 days
**ingestion of arsenic assumes 60% bioavailability assumed in Dose Calculator:
Equation and assumptions used in estimating cancer risk from all routes of exposure (except for inhalation):
Cancer Risk = (ED) (Oral Slope Factor) (Exposure Duration) / 70
ED: Exposure Dose (see above for calculations used for each route of exposure)
Oral Slope Factor: 1.5 mg/kg/day for Arsenic
Exposure Duration: Adult – 30 years, Child – 10 years

*** **Equation and assumptions used in estimating cancer risk from inhalation of dust from tailings:**
Cancer Risk = (EC) (IUR)
EC: Exposure Concentration (see above for calculations used for each route of exposure)
IUR: Inhalation Unit Risk – 0.0043 ($\mu g/m^3$) for Arsenic

Appendix D. Toxicological Summaries

This appendix provides background information from toxicological profiles published by the Agency for Toxic Substances and Disease Registry (ATSDR), from the California Environmental Protection Agency, Office of Environmental Health Hazard Assessment (OEHHA), and from the U.S. Environmental Protection Agency (EPA) [13]. It highlights the toxicological effects of contaminants of concern (exceeding health comparison or screening values) detected in environmental media evaluated in this PHA.

Acronyms and Units of Measure Used in this Appendix
ppb: parts per billion
mg/kg/day: milligram per kilogram per day
$\mu g/m^3$: micrograms per cubic meter

Aluminum [31]

- Is ubiquitous; the third most common element of the earth's crust.
- Naturally released to the environment from the weathering of rocks and volcanic activity. Human activities such as mining also result in the release of aluminum to the environment.
- Found in over-the-counter medicines, such as antacids and buffered aspirin; used as a food additive; found in a number of topically applied consumer products such as antiperspirants, and in first aid antibiotic and antiseptics, diaper rash and prickly heat, insect sting and bite, sunscreen and suntan, and dry skin products.
- Numerous studies have examined aluminum's potential to induce toxic effects in humans exposed via inhalation, oral, or dermal routes. Most of these findings are supported by a large number of studies in laboratory animals. Occupational exposure studies and animal studies suggest that the lungs and nervous system may be the most sensitive targets of toxicity following inhalation exposure. The nervous system may be the primarily organ affected by ingestion.
- Exposure, for most people, is through the consumption of food items, although minor exposures may occur through ingestion of aluminum in drinking water and inhalation of ambient air.
- ATSDR intermediate and chronic oral Minimal Risk Level = 1 mg/kg/day (developmental effect in offspring, decreased limb strength, and decreased thermal sensitivity).

<u>Carcinogenicity Classification</u>
- Aluminum production is carcinogenic to humans and pitch volatiles have fairly consistently been suggested in epidemiological studies as being possible causative agents (IARC).
- Not evaluated (DHHS).

Arsenic [37]

- Arsenic is most often found as inorganic arsenic, which is formed when arsenic combines with other elements such as oxygen, sulfur, and chlorine. Inorganic forms of arsenic are usually more toxic than organic forms, which are produced when arsenic forms stable bonds with carbon [37].
- Naturally occurring element commonly found in surface soil and surface water.

- Arsenic trioxide is the primary form marketed and consumed, with 90% used in the production of wood preservatives (copper chromated arsenic).
- Various organic arsenicals are still used in herbicides and as antimicrobials in animal and poultry feed.
- Long-term exposures of lower levels of arsenic through drinking water (170-800 ppb) can lead to a condition known as "blackfoot disease."
- Other effects include gastrointestinal irritation, and contact with skin can cause discoloration (hypo-or hyper-pigmentation), wart-like growths, and skin cancer.
- ATSDR acute oral Minimal Risk Level = 0.005 mg/kg/day (gastrointestinal effects in humans).
- ATSDR chronic oral Minimal Risk Level = 0.0003 mg/kg/day (dermal effects in humans).
- EPA's Oral Reference Dose = 0.0003 mg/kg/day (dermal effects in humans).
- Acute Reference Exposure Level = 0.19 μg/m^3 (reproductive, developmental effects in mice).
- Chronic Reference Exposure Level = 0.03 μg/m^3 (developmental, cardiovascular, nervous system in mice).
- EPA inhalation unit risk = 0.0043 μg/m^3.
- Oral cancer slope factor = 1.5 $(mg/kg\text{-}day)^{-1}$.
- Inhalation slope factor = 12 $(mg/kg\text{-}day)^{-1}$.

<u>Carcinogenicity classification</u>

- Known human carcinogen due to its ability to cause skin cancer, with oral exposures increasing the risks of liver, bladder, and lung cancer (EPA).
- Carcinogenic to humans (IARC).

Cadmium [9]

- Naturally occurring element (metal); also occurs as a result of industrial processes.
- Not usually found as a pure metal, but as a mineral combined with other elements such as oxygen (cadmium oxide), chlorine (cadmium chloride), or sulfur (cadmium sulfate, cadmium sulfide).
- Enters the body primarily through inhalation and ingestion; people are exposed to cadmium mostly from food and cigarette smoke.
- Inhalation of high levels of cadmium can severely damage the lungs and cause death.
- Chronic exposure (inhalation) to low levels can cause kidney (renal) damage.
- The absorption of cadmium in the intestinal tract by children, from early infancy through eight years of age, is much greater than in later life.
- There is very little human data on developmental effects from exposure to cadmium; animal studies have shown developmental effects (reduced birth weight and altered locomotor activity).
- Evidence is insufficient to determine an association between inhalation exposure to cadmium and reproductive effects in humans; an animal study has shown decreased sperm count in rats.
- Listed on State of California Proposition 65 Reproductive/Developmental Toxicants (OEHHA).

