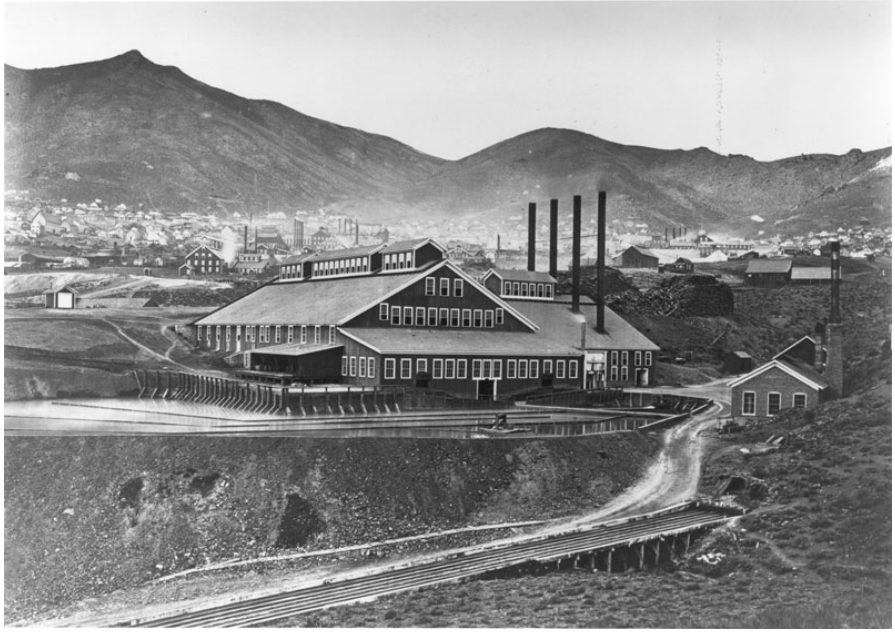
EXPLANATION OF SIGNIFICANT DIFFERENCES

CARSON RIVER MERCURY SITE

Washoe, Carson City, Storey, Lyon, and Churchill Counties, Nevada
NVD980813646



U.S. Environmental Protection Agency
Region 9
September 2013

(This page intentionally left blank)

Carson River Mercury Site
Explanation of Significant Differences

Introduction and Statement of Purpose

The purpose of this Explanation of Significant Differences (ESD) for the March 30, 1995 Record of Decision (ROD) for Operable Unit 1 (OU1) of the Carson River Mercury Site (CRMS) is to address issues that have arisen as a result of the continuing implementation and management of the remedy selected in the ROD. The issues addressed by this ESD are:

- The CRMS boundaries need to be better defined to assure that the remedy protects public health by focusing on areas of concern.
- Cleanup levels for two of the three contaminants of concern, lead and arsenic, have changed since the ROD was signed.

EPA uses an ESD to document a significant change to the ROD for a Superfund site. A significant change is defined as "a change to a component of a remedy that does not fundamentally alter the overall cleanup approach."[1] In the case of the CRMS ROD for OU1, the overall cleanup and the goal of the remediation -- to protect public health, specifically children, from exposure to the contaminants of concern in residential settings -- is not being altered. The manner in which the remedy is implemented is being refined and improved. The site definition is being revised to be contamination-based, rather than geographic, and the cleanup levels for two of the contaminants of concern, arsenic and lead, are being updated to better protect public health. Detailed discussions of the issues and the proposed modifications follow in the body of this document.

The U.S. Environmental Protection Agency (EPA) is the lead agency for the Record of Decision for OU1 of the Carson River Mercury Site. The Nevada Department of Conservation and Natural Resources Division of Environmental Protection (NDEP) is the support agency for OU1 of the CRMS. This ESD is completed pursuant to §117(c) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, and §300.425(c)(2)(1) of the National Contingency Plan. This ESD will become part of the Administrative Record for the CRMS as required by §300.825(a)(2) of the National Contingency Plan.

The Administrative Record is available for review at the following locations:

U. S. EPA Superfund Records Center
95 Hawthorne Street, Suite 403 S
San Francisco, California 94105
Hours: Monday - Friday 8 a.m. - 5 p.m.

