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June 1995

EPA Superfund Record of Decision:

Carson River Mercury Site
(OU 1), Lyon/Churchill County, NV
3/30/1995

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

RECORD OF DECISION

CARSON RIVER MERCURY SITE, WEST CENTRAL NEVADA

OPERABLE UNIT 1: SURFACE SOIL

March 30, 1995

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PART 1. DECLARATION

SITE NAME AND LOCATION

Carson River Mercury Site
Lyon, Storey and Churchill County, Nevada

STATEMENT AND PURPOSE

This Record of Decision ("ROD") presents the selected remedial action for Operable Unit 1 ("OU-1") of the Carson River Mercury Site ("CRMS") which is located in Lyon, Storey and Churchill Counties, Nevada. This document was developed in accordance with Comprehensive Environmental Response, Compensation, and Liability Act of 1980 ("CERCLA") as amended by the Superfund Amendments and Reauthorization Act of 1986 ("SARA"), 42 U.S.C. Section 9601 et seq., and in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan, 40 C.F.R. Section 300 et seq., ("NCP"). This decision is based on the administrative record for this operable unit.

In a letter to EPA dated March 29, 1995, the State of Nevada, through the Nevada Division of Environmental Protection (NDEP) concurred with the selected remedy for this operable unit of the CRMS.

ASSESSMENT OF THE SITE

Actual or threatened release of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE REMEDY

The remedial action objective for OU-1 of the CRMS is 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. There are six areas which are considered actionable based on this cleanup objective: five residential yards and one ditch ("Dayton Ditch").

The selected remedy for the five residential yards is to excavate contaminated surface soil (estimated to go to a depth of approximately 2 feet below ground surface), dispose of the soil at a RCRA municipal landfill if the soils do not exceed the TCLP standards, and restore the excavated areas. Approximately 5000 cubic yards of soil will be excavated and disposed of as part of this response action. If it is determined that all or part of the excavated soil exceeds the TCLP standards, then the excavated soil will either be treated and disposed of at a RCRA municipal landfill or disposed of at a RCRA hazardous waste landfill. Which of these sub-alternatives that will be used will depend on which sub-alternative is found to be more cost effective and the logistics of implementing each sub-alternative.

The selected remedy for the Dayton Ditch is no action. EPA selected no action for the Dayton Ditch because the health risks for this area are not great enough to warrant response actions such as capping or excavation and the State of Nevada and the community expressed opposition to institutional controls (i.e., restricting access with a fence). Although EPA has selected no action for the Dayton Ditch, additional samples will be collected from the ditch during the remedial design to further evaluate the level of impact. In the event that EPA determines that some form of remediation is warranted, then EPA will document this remedy selection in an "Explanation of Significant Differences (ESD)" or ROD amendment, or the area will be addressed as part of OU-2.

The response actions for the residential yards address the incidental soil ingestion exposure pathway which was found to be of potential concern for populations near impacted areas. Also found to be an exposure pathway of potential concern is consumption of fish or waterfowl from the Carson River system. However, this remedial action is not attempting to address this pathway. Operable unit 2 of the remedial investigation and feasibility study ("RI/FS") will evaluate methods to reduce mercury concentrations in fish and waterfowl.

The major components of the selected remedy include:

- Excavation of approximately 5000 cubic yards of contaminated soils, 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; and

- 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."

This remedial action addresses a principal risk at the CRMS by removing contaminants from surface soil, thereby significantly reducing the toxicity, mobility or volume of hazardous substances in surface soil. This remedial action will reduce the possibility of human contact with mercury and thereby reduce the human health risks.

STATUTORY DECLARATION

The selected remedy is protective of human health and the environment, complies with federal State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable. However, because treatment of soils may not occur, this remedy may not satisfy the statutory preference for treatment as a principal element of the remedy. Because this remedy will result in hazardous substances remaining on-site above health-based levels, a five-year review, pursuant to CERCLA Section 121, 42 U.S.C. Section 9621, will be conducted at least once every five years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Keith Takata (signature) — 3-30-95

Keith Takata
Deputy Director,
Hazardous Waste Management Division

Date

PART 2. DECISION SUMMARY

This Decision Summary provides an overview of the problems posed by the Carson River Mercury Site ("CRMS" or the "Site"), the alternatives considered for addressing those problems which are within the scope of operable unit ("OU-1"), and presents the analysis of the remediation alternatives. This Decision Summary also provides the rationale for the remedy selection and describes how the selected remedy satisfies the statutory requirements.

1.0 SITE DESCRIPTION

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 (Figure 1).

This Record of Decision ("ROD") calls for remedial action in Dayton and Silver City, Nevada. Both Dayton and Silver City are located in Lyon County.

1.2 SITE PHYSIOGRAPHY

The Carson River drainage basin drains approximately 3,980 square miles in east-central California and west-central Nevada. The Carson River heads in the eastern Sierra Nevada mountains south of Lake Tahoe and generally flows northeastward and eastward to the Carson Sink (Figure 1). The Carson River flows through a series of generally separate alluvial valleys from the headwaters area to the Carson Sink. In downstream order, the alluvial valleys passed by the river include Carson Valley, Eagle Valley, Dayton Plains, Stagecoach Valley, Churchill Valley, and Carson Desert (Figure 2). Between New Empire and Dayton the river flows through a narrow, high-gradient stretch along which large ore-processing mills were situated during the late 1800s. The flow of the river is interrupted west of Fallon by Lahontan Reservoir, which was constructed in 1915 as part of the Newlands Irrigation Project. Below Lahontan Dam, flow is routed through a complex network of ditches, drains,