- The relationship between occupational exposure to cadmium and increased risk of cancer (specifically lung and prostate cancer) has been explored in a number of epidemiologic studies which are inconclusive.
- ATSDR chronic oral Minimal Risk Level = 0.0002 mg/kg/day (kidney damage in humans).
- OEHHA chronic Reference Exposure Level = 0.02 µg/m^3 (kidney and respiratory damage in humans).
- OEHHA child-specific Reference Dose = 0.000011 mg/kg/day (kidney effects and greater absorption from the gastrointestinal tract in children).
- OEHHA Inhalation slope factor = 15 (mg/kg-day)$^{-1}$.

<u>Carcinogenicity Classification</u>
- Probable human carcinogen (limited human, sufficient animal evidence) (EPA).
- Human carcinogen (sufficient human evidence) (IARC).
- Reasonably anticipated to be a human carcinogen (DHHS).
- Listed on State of California Proposition 65 Reproductive/Developmental Toxicants (OEHHA).

Mercury [38]

- The kidneys are sensitive to the effects of mercury because mercury accumulates in the kidneys and causes higher exposures to these tissues. Mercury vapors may affect many different areas of the brain and their associated functions, resulting in a variety of symptoms, including tremors, irritability or nervousness, memory loss, and performance deficits in tests of cognitive function [38].
- Mercury occurs naturally in the environment and exists in several forms; these forms can be organized under three headings: metallic mercury (also known as elemental mercury), inorganic mercury, and organic mercury.
- Metallic mercury is used in a variety of household products and industrial items, including thermostats, fluorescent light bulbs, barometers, glass thermometers, and some blood pressure devices.
- Spills of metallic mercury from broken thermometers or damaged electrical switches in the home may result in exposure to mercury vapors in indoor air that could be harmful to health; microorganisms (bacteria, phytoplankton in the ocean, and fungi) convert inorganic mercury to methylmercury.
- Ingestion of fish one of the most common ways people are exposed to methylmercury.
- Exposure to high levels (above 500 µg/m^3 and above 1.9 mg/kg/day) of metallic, inorganic, or organic mercury can permanently damage the brain, kidneys, and developing fetus.
- ATSDR chronic inhalation Minimal Risk Level = 0.2 µg/m^3 (neurological effects in humans).
- ATSDR intermediate oral Minimal Risk Level (inorganic mercury/mercuric chloride) = 0.002 mg/kg/day (renal effects in mice).
- ATSDR chronic Minimal Risk Level (methylmercury) = 0.0003 mg/kg/day (neurodevelopment effects in humans).
- EPA chronic oral Reference Dose for (inorganic mercury/mercuric chloride = 0.0003 mg/kg/day (autoimmune effects in rats).

Carcinogenicity classification

- Mercury chloride and methylmercury are possible human carcinogens (EPA).
- Not classified (IARC).

Acute toxicity: includes dermal toxicity (from creams containing inorganic mercury compounds) chronic dermal exposure can cause systemic toxicity.
The CNS is the critical organ for mercury vapor exposure, whereas the kidneys are the critical organ for ingestion of inorganic mercury.

The CNS is the critical organ for exposure to mercury vapor, whereas the kidneys are the critical organ for ingestion of inorganic mercury. Other symptoms of high chronic exposures to mercury include toxicities of the gastrointestinal tract (pain, nausea, and metallic taste), kidney and kidney damage (proteinuria). About 80% of inhaled mercury vapor are retained in the body

Nickel [39]

- Hard metal that occurs naturally in soils and volcanic dust.
- Released to the atmosphere by windblown dust, volcanoes, combustion of fuel oil, municipal incineration, and industries involved in nickel refining, steel production, and other nickel alloy production.
- The most commonly reported adverse health effect associated with nickel exposure is contact dermatitis. Contact dermatitis is the result of an allergic reaction to nickel that has been reported in the general population and workers exposed via dermal contact with airborne nickel, liquid nickel solution, or prolonged contact with metal items such as jewelry and prosthetic devices that contain nickel. After an individual becomes sensitized to nickel, dermal contact with a small amount of nickel or oral exposure to fairly low doses of nickel can result in dermatitis. Approximately 10%–20% of the general population is sensitized to nickel.
- Adverse noncancer respiratory effects have been reported in humans and animals exposed to nickel compounds at concentrations much higher than typically found in the environment.
- The potential for nickel compounds to induce reproductive effects (male reproductive effects and decreased fertility) has not been firmly established but some animal studies have shown such effects (changes in the male reproductive system and impaired fertility) while other studies have not.
- Nickel refinery dust caused lung and nasal tumors in sulfide nickel matte refinery workers in several epidemiologic studies in different countries, and on animal data in which carcinomas were produced in rats by inhalation and injection.
- EPA Reference Dose = 0.02 mg/kg/day (decreased body weight in offspring).
- OEHHA child-specific Reference Dose = 0.011 mg/kg/day (offspring mortality in 3 rat studies).

Carcinogenicity Classification

- Metallic nickel may reasonably be anticipated to be a human carcinogen and nickel compounds are known to be human carcinogens (DHHS).
- Metallic nickel classified in group 2B (possibly carcinogenic to humans) and nickel compounds in group 1 (carcinogenic to humans) (IARC).

- Nickel refinery dust and nickel subsulfide classified in Group A (human carcinogen); other nickel compounds not classified (EPA).
- Listed on State of California Proposition 65 Reproductive/Developmental Toxicants (OEHHA).
- EPA Inhalation Slope Factor = 0.91 $(mg/kg\text{-}day)^{-1}$ (lung and nasal cancer).