[1] A Guide To Preparing Superfund Proposed Plans, Records of Decision, And Other Remedy Selection Decision Documents, EPA 540-R-98-031, OSWER 9200.1-23P, July 1999

Nevada Division of Environmental Protection
Bureau of Corrective Actions
901 South Stewart Street, Suite 4001
Carson City, Nevada 89701

Site History, Contamination, and Selected Remedy

The Carson River Mercury Site is a legacy of the Nevada Comstock mining era of the late 1800s, when mercury was imported to the area for the processing of gold and silver ore. Ore mined from the Comstock Lode was transported to mill sites, where it was crushed and mixed with mercury to amalgamate the precious metals. The mills were located in Virginia City, Silver City, Gold Hill, Dayton, Six Mile Canyon, Gold Canyon, Sevenmile Canyon, Washoe Valley, and adjacent to the Carson River between New Empire and Dayton. During the mining era, an estimated 14,000,000 pounds of mercury were discharged into the Carson River drainage, primarily in the form of mercury-contaminated tailings. The CRMS includes mercury-contaminated soils and tailings at former mill sites, mercury contamination in drainages adjacent to the mill sites, and mercury contamination in sediments, fish and wildlife over a more than 70 mile length of the Carson River, beginning near Carson City, Nevada and extending downstream through the Lahontan Reservoir and the Lahontan Valley to the River's terminus in the Carson Desert.

High levels of mercury in sediment and water of the Carson River were reported by the United States Geological Survey (USGS) in the early 1970's. Since then, numerous studies have documented the presence of mercury and methylmercury in sediments, soil, water, and wildlife. A 2009 USGS Scientific Investigations Report of mercury concentrations in the United States found that total mercury in bed sediment in the Carson River exceeded the Probable Effects Concentration of 1,060 nanograms per gram (ng/g) and a composite sample of smallmouth bass from the Carson River at Dayton had the highest mercury concentration reported for fish in the study, 1.95 micrograms per gram (µg/g) wet weight. This level significantly exceeds the EPA human-health criterion for fish of 0.3 µg/g.[2] The same USGS study found maximum methylmercury levels in United States streams of 4.11 nanograms per liter (ng/L). In 2006, a water sample from the bottom of Lahontan Reservoir contained 40.2 ng/L methylmercury. Elevated methylmercury levels in fish have prompted the Nevada State Health Division to issue health advisories that recommend no consumption of any fish from the Carson River from Dayton to the Lahontan Dam and all waters of the Lahontan Valley, and no consumption of white bass from Big and Little Washoe Lakes.

The Carson River Mercury Site was listed on the Superfund National Priorities List (NPL) on August 30, 1990, and remains the only Nevada site on the NPL. At the time of listing, the CRMS was described as portions of the Carson drainage and Washoe Valley in Northwestern Nevada which are affected by mercury released from milling operations during the Comstock Lode. The subsequent ROD stated that:

[2] Scudder, B.C., Chasar, L.C., Wentz, D.A., Bauch, N.J., Brigham, M.E., Moran, P.W., and Krabbenhoft, D.P., 2009, Mercury in fish, bed sediment, and water from streams across the United States, 1998–2005: U.S. Geological Survey Scientific Investigations Report 2009–5109, 74 p.

> The current definition of the CRMS study area is as follows: sediments in an approximately 70-mile stretch of the Carson River beginning near Carson City, Nevada and extending downstream though the Lahontan Reservoir to the terminal wetlands in the Carson Desert (Stillwater National Wildlife Refuge and Carson Lake); tailings piles, sediments and soil in Gold Canyon, Sixmile Canyon, and Sevenmile Canyon; and sediments and soil in Washoe Valley."[3]

The ROD also noted that ". . . EPA is unable to clearly delineate the exact boundaries of the Superfund site . . ." because the site potentially included all areas where mercury contamination from Comstock tailings had come to reside, and it is impossible to sample an area of that size with sufficient density to provide definitive characterization.

For EPA management purposes, the site is divided into two Operable Units (OU): OU1 consists of the mill sites and those areas where tailings have contaminated surface soil and drainages (generally the source areas), and OU2 is the Carson River itself, including sediments and biota (generally the depositional/ecological areas). This ESD only addresses OU1. OU2 is in the Remedial Investigation/Feasibility Study phase of the Superfund process and EPA has not selected a remedy for OU2.

In 1994, Region 9 released the Human Health Risk Assessment and Remedial Investigation Report (HHRA/RI), Carson River Mercury Site. Data gathered in support of the Remedial Investigation included over 1000 soil samples collected at 131 historic mill sites, and samples of sediment, air, groundwater, surface water, and biota. The HHRA/RI identified mercury, arsenic, and lead as contaminants of concern for the CRMS. All three metals occur naturally in ore from the Comstock Lode, but arsenic and lead were concentrated in the milling process, and the addition of mercury as an amalgam greatly exceeded the levels naturally present in the ore. Based on the Human Health Risk Assessment, EPA established a site-specific cleanup level of 80 milligrams per kilogram (mg/kg) mercury in residential soils. The level was designed to be protective of a child, age 1 to 6, who would come into contact with mercury-contaminated soils, and was based on the oral reference dose for inorganic mercury. The level takes into account the species of mercury found in the soils at the CRMS and the bioavailability of those species.