CARSON RIVER MERCURY SITE
STUDY AREA
WEST CENTRAL NEVADA

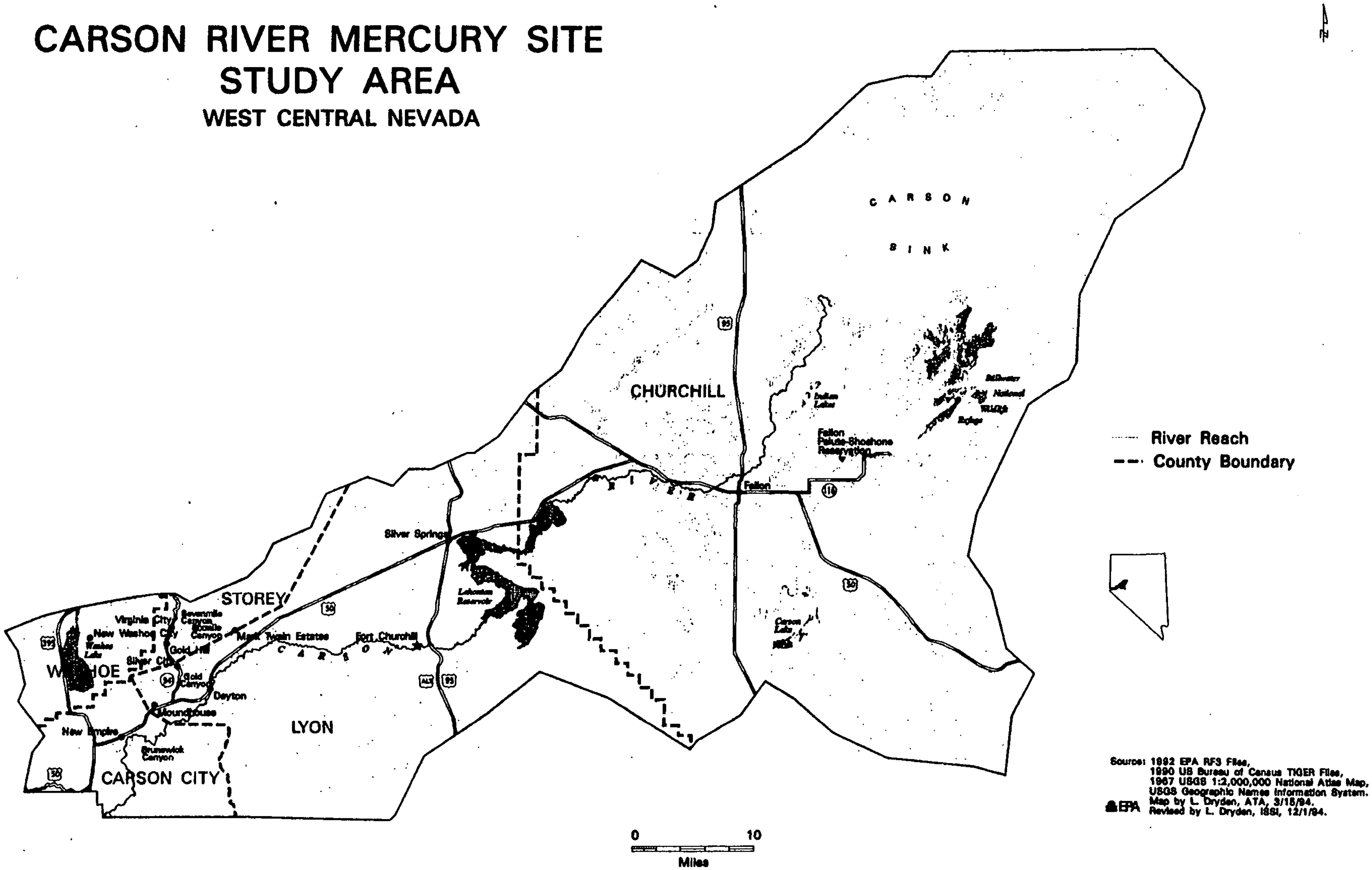


FIGURE 1

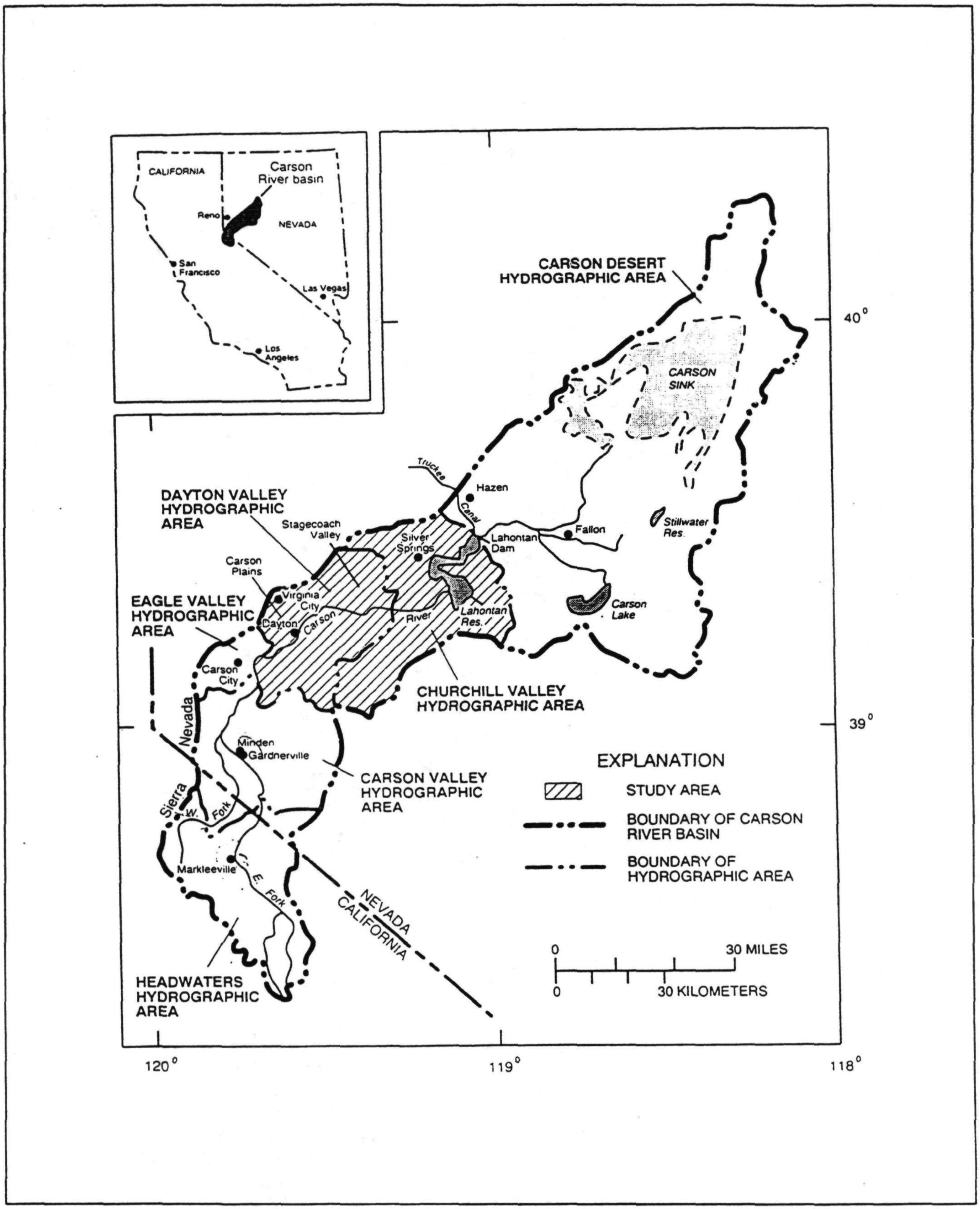


Figure 2: Carson River Basin Hydrographic Areas

and canals of the Newlands Irrigation Project. Irrigation return flow eventually discharges to Carson Lake, the Stillwater Wildlife Refuge, and/or the Carson Sink.