Appendix E. CDPH Letter Health Consultation to USEPA. June 29, 2011

State of California—Health and Human Services Agency
California Department of Public Health

Ron Chapman, MD, MPH
Director

EDMUND G. BROWN JR.
Governor

June 29, 2011

Kelly Manheimer
Project Manager, USEPA REGION 9
75 Hawthorne Street
Mail Code: SFD-7-1
San Francisco, CA 94105

Dear Ms. Manheimer:

On June 13, 2011, the California Department of Public Health (CDPH) Environmental Health Investigations Branch (EHIB) accompanied the U.S. Environmental Protection Agency (EPA) Region IX staff on a tour of the New Idria Mercury Mine (NIMM) site located in San Benito County. During the tour we identified a potential threat to public health for trespassers from breathing mercury vapor at the NIMM site near the rotary furnace building. CDPH also noted potential physical hazards posed by the dilapidated rotary furnace building and other dilapidated structures on the site. CDPH is conducting public health assessment activities at the NIMM as part of a cooperative agreement with the federal Agency of Toxic Substances Disease Registry (ATSDR).

The NIMM operated from 1854 to 1972. During its operation, the mine reportedly produced approximately 38 million pounds of elemental mercury. Mercury was extracted at the mine by roasting crushed cinnabar ore to release elemental mercury vapor which was cooled and condensed for bottling. Emissions from the roasting process were channeled through a 4 foot diameter metal flue pipe which runs from the rotary furnace building along the upgradient slope of the adjacent hill.

As a recognized California Historical Landmark, NIMM experiences tourist travel and is an appealing destination for “Geocache” enthusiasts, where individuals locate hidden objects using a Global Positioning System receiver.

During the site tour, EPA Region IX staff screened ambient air for mercury vapor using a Lumex Mercury analyzer. The amount of mercury vapor measured in ambient air was largely influence by wind gusts and wind direction. During calm periods when the wind was not gusting, mercury vapor levels were around 0.04 micrograms per cubic meter ($\mu g/m^3$). During periods when the wind was gusting and originating from the rotary furnace building, mercury vapor levels ranged from $12\mu g/m^3$ to $13\mu g/m^3$. The highest mercury vapor level was measured in a large hole within the flue pipe located approximately 50 feet above the rotary furnace building; the mercury level was measured above the analyzer's upper detection limit of 36µg/m³.

No efforts were made to collect readings from inside the rotary furnace building due to exposure concerns and the dilapidated condition of the building. It is reasonable to assume that levels within the rotary furnace building would be comparable or possibly higher than the level (> 36µg/m³) measured inside the flue pipe.

The ambient mercury vapor levels measured during wind gusts at the NIMM site exceed the EPA reference exposure level (RfC) of 0.3µg/m³. For additional reference, the measured ambient mercury vapor levels also exceed the California Office of Environmental Health Hazard Assessment's chronic (0.03µg/m³), 8 hour (0.06µg/m³) and acute (0.6µg/m³) Reference Exposure Levels (RELs) for inhalation of mercury.

Studies have demonstrated that the human nervous system is very sensitive to all forms of mercury. In the environment, inorganic mercury can be transformed into more toxic organic mercury. Exposure to high levels of metallic, inorganic, or organic mercury can permanently damage the brain, kidneys, and developing fetuses.

CDPH concludes that there is a potential threat to public health for trespassers from breathing high levels of mercury vapor in ambient air near the rotary furnace building and from physical hazards associated with the on-site dilapidated structures. Therefore, CDPH requests that EPA Region IX take the necessary actions to reduce the potential for exposure to mercury vapor and from physical hazards posed by the on-site dilapidated buildings.

If you have any questions please do not hesitate to contact Russell Bartlett at (510) 620-3671 or Tracy Barreau at (510) 620-3670.