On March 30, 1995, Region 9 signed a Record of Decision (ROD) selecting a cleanup remedy for OU1 (Attachment 1). The objective of the remedial action was to "reduce human health risks by reducing direct exposure to surface soils containing mercury at concentrations equal to or greater than 80 milligrams per kilogram (mg/kg) in residential areas." The ROD also determined that the cleanup level for arsenic that was specified in the Nevada Contaminated Soil and Groundwater Remediation Policy was pertinent and would be followed. The Nevada standard for arsenic from the Policy was 80 mg/kg. As EPA did not have a reference dose for lead, and there was no standard in the Nevada Policy, no cleanup level was established for lead in soil.

At the time the ROD was signed, six residential areas were identified as exceeding the mercury cleanup criteria, based on the sampling conducted during the Remedial Investigation. "No Action" was selected as the remedial action for one of the areas, but for the remaining five areas, the remedy anticipated "[E]xcavation of approximately 5000 cubic yards of contaminated soils,

[3] EPA Record of Decision, 1995

disposal at a RCRA municipal and/or hazardous waste landfill, and restoration of properties. In the event that subsurface soil (greater than or equal to 2 feet below ground surface) is impacted and is not addressed, then this alternative may also include institutional controls." To address areas not identified as exceeding the cleanup criteria and not residential at the time of the ROD, the remedy also included "[I]mplementation of institutional controls to ensure that any residential development in present open land use areas known or suspected to be impacted by mercury includes characterizing mercury levels in surface soils, and if necessary, addressing impacted soils. These institutional controls will be referred to as the 'Long-term Sampling and Response Plan."'

Cleanup of the five areas identified by EPA took place between August 4, 1998 and December 15, 1999. Over 9,087 cubic yards of mercury-contaminated soil was removed. The majority of the soil was disposed of at the Lockwood Landfill in Sparks, Nevada, but discovery of the foundation of an historic mill building at one of the areas required a larger excavation and transport of highly contaminated soils to treatment and disposal facilities in Pennsylvania.

EPA and the NDEP then drafted the institutional control, the Long-term Sampling and Response Plan (LTSRP). The LTSRP has operated as a draft, living, document and is in the process of being formally adopted by the agencies. The LTSRP is administered by NDEP and is applied to residential properties within the general CRMS site boundary. According to the ROD, the LTSRP applicability area includes:

- Sixmile Canyon - Refers to the tributary of the Carson River that begins near Virginia City in the Virginia mountain range and meets the Carson River approximately five miles east of Dayton. The segment of concern is the canyon which begins just below Virginia City and extends to the mouth of the canyon just above the alluvial fan.
- Alluvial Fan - Refers to the alluvial fan below the mouth of Sixmile Canyon. The fluvial channels extending across the fan from the mouth of Sixmile Canyon to the Carson River confluence are the areas of concern.
- Brunswick Canyon - Refers to the Carson River flood plain between New Empire (the Mexican Mill) and Dayton.
- Carson River Flood Plain Above Lahontan Dam - Refers to the Carson River flood plain extending between Dayton and Lahontan Reservoir.
- Carson River Flood Plain Below Lahontan Dam - Refers to the flood plain of the South Branch of the Carson River beginning below Lahontan Dam and extending to Carson Lake.

The ROD anticipated that the NDEP Bureau of Corrective Actions (BCA) would be notified of development within the general CRMS site boundary by the NDEP Bureau of Water Pollution Control (BWPC) for developments of five homes or more, and by the county planning departments for smaller developments. Much of OU1 is in Lyon County, but Washoe, Storey, and Churchill Counties and Carson City are also affected. From 1995 to 2012, approximately 45 development proposals were reviewed by BCA pursuant to the LTSRP. Of those, 28 required sampling and 2 required remediation.

Due to changes in the National Pollution Discharge Elimination System (NPDES) requirements for Construction General Permits (CGP) under the Phase II Storm Water Rule that was promulgated on December 8, 1999, the NDEP BWPC CGP now applies to projects disturbing at least one acre, or that will disturb less than one (1) acre but are part of a larger common plan for development or sale that will ultimately disturb one (1) or more acres. Therefore, a notification to the NDEP BCA of potential disturbance of sites smaller than five homes or five acres, but greater than or equal to one acre, originates from the NDEP BWPC. However, notification of new home construction or other surface disturbance of less than one acre must still be initiated by the county planning departments.

Basis for the Explanation of Significant Differences

- Issue 1: The CRMS boundaries are not well defined to focus on the areas of concern.

This issue was identified in the Second Five-Year Review Report for the site, which was completed in 2008. The review noted that "there is no clear method for determining whether a property is within or outside of the CRMS."[4] This issue primarily affects the success of the LTSRP as a continuing public health protection. If the purpose of the LTSRP is to protect the public from exposures to CRMS contaminants, then knowledge of the location of those contaminants is central to effective implementation of the institutional control.