Stream flow in the Carson River above Lahontan Reservoir is highly seasonal. The major source of water for the Carson River is the winter snowpack in the Sierra Nevada mountains. Base flow is reached in late summer (August, September, and October) and flow then increases slightly through the fall and winter (November through March), until the snowmelt season starts in early spring. Maximum annual flow typically occurs in April, May and June.

The areal extent of water bodies and wetlands in the Carson Basin is highly variable, both seasonally and from year to year. This is especially true in the Carson Desert. For example, between July 1984 and February 1985, following three unusually wet years, the water surface area of the Carson Sink was approximately 200,000 acres (Rowe and Hoffman, in press), yet by April 1988 (during a second consecutive drought year) the sink was dry (Hoffman, 1988).

Washoe Valley lies between the Carson Mountain Range and the Virginia Mountain Range which separates Washoe Valley from the Carson Basin (see Figure 1). There are two water bodies in Washoe Valley, Washoe Lake and Little Washoe Lake. Most runoff in Washoe Valley drains the eastern slope of the Carson Range. Franktown and Ophir Creeks provide the bulk of the surface runoff that reaches Washoe and Little Washoe Lakes. Steamboat Creek, flowing from Washoe Valley, and Brown's Creek and Galena Creek, comprise the bulk of the surface water resources for Pleasant Valley.

1.3 CLIMATE

The climate of the region is dry due to the "rain shadow effect" created by the Sierra Nevada Mountains which form the western boundary of the region. Average annual precipitation throughout the Carson River drainage basin ranges from between 25 to 50 inches in the headwaters area in the Sierra Nevada Mountains to between 4 and 5 inches near Lahontan Reservoir and Carson Desert (Twiss et. al., 1971).

1.4 DEMOGRAPHICS

The Carson River Mercury Site intersects Lyon County, Storey County, Churchill County, and Washoe County. According to the 1990 census taken by the Department of Commerce, U.S. Bureau of the Census, the population of the counties which are intersected by CRMS are as follows: Lyon County (population 20,001), Storey County (population 2,526), Churchill County (population 17,938), and the South Valley of Washoe County (population 4,596). Additional demographic information is provided in Section 5.0.

1.5 LAND USE

Historical land use in the Carson River basin was mostly agriculture and mining in the 1840s and '50s. The mining industry and population in the basin fell rapidly in the 1880s; however, railroad access to other markets helped promote ranching and farming. Another change in land use was an increase in irrigated acreage in the Carson Desert prompted by the impoundment of Lahontan Reservoir in 1915 and the creation of the Newlands Irrigation Project. Alfalfa is the principal irrigated crop, in terms of acreage and revenue, in the Newlands Irrigation Project. The estimated irrigated acreage ranged from 61,000 to 67,000 acres for the Newlands Project during 1980-87 (U.S. Bureau of Reclamation, 1980). Dayton and Churchill Valleys, which have the smallest populations in the Nevada portion of the Carson basin, are primarily rangeland, with agricultural areas along the Carson River. Land use and population remained relatively unchanged in the Carson River basin from 1890 until 1950, with the advent of suburban development. Since 1950, Carson City, Fallon, and rural populations have grown considerably with most of the urban and suburban development occurring on land that was previously used for agriculture (either irrigated cropland or rangeland). Presently, the local economy and urban land use are dominated by the retail trade and service sectors, primarily casinos and adjunct businesses such as hotels, motels, and restaurants that cater to tourists (Nevada Commission on Economic Development, 1985).

1.6 WATER USE

Major water bodies in the Carson basin include the Carson River, Lahontan Reservoir, Carson Lake, the Stillwater National Wildlife Refuge, and temporary lakes, reservoirs, and alkali flats in the Carson Desert. Lahontan Reservoir is the main storage reservoir for the Truckee Carson Irrigation District (TCID). Uses of surface water include: (1) agriculture irrigation; (2) maintenance of waterfowl and fishery habitats; (3) recreational use by the public such as hunting, fishing, birdwatching, swimming, and camping; and (4) to a limited extent, municipal and light-industrial purposes. Public drinking water systems are only supplied by aquifers and not by the Carson River.

In Washoe Valley there are two water bodies, Little Washoe Lake and Washoe Lake. Little Washoe Lake is used primarily for recreation . Big Washoe Lake is an intermittent lake which provides waterfowl and fishery habitats when it contains water, and provides recreational use for the public. Public drinking water systems are only supplied by aquifers and not directly by the lakes in Washoe Valley.

2.0 SITE HISTORY

2.1 SITE BACKGROUND

Mining in the Carson River drainage basin commenced in 1850 when placer gold deposits were discovered near Dayton at the mouth of Gold Canyon. Throughout the 1850s, mining consisted of working placer deposits for gold in Gold Canyon and Sixmile Canyon. These ore deposits became known as the Comstock Lode.

The initial ore discovered was extremely rich in gold and silver; gold was more abundant in Gold Canyon while silver was more abundant in Sixmile Canyon (Smith, 1943). The early mining methods concentrated on exposing as much of the lode as was possible in wide trenches. Throughout 1859, ore was shipped to San Francisco for processing. After local ore processing began in 1860, most major mines operated their own mills, but there were also a large number of private mills. Initial ore processing techniques were slow and inefficient and a fair amount of trial and error experimenting went into the development of an effective ore-processing technique. Refinements were aimed primarily at increasing the speed of gold and silver recovery, increasing the percentage of gold and silver recovered, and decreasing the amount of gold and silver discarded in tailings piles. The general milling process employed before 1900 involved pulverizing ore with stamp mills, creating a slurry, and adding mercury to the mixture. The mercury forms an amalgam with the precious metals which is then separated from the solution and retorted. After 1900, cyanide leaching and flotation processes replaced amalgamation.

Gold and silver production from the Comstock Lode increased slowly during the early years and 1863 was the first year of large production. Throughout the remainder of the 1860s and most of the 1870s, production remained high as rich ore bodies continued to be discovered at progressively deeper depths. The bottom of the lode was abruptly reached in 1877 at a depth of about 1,650 feet, and 1878 was the first year of dramatically reduced production. Between 1877 and 1878, ore production dropped from 562,519 tons to 272,909 tons and the total value decreased from $36,301,536 to $19,661,394. In 1879, production and value dropped even further. In 1901, the first cyanide-leaching operation began in Sixmile Canyon. Cyanide leaching was capable of recovering more gold and silver from lower-grade material than was possible by amalgamation methods, and during the early 1900s mining operations consisted of mining lower-grade material and reworking former ore dumps and tailings piles. Between approximately 1920 and 1950, large tonnages of low-grade ores were mined (Bonham, 1969). Since approximately 1950, mining operations have been extremely limited in scope. Currently, two mining operations are located within the Sixmile Canyon drainage.