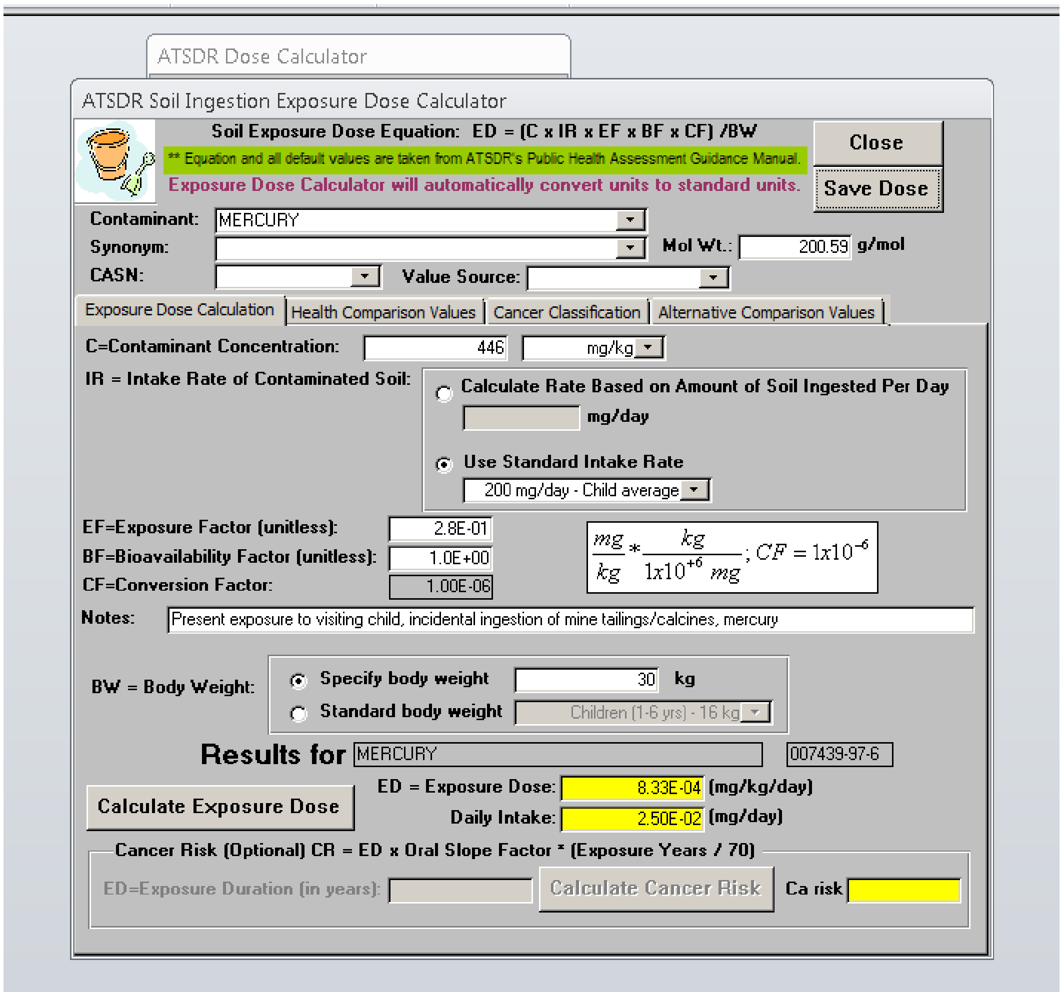
Sincerely,

Russell Bartlett
Environmental Health Scientist
Environmental Health Investigations Branch

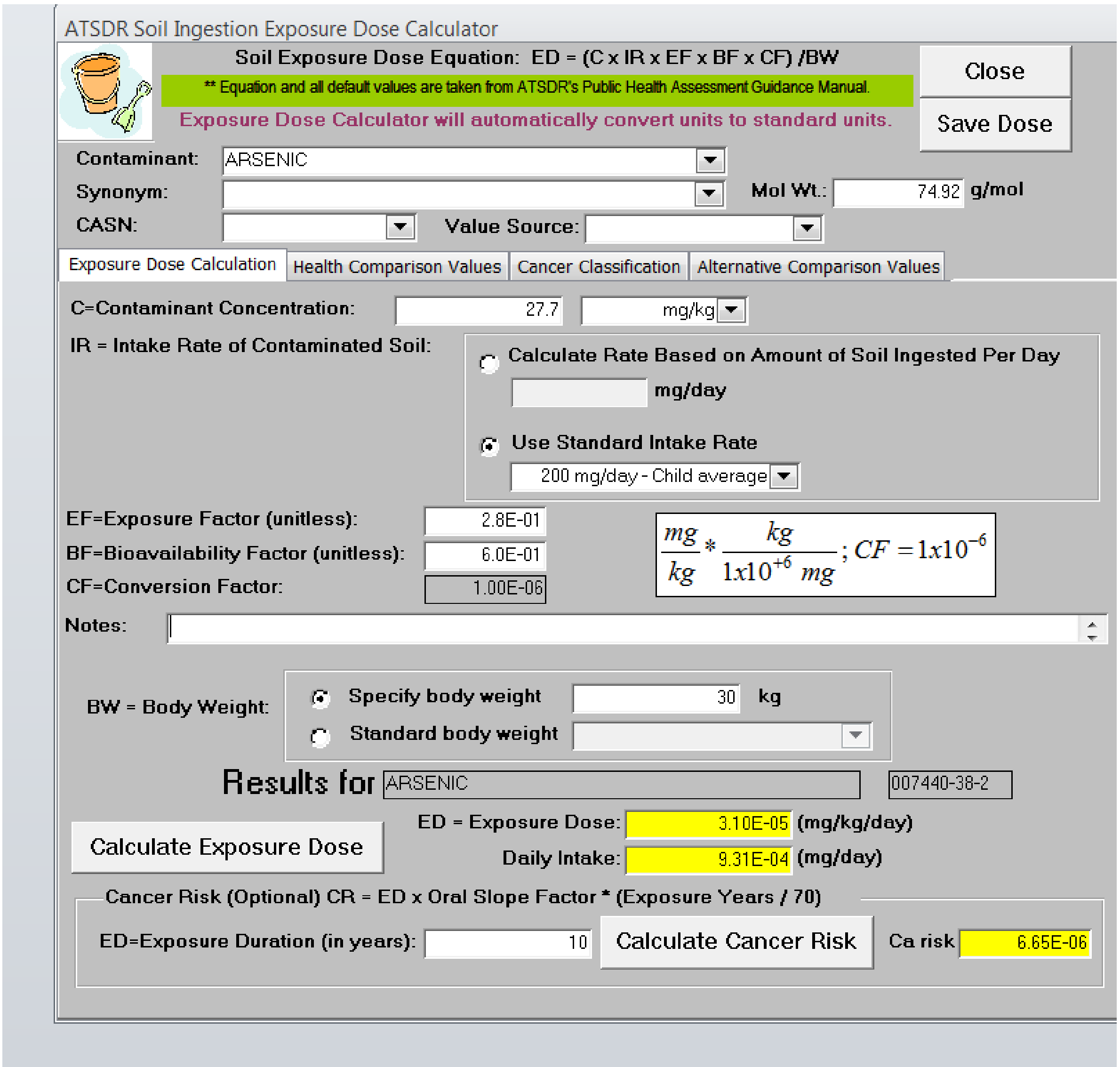
Tracy Barreau, REHS
Acting Chief, Site Assessment Section
Environmental Health Investigations Branch

Appendix F: Screenshots of Dose Calculations for Visiting Child.

Dose calculation for visiting child, present exposure via incidental ingestion of mercury in mine tailings, using ATSDR's Dose Calculator (Version May 2014) [21].



Cancer risk calculation for visiting child, present exposure to arsenic from incidental ingestion of mine tailings, using ATSDR's Dose Calculator (Version May 2014); assuming 60% bioavailability of maximum arsenic concentration: 27.7 mg/kg x 0.6 = 16.6 mg/kg, 10 years exposure):



Appendix G: New Idria Superfund Site Interim Removal Action Factsheet, USEPA, October 2011.

New Idria Mercury Mine

U.S. Environmental Protection Agency • Region 9 • San Francisco, CA • October 2011

EPA Finalizes Site on the NPL Begins Interim Cleanup Actions

On September 16, 2011, the United States Environmental Protection Agency (EPA) placed the New Idria Mercury Mine (NIMM) on the federal National Priorities List, commonly called the Superfund List.