The very nature of the CRMS makes contaminant location difficult. Rather than a conventional industrial facility, the CRMS is composed of historic locations, some more than 150 years old and many no longer visible, and the areas where contamination from those locations has come to rest. Since EPA conducted its initial mill site identification and investigation effort, an additional 100^{+} mill sites have been identified from the historical records.

The issue of site definition is acknowledged in the ROD, which states:

» 1.1 SITE DEFINITION
The Carson River Mercury Site (CRMS) consists of the portions of the Carson drainage and Washoe Valley in Northwestern Nevada which are affected by mercury released from milling operations during the Comstock Lode. The exact boundaries of the affected area were not defined as part of this remedial investigation because knowledge of these boundaries were considered to have little or no influence on the findings of the risk assessment.

The current definition of the CRMS study area is as follows: sediments in an approximately 70-mile stretch of the Carson River beginning near Carson City, Nevada and extending downstream through the Lahontan Reservoir to the terminal wetlands in the Carson Desert (Stillwater National Wildlife Refuge and Carson Lake); tailing piles, sediments and soil in Gold Canyon, Sixmile Canyon, and Sevenmile Canyon; and sediments and soil in Washoe Valley.

[4] Second Five-Year Review Report for Carson River Mercury Site, Cities of Dayton and Silver City, Lyon County, Nevada, September 30, 2008

Other site descriptions in the ROD follow:

» 6.4 AREAS OF DEPOSITION AND ACCUMULATION

Areas of deposition and accumulation refers to areas where mercury imported to the region is presently deposited and potentially accumulating as a result of the fate and transport mechanisms discussed in the preceding section. For the purpose of characterizing and assessing human exposure at the CRMS, areas of deposition and accumulation were broken out and assessed separately. These areas and how they were defined for the remedial investigation are as follows:

Millsites/Tailing Piles: refers to the locations of the historic millsites and all associated features (i.e., tailing piles, tailing ponds, flumes, etc.) which are recognized as the original point sources of mercury in the drainage;

Tributaries: refers to the tributaries which drain the Virginia Mountain Range into the Carson basin and Washoe Valley (i.e., Six Mile Canyon, Gold Canyon, etc.);

Alluvial Fan: refers to the alluvial fan below the mouth of Sixmile Canyon;

Flood Plain: refers to the Carson River floodplain beginning above New Empire and extending to the terminal wetlands;

Carson River: refers to the main channel of the Carson River beginning above New Empire and extending to the terminal wetlands;

Lahontan Reservoir: refers to Lahontan Reservoir which has a surface area of approximately 4,856 acres (EPA, 1977);

Carson Lake: refers to Carson Lake which occupies approximately 5,600 acres (Hoffman et.al, 1990);

Stillwater Wildlife Management Area: refers to the Stillwater Wildlife management area which occupies approximately 9,600 acres during an average water year (Hoffman et.al, 1990);

Indian Lakes: refers to the Indian Lakes recreation area which have a total surface area of approximately 549 acres during an average water year (Tuttle, 1992); and

Washoe Lake: refers to the combined area of Little and Big Washoe Lake which have a combined area of approximately 5,100 acres during a normal water year (Washoe County, 1992).

» 9.1 DESCRIPTION OF REMEDIATION ALTERNATIVES

The Long-term Sampling and Response Plan will set forth specific sampling guidelines for characterizing mercury levels in surface soils and for addressing impacted areas. The areas where any residential development will be subject to the guidelines prescribed in this plan are generally described as follows:

Sixmile Canyon - Refers to the tributary of the Carson River that begins near Virginia City in the Virginia mountain range and meets the Carson River approximately five miles east of Dayton. The segment of concern is the canyon which begins just below Virginia City and extends to the mouth of the canyon just above the alluvial fan.

Alluvial Fan - Refers to the alluvial fan below the mouth of Sixmile Canyon. The fluvial channels extending across the fan from the mouth of Sixmile Canyon to the Carson River confluence are the areas of concern.

Brunswick Canyon - Refers to the Carson River flood plain between New Empire (the Mexican Mill) and Dayton.

Carson River Flood Plain Above Lahontan Dam - Refers to the Carson River flood plain extending between Dayton and Lahontan Reservoir.
Carson River Flood Plain Below Lahontan Dam - Refers to the flood plain of the South Branch of the Carson River beginning below Lahontan Dam and extending to Carson Lake.
In instances where residential development is proposed within these defined areas, [the] Nevada Division of Environmental Protection (NDEP) will provide the interested parties with the Long-term Sampling and Response Plan Guidelines. The guidelines will provide specific instructions for sampling an area to assess mercury levels in surface soils, instructions for interpreting and reporting results, instructions for follow-up sampling, and instructions for addressing impacted areas.