2.2 HISTORY OF SITE INVESTIGATIONS

Elevated mercury levels in the Carson River drainage basin were discovered in the early 1970s when sampling conducted by the U.S. Geological Survey (USGS) revealed elevated levels in river sediment and unfiltered surface water from the Carson River downstream from pre-1900 ore milling sites (Van Denburgh, 1973). Subsequent studies by a number of investigators (Richins, 1973; Richins and Risser, 1975; Cooper, 1983; Cooper et. al., 1985; Hoffman et. al., 1990) have further delineated the extent of mercury in river and lake sediment and water. Based largely on the information presented in these studies, the Carson River below New Empire was added to the National Priorities List (NPL) in August, 1990 due to the widespread occurrence of mercury.

3.0 ENFORCEMENT ACTIONS

Enforcement activities at the CRMS have included issuing orders for the removal of mercury contaminated tailing piles which were found to pose imminent and substantial health risks and conducting a comprehensive investigation of potentially responsible parties (PRPs).

In November, 1990, mercury laden tailings located five miles east of Dayton and adjacent to U.S. Highway 50 were excavated and treated in response to an order issued by EPA. The Respondents addressed the contamination by excavating ostensible tailings and taking the material to the Flowery Mine heap leaching facility for treatment by cyanidation.

In August, 1992, mercury laden tailings located in Dayton, Nevada were excavated and treated in response to an order issued by EPA. For the area bounded by U.S. Highway 50 on the east, Douglas Street to the north, and River Road to the west, the Respondents were ordered to prevent exposure to soil with mercury concentrations greater that 25 ppm. The Respondents addressed the contamination by excavating contaminated soil, backfilling with clean soil, and taking the contaminated soil to the Flowery Mine heap leaching facility for treatment by cyanidation.

As part of the RI/FS, EPA conducted a comprehensive investigation of potentially responsible parties ("PRPs") for the CRMS. This PRP search included historical research to determine the locations of Comstock mills, to develop chain-of-titles for the mills, and to develop general information regarding the operation of the mills. This information was then used to identify PRPs for the CRMS as well as to direct OU-1 field investigations. The findings of the PRP search included maps which describe the locations of 143 historic millsites, identification of 213 entities who had significant involvement with the Comstock Lode, identification of possible corporate successors of historic milling companies, and identification of 300 current land owners.

The identification of corporate successors of historic milling companies is a complex process and EPA's investigation is not yet complete. Accordingly to date, EPA has not yet determined whether any existing entities are actual corporate successors who would be PRPs at the CRMS.

4.0 COMMUNITY RELATIONS ACTIVITIES

There have been extensive community relations activities throughout the course of this project. Community relations activities for the CRMS have included: setting up information repositories, issuing fact sheets to the affected communities (Dayton, Silver City, Virginia City, and Fallon), organizing a technical advisory committee ("TAC") made up of local representatives from various State and federal agencies, making contacts with editors of local newspapers, meeting with county officials, making presentations at county hearings, making presentations for professional organizations, conducting public meetings at the outset of the project and at the proposed plan stage, and speaking with local residents by phone or in person to request property access and to present sampling results. These community relations activities have provided for effective dissemination of information throughout the affected communities as well as for good feedback from the affected communities.

Information repositories were set up to provide public access to the reports used by EPA for developing a strategy for the RI/FS and to access reports produced by EPA (i.e., RI/FS). The locations of these information repositories are as follows:

- Nevada State Library and Archives
  401 N. Carson Street
  Carson City, Nevada 89710

- Dayton Valley Library
  Dayton, Nevada 89403

- Churchill County Library
  553 South Maine Street
  Fallon, Nevada 89406

Fact sheets were distributed to the members of the affected communities throughout the course of the project to provide the status of the project and to report important findings. The fact sheets issued to date are as follows:

- March 1991, EPA Begins Cleanup of Mercury Contamination;

- August 1991, EPA Update on the Carson River Mercury Site;

- September 1992, Carson River Mercury Investigation Continues: Surveying and

Mapping of Millsites;

- March 1993, EPA to Begin Field Sampling;
- November 1994, EPA Announces Sampling Results; and
- December 1994, EPA Announces Proposed Plan for Soil.

To date, EPA has conducted two series of public meetings for the CRMS project. The purpose for the first series of public meetings was to explain why the region was declared a Superfund site, to describe the Superfund process, and to present EPA's strategy for conducting the RI/FS. This presentation was made in Carson City, Dayton, and Fallon, Nevada on March 24, 25, and 26, 1992, respectively. The purpose for the second series of public meetings was to present the proposed plan for OU-1. This presentation was made in Dayton and Silver City, Nevada on January 18 and 19, 1995, respectively.

5.0 SCOPE AND ROLE OF THE RESPONSE ACTION

5.1 SCOPE OF THE RESPONSE ACTION

The remedy selected for OU-1 of the CRMS addresses human health risks associated with direct exposure to surface soil with elevated mercury levels. It is not within the scope of this response action to address human health and ecological risks associated with mercury in the Carson River system. Although the human health risks associated with consumption of fish and waterfowl from the Carson River system were assessed in the risk assessment for OU-1, response actions to reduce mercury concentrations in fish, waterfowl and other biota will be evaluated in the RI/FS for OU-2. Thus, the remedy selected for OU-1 is only intended to reduce direct exposure to mercury contaminated surface soils and not to protect surface water.

The remedial action objective for OU-1 is to address residential areas where mercury in surface soils is equal to or greater than 80 milligrams per kilogram (mg/kg). There are five areas in Dayton and one area in Silver City, Nevada where mercury levels in surface soil exceed this level. These six areas include five residential yards and one ditch ("Dayton Ditch").

The selected remedy for the five residential yards is to excavate surface soil (estimated to go to a depth of approximately 2 feet below ground surface), dispose of the soil at a RCRA municipal landfill if the soils do not exceed TCLP standards, and restore the excavated areas. If it is determined that all or part of the excavated soil exceed TCLP standards, then the excavated soil will either be treated and disposed of at a RCRA municipal landfill or disposed of at a RCRA hazardous waste landfill. Which of these sub-alternatives to be used will depend on which sub-alternative is found to be more cost effective and the logistics of implementing each sub-alternative. Approximately 5000 cubic yards of soil will be excavated and disposed of as part of this response action.

The selected remedy for the Dayton Ditch is no action. EPA selected no action for the Dayton Ditch because the health risks for this area are not great enough to warrant response actions such as excavation or capping and the State of Nevada and the community do not support addressing the area with institutional controls (i.e., restricting access with a fence). Although EPA has selected no action for the Dayton Ditch, additional samples will be collected from the ditch during the remedial design to further evaluate the level of impact. In the event that EPA determines that some form of remediation is warranted, then EPA will document this remedy selection in an "Explanation of Significant Differences (ESD)" for this ROD or the area will be addressed as part of OU-2.