EPA has begun the process of taking interim steps to address contamination from the mine workings. The former mine is located approximately 64 miles southeast of Hollister, in San Benito County, California (see map below).

Historical mercury mining operations at the mine have resulted in mercury contamination and acid mine drainage into San Carlos Creek, Silver Creek and a portion of Panoche Creek, at levels that are toxic to aquatic organisms. Environmental impacts extend more than fifteen miles to creeks and wetland areas, and endangered species habitat, ultimately perhaps the San Joaquin River and the San Francisco Bay.

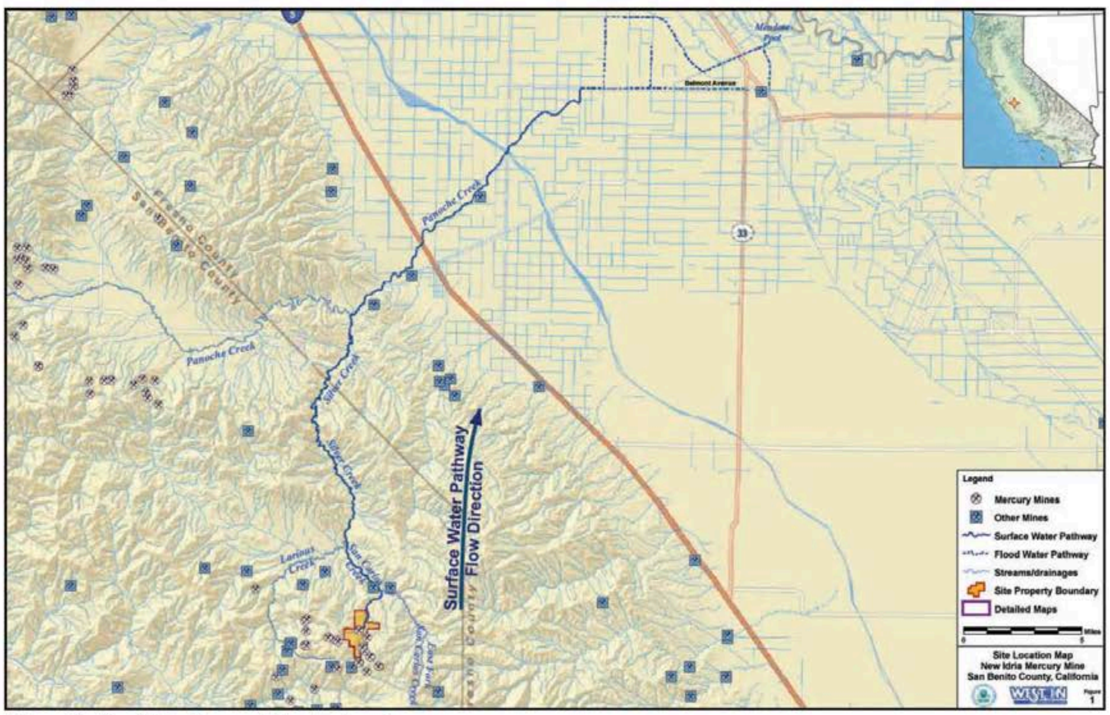


Figure 1: *New Idria Mercury Mine site location*

Interim Cleanup Actions

EPA's planned interim cleanup action this fall (see Figure 2) will address the following concerns:

- Water, in the form of acid mine drainage, is coming from the mine and impacts San Carlos Creek. The action will route the drainage through a conveyance to a settling pond, which will minimize the mercury picked up by the water.
- Stormwater, from rain events, flows over the tailings piles and picks up additional mercury, which is then transported to San Carlos Creek. The action will re-route the stormwater away from the tailings piles.
- Site Security: currently, there are few signs and insufficient fencing around the contaminated areas. The action will post more signs, and add fencing around the furnace area.

New Idria Mercury Mine added to NPL List

On September 16 2011, the U.S. Environmental Protection Agency (EPA) added the New Idria Mercury Mine site to EPA's National Priorities List (NPL), commonly called the Superfund List. Documents related to the listing are located at the San Benito County Free Library, 470 5th Street, Hollister, CA.

EPA identifies sites that may pose threats to nearby populations through actual or potential contamination of soils, groundwater, surface water, or air. Placing the site on the NPL allows EPA to use federal resources to conduct cleanup activities at the site, including investigating the sources of contamination and determining what measures may be necessary to protect human health and the environment.

Figure 2: *New Idria Mine Map with planned interim actions*

Now that NIMM is finalized on the Superfund List, an in-depth investigation of the location and concentration of site contaminants will be performed, followed by an analysis of ways to address the contamination. EPA will then identify the preferred cleanup remedy and share this in a public meeting, which will be accompanied by a formal public comment period. After all public comments are considered, EPA will document the selected remedy in a legal document called a Record of Decision (ROD).

Following the ROD, EPA designs, constructs, tests, operates and/or performs the necessary cleanup activities, or requires one or more legally responsible parties to do so. The public is encouraged to share its issues and concerns throughout the Superfund process.

What is Superfund?

Superfund is the commonly-used name for the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), a federal law that enables EPA to respond to sites with hazardous substances that threaten public health and the environment.

EPA responds to a site by identifying those that are responsible for contaminating it, then requiring them to perform cleanup activities under EPA oversight. If EPA is unsuccessful in identifying responsible parties to perform cleanup activities, EPA may use Superfund monies to perform the cleanup itself.

If a responsible party is not identified, a site cannot undergo a federal cleanup unless it is listed on the NPL.

Community Involvement

EPA is committed to involving the public in the cleanup process at the New Idria Mercury Mine site. Its Community Involvement Program focuses on answering the community's questions about the cleanup effort, providing information to the community about site activities, and incorporating community issues and concerns into Agency decisions.