» 10.0 SELECTED REMEDY
Implementation of institutional controls to ensure that any residential development in present open land use areas known or suspected to be impacted by mercury includes characterizing mercury levels in surface soils and, if necessary, addressing impacted soils. These institutional controls will be referred to as the "Long-term Sampling and Response Plan."

The consistent thread through all the descriptions of the site in the ROD is that it includes those areas where Comstock mining era contaminants of concern have come to reside. At the time the ROD was signed, the technology did not exist to display data in a manner that could identify the contaminated areas on a property by property scale. With the improvements in Geographic Information System (GIS) technology, it is now possible to record and display sample locations and analytical results with an accuracy that permits delineation of a site based on the distribution of contaminants.

EPA generally defines a Superfund site to be "…that portion of a facility [site] that includes the location of a release (or releases) of hazardous substances and wherever hazardous substances have come to be located. As such the extent of a site is not limited by property boundaries, and does not include clean areas within a facility's property boundaries."[5] The Agency also recognizes that "[T]he extent and nature of a release becomes more refined as information…is gathered….NPL site boundaries will vary over time. Throughout the life of the project, information may develop that results in finding more contamination than was previously thought to be present. Conversely, as remedial action is implemented, site boundaries may contract."[6]

When EPA conducted the Remedial Investigation for the CRMS in the early 1990's, the Agency identified, sampled, and mapped 131 mill sites in OU1. Out of this effort, six areas were found to be both residential and have mercury in soil above the 80 mg/kg cleanup level, and five were remediated as described above.

[5] Clarifying the Definition of "Site" Under the National Priorities List, Quick Reference Fact Sheet, U.S. EPA, EPA/540/F-95/033 OSWER-9320.2-10FS, May 1996.
[6] Ibid

The sampling data from sites which were not identified for remedial action in 1995 because their mercury levels were below 80 mg/kg or they were not being used for residential purposes, was not subsequently managed in a way that could assist EPA and NDEP to determine which areas could be subject to the LTSRP in the future (mercury, arsenic, and lead above cleanup standards but not residential in 1995) and those areas which could be excluded from future CRMS consideration (contaminants below cleanup levels). The LTSRP was simply applied on a general geographic basis to development along the flood plain of the Carson River and in a wedge-shaped area starting at Virginia City and running down Gold and Sixmile Canyons to the flood plain, consistent with the site description contained in Section 9.1 of the ROD.

The institutional control did not provide protection for public health from residential development in CRMS areas associated with Washoe Lake, even though it was recognized as an area with contaminants of concern. Conversely, the geographic nature of the LTSRP applicability area included upland properties which were not impacted by the historic mill sites. The inconsistency caused by the various general geographic site definitions in the ROD hampers the protectiveness and effectiveness of CRMS management and public health protections and is not consistent with the manner in which EPA defines a “site”.

- Issue 2: Cleanup levels for two of the three contaminants of concern, lead and arsenic, have changed since the ROD was signed.

Contaminants of concern for the CRMS were determined in the EPA 1994 HHRA/RI to be mercury, arsenic, and lead. Although mercury occurs naturally in the Carson River basin, the background levels are overwhelmed by the amount of mercury imported into the Comstock to process ore. Arsenic and lead are naturally occurring trace metals in the area that were concentrated in the ore milling process.

The HHRA evaluated the cancer and non-cancer health risks from exposure to CRMS contaminants by various exposure pathways. For OU1, exposure by incidental soil ingestion was found to be the pathway of potential concern for mercury, arsenic, and lead. Using toxicity information and CRMS concentration data for each compound, the cancer and non-cancer risks were then estimated. The risk assessment concluded that cancer risks from exposures to the contaminants of concern at OU1 were not significant. However, the non-cancer health risks for children under the age of six, living on or adjacent to contaminated areas and incidentally ingesting mercury or arsenic from soil, were found to be at levels that EPA considered to be potentially adverse i.e., Hazard Index (HI) >1 (Table 1). Because of the nature of the health effects of lead, the risk for residential exposure to lead in the soils of the CRMS was calculated separately using levels found in soils in the Dayton area. The calculation determined that lead in soils should not present a significant health threat. Exposures from recreational land use were not significant for any contaminant.

Table 1: Estimated Hazard Indices (HI) for Individuals Living On or Adjacent to Impacted Areas[1]			
Exposure Pathway	**Contaminant**	**Typical Estimate[2]**	**High-end Estimate[3]**
Soil Ingestion[4]	Mercury	0.09	2.80
	Arsenic	0.05	1.23
Dust and/or Vapor Inhalation	Mercury	0.10	0.38
	Arsenic	0.002	0.007
Consumption of Domestic Produce	Mercury	0.40	0.80
Hazard Index		0.64	5.22

[1]A HI >1 indicates that the associated exposure scenario has the potential to result in adverse noncancer health effects. The HI is the sum of individual Hazard Quotients.
[2]Typical Hazard Quotient estimate is for an adult.
[3] High-end Hazard Quotient estimate is for a young child (<6 years).
[4] Chronic daily intake (CDI) was estimated based on mercury levels measured in surface soil at the MS004 sample area in Dayton