5.2 ROLE OF THE RESPONSE ACTION

The human health risks assessment established that the exposure pathways of potential concern for the CRMS are: (1) consumption of fish or waterfowl from the Carson River system and (2) incidental ingestion of contaminated soil. The role of the selected remedy is to reduce human health risks by reducing exposure via incidental ingestion of contaminated surface soil. Based on the human health risk assessment, this pathway is found to be of potential concern where surface soils contain mercury at levels equal to or greater than 80 mg/kg.

6.0 SUMMARY OF SITE CHARACTERISTICS

6.1 SOURCES

Sources of mercury in the Carson drainage basin and Washoe Valley include mercury imported during the Comstock era and, possibly, naturally occurring mercury. There is insufficient information to characterize the full extent and significance of naturally occurring mercury in the Carson drainage basin and Washoe Valley. However, according to reports which characterize the geology of the Carson River drainage basin (Thompson, 1956; Bonham, 1969; and Moore, 1969), naturally occurring deposits of mercury of economic importance do not exist in the basin. Less significant natural occurrences of mercury can be associated with mineralized zones and hot springs deposits. Although it is possible that there are such natural occurrences of mercury in the region, such sources are not considered important relative to the large amount of mercury imported to the region during the Comstock era.

Mercury imported to the region during the Comstock era was purchased by mills for processing gold and silver ore. These mills employed various processes to amalgamate gold and silver. All of these processes included pulverizing the ore with stamps; creating an amalgam by mixing the crushed ore, salt, and elemental mercury into a slurry; separating the impregnated amalgam; and, finally, separating the gold and silver from the mercury with a retort. It is estimated that 186 such mills operated during the Comstock era (Ansari, 1989).

6.2 RELEASE MECHANISMS FROM SOURCES

The most widely used ore-processing method during the Comstock era was the "Washoe Process" (Smith, 1943). With this process, the raw ore is wet crushed with stamps, the crushed ore is separated from the slurry in a settling tank and then the crushed ore is charged with mercury (approximately 10 percent of the weight of the ore) (Smith, 1943)) in the amalgamation pan. The amalgam is separated from the slurry and the silver and gold is separated from the amalgam with a retort. It is thought that the majority of the mercury released to the environment was associated with tailings which were separated from the amalgam slurry and discharged into the drainage. Other possible release mechanisms would have included air emissions from the retort, fugitive air emissions throughout the process, and spilling throughout the process where mercury was handled. It is estimated that the loss of mercury exceeded 1 pound for each ton of ore milled which translates to approximately 14,000,000 pounds of mercury (Smith, 1943).

6.3 TRANSPORT MECHANISMS

Potential migration pathways for mercury through the CRMS include surface water, groundwater, soil, and air. Transport mechanisms are as follows:

- fluvial transport of mercury laden sediment and soil,
- fluvial transport of dissolved mercury,
- air transport of particulate mercury,
- air transport of volatile mercury, and
- percolation of elemental mercury and/or amalgam.

Fluvial transport is considered the most important mechanism for distributing mercury throughout the Carson Drainage and Washoe Valley. This is because mill tailings are considered the most significant release mechanism and this material is easily transported by fluvial processes. Eolian transport mechanisms may also account for the widespread dispersion of mercury in the region. The fate and transport of gaseous mercury emissions to the atmosphere is not well defined, however, it is believed that gaseous mercury was released to the environment from mills while operating and that mercury evasion is presently occurring. Also included as a transport mechanism is percolation which refers to the vertical movement of mercury through the subsurface. This transport mechanism would account for the vertical movement of elemental mercury or amalgam that was released to the environment.

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).

7.0 SUMMARY OF REMEDIAL INVESTIGATION

The objectives of this phase of the remedial investigation are as follows:

- identify the contaminants of potential concern (COPC),
- develop data for the human health risk assessment (i.e., estimate exposure point concentrations for potentially complete exposure pathways), and
- characterize mercury levels at and around historic millsites.

The remedial investigation activities associated with each of these objectives are described herein.

7.1 IDENTIFY CONTAMINANTS OF POTENTIAL CONCERN

In order to determine if other trace metals occur at levels of concern, approximately 10% of the soil samples (119 samples) were analyzed for all of the trace metals included in EPA's "Target Analyte List (TAL)." Contaminants of potential concern were identified by a two step process. The first step compared the maximum detected concentration in surface soils with EPA's preliminary remediation goal (PRG). Those trace metals exceeding their respective PRG were retained for the second step which compared the arithmetic mean of the concentrations detected at historic millsites and extant tailing piles with the estimated background level for the trace metal. If this mean concentration exceeded the background level, then the trace metal was identified as a COPC. In addition to mercury, arsenic and lead were identified as COPCs by this process.

In assessing the hazards from mercury in a particular environment, it is not enough to know the form in which mercury entered that environment because various transformations can take place. The major forms of mercury which have been identified to date are methyl-mercury, elemental mercury, and mercuric mercury. As part of the effort to identify contaminants of potential concern, soil samples were analyzed to determine the species of mercury generally occurring in soil. These results determined that less than 10% of the total mercury in soils is mercuric chloride or soluble mercury and approximately 90% of the mercury is either mercuric sulfide or elemental mercury. Mercury occurring in fish and waterfowl was assumed to be 100% methyl mercury.

7.2 DEVELOP DATA FOR THE HUMAN HEALTH RISK ASSESSMENT

In order to assess human health risks, exposure point concentrations are determined for the potentially complete exposure pathways. The exposure point concentration is an estimate of the concentration of the COPC that is contacted via an exposure pathway (i.e., ingestion of soil) over a given period of time. In order to estimate exposure point concentrations, samples were collected from media potentially affected by mercury (i.e., soil, air and water) in areas where mercury contamination was suspected to occur. The majority of this environmental sampling was conducted in Dayton where it was assumed that there are the highest levels of mercury occurring in a populated area. This assumption was primarily based on the fact that there were several historic millsites located in and around Dayton. Also, because Dayton is located at the mouth of Gold Canyon and on the flood plain of the Carson River, tailings could be deposited in and around Dayton from other upgradient source areas. Samples were collected from soil, ground water, air, and domestic produce; and exposure point concentrations were derived from the arithmetic mean and the associated 95 percent upper confidence limit (95 UCL). If the data set was insufficient to calculate the 95 UCL, the maximum detected value was used as the exposure point concentration. In addition to the Dayton area, soil samples were also collected from Sixmile Canyon, Gold Canyon, the alluvial fan below Sixmile Canyon, the Carson River flood plain, the beach areas of Lahontan Reservoir, Washoe Lake, and Indian Lakes; and exposure point concentrations were derived to represent the level of contamination in these areas. Exposure point concentrations were also derived for muscle tissue from fish and waterfowl using data from Nevada Department of Wildlife, Nevada Division of Environmental Protection, and United States Fish and Wildlife Service.