EPA organizes its public participation effort through the development of a Community Involvement Plan (CIP). This document identifies issues and concerns, methods of involving the public in the cleanup decision-making process, and other site-related information.

To start the CIP development process, EPA interviews various stakeholders (residents, activists, public officials, etc.). *If you would be willing to be interviewed by EPA to help in the production of the CIP,* please contact David Cooper (see contact info at right).

One convenient place to find major site documents is to go to EPA's web site: **www.epa.gov/region09/newidria.**

To learn more about the site, you will find hard copy documents at EPA's Information Repository (see right).

Information Repository

San Benito County Free Library
470 5th Street
Hollister, CA 95023-3885

EPA Points of Contact

Kelly Manheimer
Remedial Project Manager
SFD-7-1
75 Hawthorne
San Francisco, CA 94105
415-972-3290
Manheimer.kelly@epa.gov

David Cooper
Community Involvement Coordinator
SFD-6-3
415-972-3245
800-231-3075
Cooper.david@epa.gov

Mailing List Coupon

If you are not already on EPA's mailing list for the New Idria Mercury Mine Site, please send an e-mail or return the coupon below to David Cooper, Community Involvement Coordinator, U.S. EPA, Region 9, 75 Hawthorne Street (SFD-6-3), San Francisco, CA 94105, (415) 972-3245, *cooper.david@epa.gov*

Name ______________________________

Mailing Address ______________________________

City, State ______________________________ Zip ______________

Telephone (optional) ______________________________

E-mail (optional) ______________________________

Affiliation (optional) ______________________________

Appendix H: Public Comments and Response from the California Department of Public Health (CDPH).

Public Comments and Responses from the California Department of Public Health (CDPH)

On February 17, 2016, the Public Health Assessment for the New Idria Mercury Mine Superfund Site was released in draft for public comment. In order to accommodate residents that live in the remote areas around the site, the comment period was open for six weeks and ended on April 1, 2016.

As part of this release, CDPH mailed the public comment draft PHA to approximately 40 addresses, which include residents, the public library in Hollister, and other stakeholders.

CDPH received one set of comments, which are provided in the following pages. When appropriate, a response from CDPH is provided in italics.

Comments:

GENERAL COMMENTS

1. Conclusions 1, 3, and 4 (pp. 2-4) are overly broad and potentially misleading for "residents living near the site" and "recreational visitors," the two potentially exposed populations identified in the report (p. 18). The conclusions indicate that current exposures from inhalation of mercury vapor and ingestion of mercury in mine tailings could harm people's health and that exposure to arsenic in soils could pose a slightly elevated risk of cancer. These conclusions should be qualified to indicate that they reflect potential future exposures, assuming essentially unlimited access to the Site with, for example, no fencing and no signage. The conclusions do not reflect current conditions or the potential for exposures of current receptors. Furthermore, the assumption that nearby adult and child residents visit the site 104 days per year (52 weekends) does not appear to reflect current conditions at the Site. For example, p. 18 of the report states:

    > CDPH identified fewer than five residences near the Site. The houses closest to the Site are intermittently occupied, mostly on weekends ..., with typically one or two adults present and children visiting occasionally... The adult residents were adamant about supervising visiting children and prohibiting them from playing in or around potentially hazardous areas. The residents were particularly concerned about the physically hazardous conditions of the dilapidated rotary furnace building, calcine tailings piles, areas around the level 10 AMD confluence, and other site hazards such as rattlesnakes.

    For recreational visitors, CDPH and ATSDR state (p. 18):

    > It is reasonable to assume that people would visit for only a brief period, perhaps an hour or two per visit once or twice a year, since access is difficult (visitors must traverse a 20-mile-long dirt road to reach the Site) and no recreational facilities or potable water are available.

Finally, the report notes, “in the fall of 2011 USEPA fenced the perimeter of the recognized "hot spots" on the Site and posted signs around the perimeter of the Site warning trespassers and visitors about the potential threats to public health."

Considering existing fencing and signage at the site, the report conclusions should distinguish between potential exposures under current site conditions and those that might occur under a hypothetical future scenario, e.g., if nearby residents (including children) are unaware of the hazardous conditions at the site, road access and amenities at the site have been improved, and access restrictions and signage are no longer present.

CDPH Response: CDPH's conclusions 1, 3, and 4 are conservative assumptions based on information gathered from multiple sources, including from interviews with residents and information provided by USEPA. As mentioned in Section 3.0 (Site Visits), CDPH was informed by residents that although the frequency of trespassers appeared to have diminished since the fence was installed, trespassers still access the Site. In Section 4.4.2 (Recreational Visitors), CDPH also mentions that during site visits, CDPH staff witnessed several visitors entering the abandoned buildings outside the fence and others trespassing beyond the fence, despite signs designating this as a hazardous area. Additionally, in a personal communication with USEPA Project Manager for the Site on January 11, 2016, CDPH was informed that the fence's padlock securing entry to the Site had been broken and evidence of vehicle tracks entering the Site were also present throughout the Site. Steps to have it repaired have also taken place. Thus, CDPH concludes that even under current conditions, with signage and fencing, conditions at the Site pose potential exposures to trespassers, including children.

2. Given the highly conservative assumptions used to estimate potential exposures, the Section 1.0 Summary and other sections of the report should describe the assessment as a "screening-level assessment." In particular, the dose estimates for exposure to mine tailings are based on maximum contaminant concentrations combined with highly conservative exposure assumptions (i.e., that nearby adult and child residents visit the site 104 days per year and each time visits the location with the maximum concentration). Further, a review of the dose calculations indicates that for the soil ingestion pathway (the pathway with the highest estimated dose), the default amount of soil consumed over an entire day (i.e., 200 and 100 milligrams per day [mg/d] for the child and adult, respectively) is ingested at the location with the maximum detected concentration during the 2-hour visit. Typically, the default soil ingestion rates are used to represent soil ingestion over the day and not over just a 2-hour period.