To protect children from exposure to the contaminants of concern from residential exposures, the 1995 ROD established the site-specific 80 mg/kg cleanup standard for mercury in soil, and also adopted the Nevada Contaminated Soil and Groundwater Remediation Policy, June 25, 1992, arsenic standard of 80 mg/kg. Because neither EPA nor the State of Nevada had a cleanup level for lead, none was specified in the ROD.[7]

Section 121(d) of CERCLA requires that remedial actions selected for Superfund sites comply with "legally applicable or relevant and appropriate standard[s], requirement[s], criteria, or limitation[s]." The highest tier of cleanup standards are those promulgated under Federal or, with certain conditions, State law that are "applicable or relevant and appropriate" (ARAR) to a particular site, contaminant, or remedial action. As such, ARARs can be chemical-specific, location-specific, and/or action-specific requirements.

At the time the ROD was signed, there were no federal or state laws concerning mercury, arsenic and lead cleanup levels that were considered to be ARARs for the cleanup of OU1. However, there were standards from the next tier of requirements, termed "To Be Considered" standards, which were determined to be germane to the CRMS cleanup. The Nevada Contaminated Soil and Groundwater Remediation Policy was determined to be appropriate for the arsenic standard and that cleanup level was selected in the ROD. For mercury, the section of the Policy that states that site specific cleanup levels may be used at a site if they were developed using a scientifically valid risk assessment was used. The Nevada Contaminated Soil and Groundwater Remediation Policy cited in the ROD is no longer in effect. Cleanup levels for soil in Nevada are now governed by Nevada Administrative Code (NAC) 445A.2272.

[7] Please see ROD for discussion of lead level

Description of the Significant Differences

- Issue 1: The CRMS boundaries are not well defined to focus on the areas of concern.

The global definition of the CRMS contained in Section 1.1 of the ROD remains applicable: "The Carson River Mercury Site (CRMS) consists of the portions of the Carson drainage and Washoe Valley in Northwestern Nevada which are affected by mercury released from milling operations during the Comstock Lode." The more specific, geographical description in Section 9.1 of the ROD of the area subject to the LTSRP was based on the belief that the sampling conducted during the Remedial Investigation had identified all the areas with mercury above the cleanup level, both residential and non- residential. The area of the CRMS subject to the LTSRP was described geographically in the ROD based on the data collected in the Remedial Investigation.

As time has passed and CRMS land uses have changed and more information has become available, it has become apparent that there are areas which were not identified in the original scope and description of the LTSRP applicability area which should be included if the institutional control is to be effective in protecting the public from residential exposures to CRMS contaminants. The definition of the areas to which the LTSRP applies needs to be based on the locations of contaminants, driven by sampling data, not simply a general geographic description. The contamination-zone based site definition and description in ROD Sections 1.1 and 10.0 make sense when the purpose of the LTSRP is considered; the geographic description in Section 9.1 does not. A contamination-zone based definition is also more consistent with the Superfund program's general definition of "site" referenced above.

A contamination-zone based definition of the CRMS means that the site is defined by data. The data need to be organized and communicated in a way that is useful for site managers and the public. To that end, NDEP has digitized CRMS sampling data and has prepared a GIS-platformed management map of the CRMS. The map uses historical records of mill site locations, watershed and drainage information, and data from EPA and LTSRP sampling to more specifically identify the areas where CRMS-related contaminants are found or are likely to be located, and includes several contamination zones to account for possible transport from the original mill site locations. The contamination zones, termed by NDEP as "risk zones", include the sediments above the ordinary and permanent high water mark of the Carson River and its tributaries to assure that the areas which may be developed adjacent to the river or tributaries are included in the public health protections provided by the LTSRP.

The map is designed to change over time as additional data more closely profile and define the areas with and without elevated levels of contaminants of concern, and contaminated properties are remediated pursuant to the LTSRP. This will assure that the CRMS site definition remains aligned with the public health risk and with EPA's definition of "site" as "…the location of a release." The current version of the CRMS map is available on the NDEP website at http://ndep.nv.gov/bca/carsonriver/criverwhatsnew.htm.

To further refine the map, EPA and NDEP will conduct additional sampling of OU1 of the CRMS. NDEP is currently reviewing an archeological survey of the expanded list of mill site

locations to assure that the OU1 work complies with the requirements of the National Historic Preservation Act and that historic features are protected. After the survey, samples of soil and tailings will be collected and analyzed for contaminants of concern. The site boundaries will be adjusted as the sample results indicate.

- Issue 2: Cleanup levels for two of the three contaminants of concern, lead and arsenic, have changed since the ROD was signed.