The results of this sampling were used to assess the human health risks for the entire study area and establish a mercury action level for surface soil. The human health risk assessment is discussed in Section 8, Summary of Site Risks. The site specific action level born out of this risk assessment is 80 mg/kg. This action level identies a soil level that would create a dose for a child (age 1 - 6) equivalent to the oral reference dose (RfD) for inorganic mercury. This action level takes into account the species of mercury generally found in the soil matrix (see Section 7.1) and the bioavailability of those species. The bioavailability factor which was used to derive the site specific action level for mercury is presented in Section 8.1, Exposure Assessment.

7.3 CHARACTERIZE AND ASSESS HISTORIC MILLSITES

Among the areas where mercury was thought to occur, it was assumed that the highest levels of mercury would occur at and around historic millsites and extant tailing piles. The basis for this assumption is that there would be minimal dilution caused by transport. Thus, the remedial investigation included an exhaustive research effort to identify the Comstock mills and map the millsites. Out of this research, the location of 131 mills were identified and the area of these millsites were mapped (Figure 3). At each of the millsites, 5 to 25 surface soil samples were collected to evaluate if levels of mercury, arsenic, and lead were significant. Although subsurface soil was also sampled at millsites, the main objective was to evaluate whether incidental ingestion of surface soil was an exposure pathway of concern at the millsites. Surface soil samples were collected at locations where mercury was thought likely to occur (i.e., tailing piles, tailing ponds, ruins, etc.,).

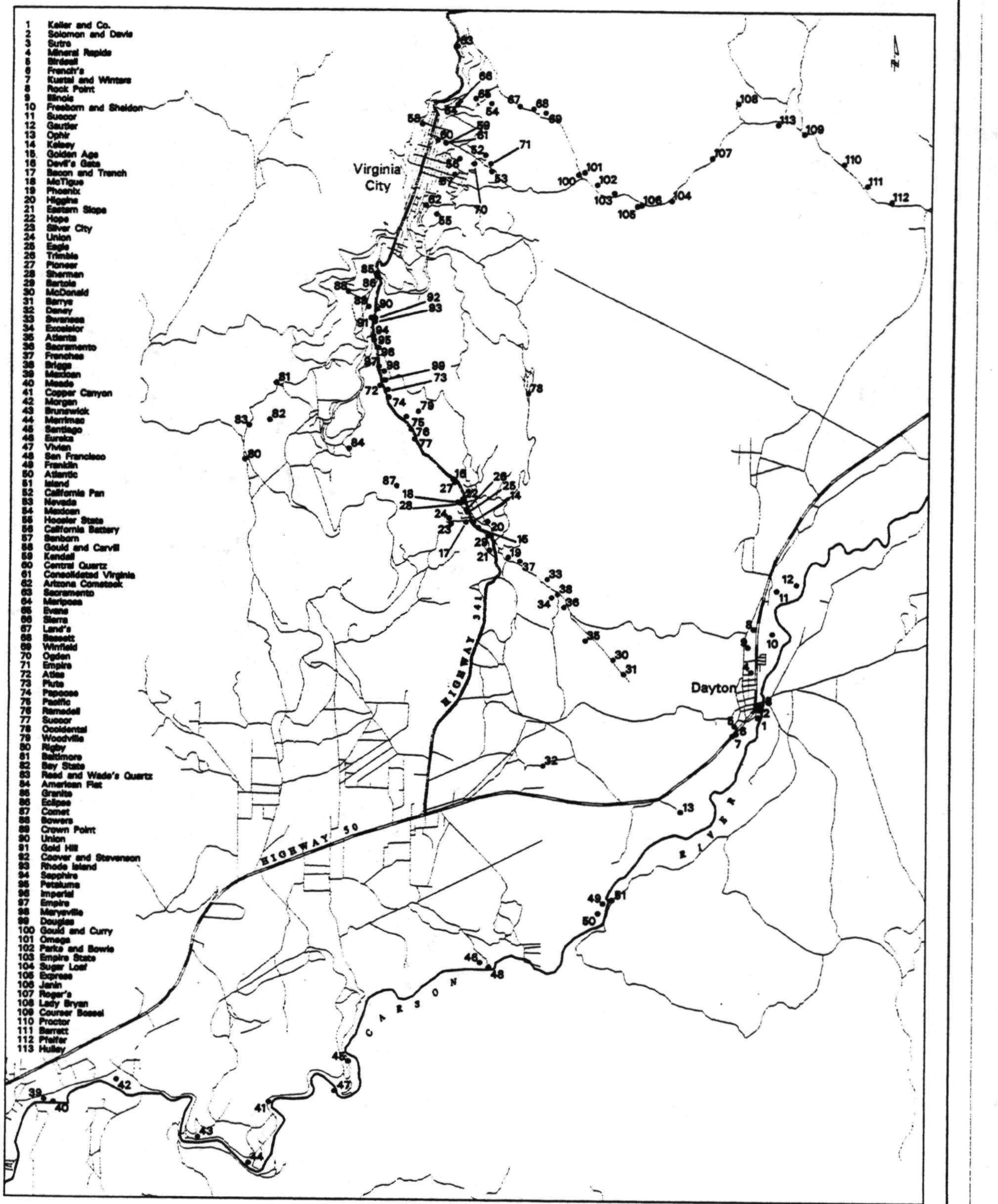
The significance of mercury contamination was evaluated by comparing mercury levels with EPA's site specific Preliminary Remediation Goal (PRG) for soil which is 25 mg/kg. Sampling areas where there were no sample results greater than or equal to 25 ppm were screened out of further evaluation. Sampling areas where there were more than two sampling locations equal to or greater than 25 ppm were evaluated by defining a subarea with the sampling results equal to or greater than 25 ppm and determine the arithmetic mean using the data included in this subarea. Subareas were not defined for sampling areas where there was only one or two samples equal to or greater than 25 ppm, unless the sample(s) could be grouped with an adjacent subarea. Also, if two adjacent samples were equal to or greater than 25 ppm, a line between the two points was buffered to create a subarea. Using the site specific action level of 80 mg/kg, these areas were assessed. Through this process, 6 subareas of potential concern were identified and are described in Figures 5 and 6.

8.0 SUMMARY OF SITE RISKS

The data from the remedial investigation was used to assess human health risk following the procedures described in the Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A), Interim Final, EPA/540/1-89/002, December 1989 ("RAGS").