CDPH Response: In section 4.3 (Identification of Contaminants of Concern), CDPH discusses the screening method that CDPH used to identify contaminants of concern (COCs) for further evaluation, and to determine whether levels of contaminants in various environmental media pose a health hazard from noncancer or cancer health effects. The screening of COCs is the first step, and one component of a public health assessment. This public health assessment was written according to the Public Health Assessment Guidance Manual as published by ATSDR.

CDPH used the default ingestion amount of soils for both adult and child in order to be conservative and health protective. According to the USEPA Exposure Factors Handbook (2011), the soil ingestion recommendation are intended to represent ingestion of a combination of soil and outdoor settled dust within the period of one day, without distinguishing between these two sources or indicating a specific timeframe in which the actual exposures occur. Given the mostly bare soil conditions in the accessible parts of the Site (i.e. exposed tailings piles, dirt roads) and likely outdoor activities of adults and children (climbing, biking, running, walking, rock collecting, crawling on soil, playing with soil and rocks), the assumption that adults and children will receive the default daily dose in a 2 hour time period is reasonable.

3. While sufficient data to estimate a 95% upper confidence limit of the arithmetic mean are not available at this time, the data collected to date appear to have targeted areas where the highest contaminant concentrations are expected.

<u>*CDPH Response:*</u> *CDPH's staff follows ATSDR's Public Health Assessment Guidance Manual as well as specific guidance regarding the estimation of exposure point concentrations (EPCs). In absence of data from a more complete site investigation, CDPH used the available data that prioritized the investigation of areas of likely contamination. Due to insufficient data to estimate a 95% upper confidence limit, CDPH used the maximum concentrations in each respective medium at the Site.*

4. The Assessment does not indicate whether it has been peer reviewed nor does it identify who conducted any peer review. The final Assessment should indicate the date the Assessment is completed, and, if it is peer reviewed, it should identify the reviewers.

<u>*CDPH Response:*</u> *All public health assessments done under cooperative agreement with ATSDR are reviewed by ATSDR's Office of Science before being published. Additionally, technical reviewers are listed on the Preparers of Report on page 33.*

SPECIFIC COMMENTS

1. P.4, Conclusion 5 (and P. 30, #5): The conclusion, "Inhalation of mercury vapor in ambient air prior to 1972 when the mines were in operation could have harmed workers' and residents' health" is inherently speculative and not supported by the information under "Basis for Conclusion 5." In particular, CDPH and ATSDR note," in order to assess exposures while the mine was in operation, CDPH and ATSDR would need air-monitoring data for mercury vapors for this time period. These data were not collected while the mine was in operation. Thus, the potential for health hazards from mercury vapors cannot be determined for past exposures." Further, in the last paragraph on p. 13 the report states,"...CDPH considers inhalation of ambient air a completed exposure pathway for past and current exposures, but it is not possible to reconstruct the ambient air concentrations, inhalation doses, or health hazards associated with past conditions."

<u>CDPH Response:</u> CDPH agrees that Conclusion 5 is speculative. However, without the necessary data to assess past exposures to mercury vapors, CDPH cannot rule out the possibility that mercury vapors could have harmed workers' and residents' health.

2. P. 7, Section 2.1: Under Site Description, it is stated that "(A) small unnamed reservoir, referred to as San Carlos Creek reservoir, is located off-site, approximately 1mile upstream of the town." To our knowledge, the unnamed reservoir has not been referred to as "San Carlos Creek reservoir" elsewhere, except by CDPH in this document, and it is not clear that the reservoir is in fact hydrologically connected to the waterbody known as San Carlos Creek.

<u>CDPH Response:</u> USEPA's Expanded Site Inspection report from 2010, from which data for this public health assessment was used, refers to the off-site reservoir located 1 mile upstream as the "San Carlos Creek" reservoir.

3. P. 8,Section 2.1:Under Site Description, it is stated that "(A)fter mining operations ceased, the mine flooded with groundwater and surface water in the presence of iron and sulfur, an acid known as acid mine drainage (AMD) is formed that is drained outside in channels called adits." The basis for the statement that the formation of AMD (only) occurred after mining operations ceased is not provided in the document.

<u>CDPH Response:</u> Comment noted. According to the USEPA Expanded Site Inspection report from 2010, AMD has been discharging from the Level 10 adit into San Carlos Creek since at least 1969. CDPH has made this change to the Site Description section on page 8, section 2.1.

4. P. 10, Section 3.0: Under Site Visits, it is stated that during a visit to the Site on June 13, 2011, "(A)t the request of CDPH, USEPA staff screened ambient air for mercury vapor using a handheld Lumex Mercury Vapor Analyzer. The measured mercury vapor levels around the furnace and the condenser exceeded USEPA's and the California Office of Environmental Health Hazard Assessment's (OEHHA's) health screening levels (see Exposure to Mercury Vapors in Ambient Air section below)." No mercury vapor concentrations in ambient air collected from the June 13, 2011 site visit are presented in this report to support the above statement, although mercury vapor concentrations in ambient air samples collected from a Site visit on June 20, 2012 are presented in Table C16.

<u>CDPH Response:</u> The mercury vapor concentrations for the June 13, 2011 site visit were verbally communicated by USEPA staff to CDPH staff present during the site visit in which the screening for mercury vapors with a Lumex took place. This communication is documented in the Letter Health Consultation dated June 29, 2011, provided in Appendix E of this document.

5. P. 12, Section 4.2.1: Under Surface Water, it is stated that "(C)ontamination stemming from the Site was found at least 5.7 miles downstream from the AMD discharge area. The next sampling location was substantially farther downstream (17.2 miles), and all samples beyond this point show lower contaminant concentrations compared to concentrations

> near the Site." In the Site Description section (P. 7; Section 2.1), it is stated that the Site is located within the New Idria Mining District, which "includes over a dozen smaller mercury mines and mining operations for chromite, magnesite, asbestos, and benitonite [sic]." For this and other reasons, data available at this time are insufficient to support a hypothesis that contamination found at downstream sampling locations, especially those as far as 5.7 to 17.2 miles downstream from the Site, "stems" from the Site, or from operations at the other mercury and non-mercury mines, or from other sources.