The Nevada Contaminated Soil and Groundwater Remediation Policy is no longer in effect. The cleanup levels for soils in Nevada are now governed by the Nevada Administrative Code (NAC):

> NAC 445A.2272 Contamination of soil: Establishment of action levels. **(**NRS 445A.425**)**
>
> 1. For the purposes of NAC 445A.22695 to 445A.2271, inclusive, the action level for soil must be established at the following levels:
>
> (a) The background concentration or volume of a hazardous substance, hazardous waste or a regulated substance set forth in:
>
> (1) The permit issued to the owner or operator by the Division; or
>
> (2) A study approved by the Division.
>
> (b) The presence of a hazardous substance, hazardous waste or a regulated substance in the soil at an appropriate level of concentration that is based on the protection of the waters of the State, public health and safety for all identified routes of exposure and the environment. The appropriate level of concentration must be determined by the Division using the Integrated Risk Information System, adopted by the Environmental Protection Agency, as it existed on October 3, 1996, or any other equivalent method or peer-reviewed source of information chosen by the Division.
>
> 2. Except as otherwise provided in this subsection, if more than one action level for soil may be established using the criteria set forth in paragraph (b) of subsection 1, the most restrictive action level must be used. In no case may the action level be more restrictive than the background concentration of the hazardous substance, hazardous waste or regulated substance.
>
> 3. The State Environmental Commission hereby adopts by reference the Integrated Risk Information System, adopted by the Environmental Protection Agency, as it existed on October 3, 1996.[8]

The EPA Integrated Risk Information System is used to derive the Agency's Regional Screening Levels (RSLs). RSLs are used by Superfund site decision makers to help determine whether levels of contamination found at a site may warrant further investigation or site cleanup. RSLs are used by NDEP for the same purpose, consistent with Nevada Administrative Code 445A.2272, as the successor to the Nevada Contaminated Soil and Groundwater Remediation Policy. RSLs are guidance, not promulgated standards.

The EPA RSL level for arsenic in residential soil is currently 0.61 mg/kg, based on the carcinogenicity of arsenic, and assuming that 60% of the arsenic is bioavailable. The geology of Nevada is such that arsenic occurs naturally in soil at levels far exceeding the RSL. A 1981

[8] Added to NAC by Environmental Comm'n, eff. 10-3-96; A by R189-08, 8-25-2009

United States Geological Study (USGS) Open File Report recorded arsenic values in Nevada soils of 2.9 to 24.0 mg/kg, and data from Tidball et al, cited in the EPA Human Health Risk Assessment and Remedial Investigation Report, found an arithmetic mean for arsenic in soil of 13.14 mg/kg.[9,10] To establish a meaningful and protective level for arsenic in soils of the CRMS, both natural levels and the effect that the milling process had on concentrating arsenic must be considered. As a matter of policy, EPA does not establish cleanup goals below natural background levels. NDEP statistically evaluated arsenic data from the almost 400 soil samples reported in Tidball, et al. The NDEP Position Paper detailing the evaluation is attached to this ESD (Attachment 2). Based on the analysis, NDEP concluded that "…32 mg/kg represents an appropriate and conservative generic screening/action level for arsenic in surface soils within the Carson River drainage basin." This level is based on an analysis using normal probability plots to identify a naturally occurring background population for arsenic. The 95th percentile of this background population of arsenic concentrations was selected as the background screening level for the Carson River basin. This determination of a naturally occurring background concentration meets the requirements of NAC 445A.2272(1)(a)(2). EPA concurs with the NDEP evaluation and recognizes the cleanup level of 32 mg/kg arsenic as a site-specific ARAR for the CRMS.

Unlike arsenic, concentrations of lead in Nevada soils are not naturally elevated. Lead levels in Nevada soils reported in the 1981 USGS paper ranged from <10 mg/kg to 70 mg/kg and the mean reported in the data from Tidball et al was 17.2mg/kg.[11] The NDEP estimated a background screening level of approximately 22 mg/kg for lead using the Tidball et al. data set. The EPA Office of Solid Waste and Emergency Response (OSWER) has utilized a risk reduction goal of limiting exposure to soil lead levels such that children would have no more than 5% risk of exceeding a blood lead level of 10 micrograms per deciliter (µg/dL). Until EPA revises this policy, that risk reduction goal is appropriate to support Superfund site cleanup decisions. The OSWER Directive on risk assessment and cleanup of lead in residential soil recommends that soil lead levels less than 400 mg/kg are generally safe for residential use.[12] That level has been incorporated into the EPA RSLs, and EPA considers the level to be an appropriate and protective "to be considered" requirement for the CRMS. The level of 400 mg/kg is therefore adopted as the cleanup level for lead in residential soil in the CRMS.