8.1 EXPOSURE ASSESSMENT

The purpose for the exposure assessment is to characterize and evaluate the significance of potentially complete exposure pathways. A complete exposure pathway includes the following four elements: 1) a source and mechanism of chemical release, 2) retention or transport medium, 3) a point of human contact or exposure point, and 4) an exposure route (i.e., ingestion, inhalation, or dermal contact) at the contact point. Exposure pathways that were evaluated for the COPCs are described in Table.1.



HISTORIC COMSTOCK MILL LOCATIONS

STOREY - LYON COUNTY, NEVADA

Source: Piedmont Engineering, 1993;
1990 US Bureau of Census TIGER Files.
EPA Map by L. Dryden, ATA, 3/15/94.

0 — 2
Miles

General Area
- Dayton
- Silver City
- Gold Canyon
- Carson River
- Virginia City
- Gold Hill
- American Flat
- Sixmile Canyon

FIGURE 3

ACTIONABLE AREAS
DAYTON

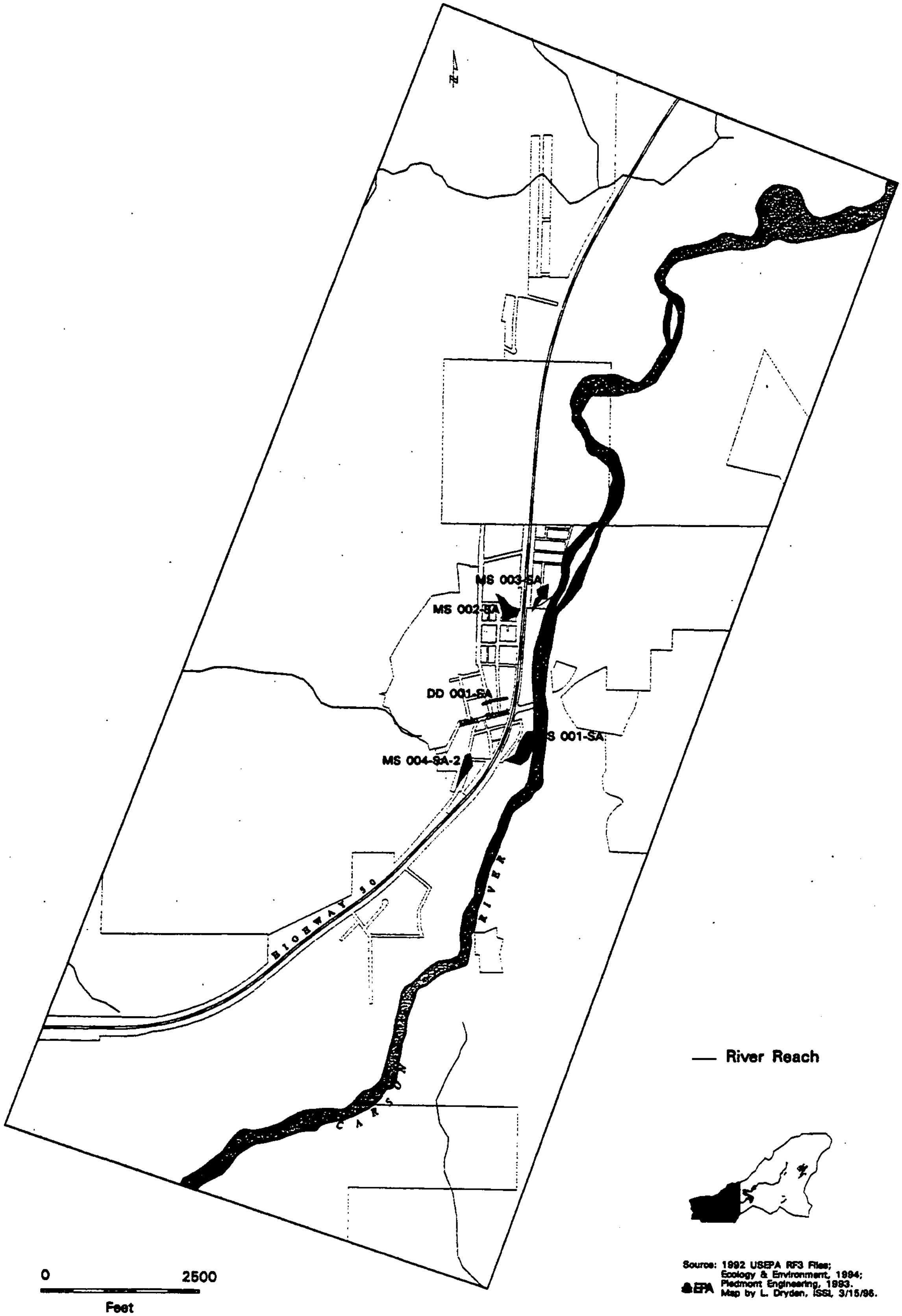
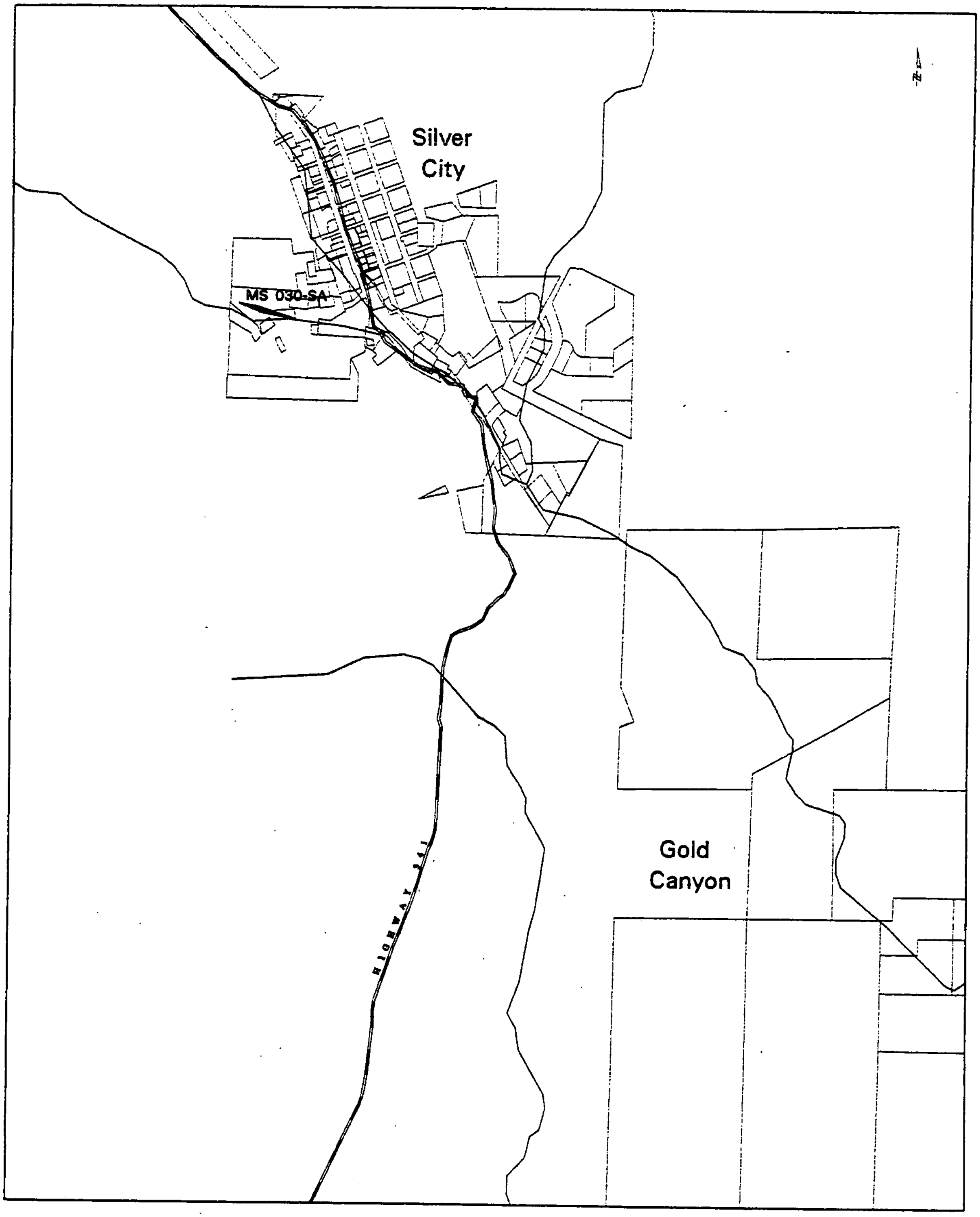
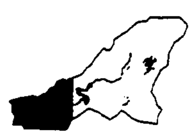