<u>CDPH Response:</u> *CDPH used two major environmental investigations published by USEPA to assess the Site in this PHA: the first in 1998, a combined Preliminary Assessment/Site Inspection (PA/SI), and the second in 2010, an Expanded Site Inspection (ESI).*

The 1998 PA/SI investigation identified elevated levels of mercury on-site and in sediment and surface water samples downgradient from the Site and documented a significant release that is attributable to the Site (three times the background level per USEPA protocol) to at least 5.7 miles downstream.

In July 2010, EPA tasked WESTON to conduct an Expanded Site Inspection of the New Idria Mercury Mine, including the collection of environmental samples. The specific sampling objectives were to collect data that could be used to document whether a release of mercury or other metals had occurred to San Carlos and Silver Creeks that could be attributed specifically to the New Idria Mercury Mine site. As a result of the 2010 ESI, USEPA concluded the following in its Hazard Ranking System Documentation Record for the New Idria Mercury Mine (page 30 of the HRS Record):

> *"Site sources are in direct contact with and are a continuous probable point of entry (PPE) in San Carlos Creek from approximately the location of samples NIMM-SW-3 to NIMM-SW-7. The furthest downstream PPE is at the location of sample NIMM-SW-7 (Ref. 6, p. 55, Photo 23, Photo26; Ref. 20). Sampling shows the presence of hazardous substances meeting the criteria for an observed release attributable to the site to a distance of 19.9 miles downstream of the furthest downstream PPE (Ref. 6, p. 29; Ref. 20). Although other mines existed in the vicinity of the site, the NIMM facility was the central processing area for the surrounding mines"*

CDPH has removed the sentence from p.12, Section 4.2.1 that reads "(C)ontamination stemming from the Site was found at least 5.7 miles downstream from the AMD discharge area" and has replaced it with "The 1998 USEPA PA/SI investigation identified elevated levels of mercury on-site and in sediment and surface water samples downgradient from the Site and documented a significant release that is attributable to the Site (three times the background level per USEPA protocol) to at least 5.7 miles downstream."

In the same section, CDPH also added the following sentence: "USEPA's 2010 ESI documents that surface water samples showed the presence of hazardous substances meeting the criteria for an observed release attributable to the site to a distance of 19.9 miles downstream of the furthest downstream probable point of entry."

6. P. 19, Section 4.5: It would be helpful to add the assumed age of the "child resident" to the description of the receptors. A review of the ATSDR Dose Calculator indicates that the assumed age of the child is 1-11 years and the body weight is 30 kg. It is highly unlikely that a child less than about 10 years old would be visiting the site more than one or two times per year. Further, it is unlikely that toddlers and young children would be given free access to explore the area unsupervised. The very young age of the child over the assumed exposure period further adds to the conservatism of the assessment.

CDPH Response: Comment noted. The following sentence has been included on page 19, Section 4.5 (Exposure Assumptions): "Exposure dose calculations assumed that an adult resident weighs 70 kilograms and that a child resident, aged 1 to 11 years, weighs 30 kilograms."

7. P.19, Section 4.5.1: The last sentence contains an error and should be revised to read "..., CDPH assumed 100% relative bioavailability of metals, with the exception of arsenic in soil (60% relative bioavailability for incidental ingestion...)". (Relative bioavailability adjustments are performed when the site exposure medium differs from the exposure medium in the studies that support the toxicity values, whereas absolute bioavailability is the fraction of a dose that is absorbed into the systemic circulation.)

CDPH Response: Comment noted. The last sentence on page 19, Section 4.5.1 has been modified to include "relative" as a qualifier.

8. P.30, Section 7.0: CDPH staff concluded that the agency and ATSDR cannot determine whether contaminants at the Site are impacting private wells and harming people's health. The report states that "only six residents live within a 5-mile radius" and "(T)he closest permanent residents live approximately 1 mile downstream of the Site." (Section 2.2; p.8). The report also states that "(T)here are no known drinking water wells within 4 miles of the Site and no known surface water intakes within 20 miles downstream from the Site" (Section 2.4; p.10). For the contaminants at the Site to impact private wells and thereby harm people's health, all the following events would have to occur: (1) privately owned or unregistered water wells in the sparsely populated Site area that are not regulated by the State of California would have to exist; (2) groundwater in such "hypothetical" unregistered or unregulated wells (located at least 1 mile from the Site) would have to be impacted by contaminants at the Site; and (3) contaminant concentrations in groundwater and associated exposures would have to result in adverse health impact to receptors. There are no existing Site data that would support any of the above conditions, let alone all of them.

CDPH Response: Comment noted. No changes were made.

9. Tables C13 and C14: The footnotes indicate that the soil ingestion rates are 100 mg/d for the child and 200 mg/d for the adult. This appears to be incorrect, i.e., the adult soil ingestion rate is 100 mg/d and the child ingestion rate is 200 mg/d.

CDPH Response: Comment noted. Footnotes for tables C13 and C14 regarding soil ingestion rates for adult and child have been corrected.

10. Table C14: The exposure assumptions used to estimate the hazard quotients (HQs) in this table appear to be those identified for "residents living near the site." The table title should include the receptor evaluated. Further, as suggested under our "General Comment," the assumptions used to calculate doses better reflect those of hypothetical future residents and not the exposures of current residents.

CDPH Response: CDPH modified the titles of tables C9 – 15 to reflect that they refer to "On-site or Nearby Residents." CDPH also changed the section heading 4.5.2 to "On-Site and Nearby Residents." As noted in this public health assessment, these exposure scenarios are also protective of recreational visitors.