The presence of elevated levels of arsenic and lead at a residential location, in the absence of mercury above natural background levels, shall not solely make that location subject to the management provisions of the CRMS. Because such large quantities of mercury were introduced into the native ore in the milling process, it serves as the sentinel compound for Comstock-related contamination. In the absence of mercury above typical background levels, elevated levels of arsenic and lead found at a residential location cannot be assumed to be CRMS-related. The arsenic and lead levels may just reflect natural background. Therefore, a background level

---

[9] Boerngen, Josephine G., and Shacklette, Hansford T. Chemical Analyses of Soils and Other Surficial Materials of the Conterminous United States: Denver, Colorado: U.S. Geological Survey Open-File Report 81-197; 1981.
[10] Tidball, R.R., Briggs, P.H., Stewart, K.C., Vaughn, R.B., and Welsch, E.P., 1991, Analytical data for soil and well core samples from the Carson River basin, Lyon and Churchill Counties, Nevada, U.S. Geological Survey Open-File Report 91-584A.
[11] Ibid.
[12] Memorandum: OSWER Directive: Revised Interim Soil Lead Guidance For CERCLA Sites AND RCRA Corrective Action Facilities, EPA OSWER Directive #9355.4-12, August 1994

for mercury in soils in the CRMS has been established as a threshold to indicate the presence of contaminated materials. If mercury is present above the background level, then further analysis will be conducted to determine whether the property has been affected by CRMS-related contamination.

NDEP analyzed studies of the Carson River basin to determine typical mercury background levels (Attachment 3). Based on the analysis of data from the Tidball study and from sampling recently conducted by Comstock Mining, Inc. in support of their mineral exploration and extraction activities in Gold Canyon, NDEP concluded that "Data from the Tidball study (Tidball et al., 1991, n = 397) and the recent background study conducted by Comstock (Comstock Mining, 2012, n = 56), suggest that concentrations of mercury in soil that exceed 1 mg/kg are unlikely to represent background conditions in non-mineralized areas."[13] EPA concurs with this analysis and has determined that 1.0 mg/kg mercury in soils and tailings is the appropriate threshold level which EPA and NDEP will reference as a screening level to begin to determine that a sample location may be impacted by Comstock Lode milling activities.

If an area is identified with levels of arsenic or lead above the cleanup levels in the absence of mercury above background concentrations, and the area is determined not to be CRMS-related, EPA and NDEP will consult regarding the best path forward to assure that any public health or environmental risks associated with the area are addressed.

Table 2. Summary of Soil ARAR/TBC Changes

Contaminants of Concern	1995 ROD ARARs/TBCs (mg/kg)	Current (mg/kg)	ARARs /TBCs Changed?
Mercury	80	80	No change
Arsenic	80	32	More stringent
Lead	--	400	More stringent

Support Agency Comments

The Nevada Division of Environmental Protection concurs with this ESD. The NDEP letter confirming its agreement is incorporated as Attachment 4 of this document.

Statutory Determinations

The modifications to the remedy for the Carson River Mercury site satisfy the requirements of CERCLA §121.

[13] Evaluation of Metals Data from Tidball et al. (1991): Arsenic, Lead and Mercury. Mary A. Siders, Ph.D. NDEP, BCA, June 29, 2012

Public Participation Compliance

Section 300.435 Remedial design/remedial action, operation and maintenance, subsection (c)(2)(i) of the National Contingency Plan states:

> (c) *Community relations...*
> (2) After the adoption of the ROD, if the remedial action or enforcement action taken, or the settlement or consent decree entered into, differs significantly from the remedy selected in the ROD with respect to scope, performance, or cost, the lead agency shall consult with the support agency, as appropriate, and shall either:
> (i) Publish an explanation of significant differences when the differences in the remedial or enforcement action, settlement, or consent decree significantly change but do not fundamentally alter the remedy selected in the ROD with respect to scope, performance, or cost. To issue an explanation of significant differences, the lead agency shall:
> (A) Make the explanation of significant differences and supporting information available to the public in the administrative record established under §300.815 and the information repository; and
> (B) Publish a notice that briefly summarizes the explanation of significant differences, including the reasons for such differences, in a major local newspaper of general circulation.

Because community involvement activities for the CRMS have been limited since the remedial action in 1999, it is appropriate to do a more robust community involvement program than that required by the National Contingency Plan. Therefore, in addition to publishing notice of the ESD in the Virginia City News, the Dayton Courier, the Nevada Appeal, the Mason Valley News, and the Reno Gazette-Journal, the Region will issue a Fact Sheet to residents in the OU1 area to apprise them of the changes being made pursuant to this ESD. The Region and NDEP will also meet with local officials, and hold open houses and community meetings, as deemed appropriate, to inform residents of the CRMS of the changes.

This ESD is approved by:

Michael Montgomery
Assistant Director
Superfund Division
EPA Region 9

9/27/13
Date