FIGURE 4



ACTIONABLE AREA
SILVER CITY



0 2000
Feet

— River Reach

Source: 1992 USEPA RF3 Files;
Ecology & Environment, 1994;
Piedmont Engineering, 1993.
EPA Map by L. Dryden, ISSI, 3/15/96.

FIGURE 5

TABLE 1: Exposure Pathways Evaluated for the Contaminants of Potential Concern			
Exposure Pathway	**Contaminant of Potential Concern**		
	Mercury	**Arsenic**	**Lead**
Incidental soil ingestion	yes	yes	yes
Incidental sediment ingestion	yes	yes	no
Incidental surface water ingestion	yes	yes	no
Ground water ingestion	yes	yes	yes
Fish consumption	yes	no	no
Waterfowl consumption	yes	no	no
Air inhalation	yes	yes	yes

Ingestion of ground water, surface water and sediment were screened out of the exposure assessment because the COPCs were detected at relatively low levels in these media. The other exposure pathways were evaluated by estimating the chronic daily intake (CDI) of the COPCs for each pathway. The CDI is determined by multiplying the exposure point concentration by the intake factor for that medium.

The estimated CDI of mercury and arsenic via incidental soil ingestion was adjusted to reflect the degree to which metal species are available for absorption following ingestion. The estimated CDI of mercury via incidental soil ingestion was multiplied by 0.28 to reflect the degree to which mercury species are available for absorption following ingestion. Based on mercury species data developed for the CRMS, it was assumed that approximately 90% of the mercury in soil is mercuric sulfide (HgS) and 10% is mercuric chloride ($HgCl_2$). This was considered a conservative assumption given that the mercuric chloride component was generally less than 10%. Using 15% as the oral absorption value for mercuric chloride and 3% for mercuric sulfide, an oral absorption factor of 0.28 was derived ((3/15 x 0.90) + (15/15 x 0.10) = 0.28). The estimated CDI of arsenic via incidental soil ingestion was multiplied by 0.80 to reflect the degree to which arsenic is assumed to be available for absorption.

8.2 TOXICITY ASSESSMENT

The toxicity assessment weighs available evidence regarding the potential for particular chemicals to cause adverse effects in exposed individuals (weight-of-evidence), and quantitatively characterizes the relationship between the extent of exposure to an agent and the increase likelihood and/or severity of adverse effects (dose-response assessment).

The toxicity assessment evaluates noncancer effects using reference doses (RfD) as numeric indicators of toxicity. The RfD is an estimate (with uncertainty spanning perhaps an order of magnitude or greater) of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime. The oral RfD which was used to evaluate exposure via ingestion to both inorganic and organic mercury is 0.3 ug/kg-day. Because there is an ongoing debate as to whether the RfD for methyl mercury is sufficiently health protective for unborn or young children in critical stages of development, this RfD was not used to evaluate exposure via fish consumption for children and pregnant or nursing mothers. The reference concentration (RfC) used to evaluate exposure to mercury via inhalation is 0.3 ug/m^3. The oral RfD which was used to evaluate exposure to arsenic via ingestion is 0.3 ug/kg-day. The RfDs and RfC were obtained from the Integrated Risk Information System (IRIS) updated through June 1993 and the Health Effects Assessment Summary Tables (HEAST) updated through March 1993.

EPA withdrew the established RfD for lead in 1989. This was done because 1) there is not a discernible threshold for health effects related to lead exposure and 2) there are numerous environmental sources of lead which have to be considered in estimating lead exposure. In lieu of the RfD, it was determined that blood levels, which can be correlated with toxic effects, provide the best index for evaluating lead exposure. The blood lead "level of concern" is 10 ug/dL.

The toxicity assessment evaluates cancer effects based on the assumption that cancer can occur at any exposure level ("no-threshold"). EPA use the linear multistage model for extrapolating cancer risks from high dose levels, where cancer responses can be measured, to relatively low dose levels, which are of concern in the environment. This dose-response extrapolation is known as a cancer slope factor (CSF) which is used to estimate lifetime cancer risks associated with chronic low-level exposures to contaminants. The CSFs were also obtained from the Integrated Risk Information System (IRIS) updated through June 1993 and the Health Effects Assessment Summary Tables (HEAST) updated through March 1993.

8.3 RISK CHARACTERIZATION

Risk characterization combines the exposure and toxicity assessments to produce quantitative estimates of risk from the chemicals of potential concern. EPA evaluated the noncancer and cancer health risks associated with each of the complete exposure pathways.

Estimates of noncancer health risks are calculated by dividing the estimated chemical-specific CDI (ug/kg-day) by the respective RfD (ug/kg-day). This ratio is referred to as a "Hazard Quotient (HQ = CDI/RfD)." The sum of HQs for multiple chemicals and pathways is the "Hazard Index (HI)." EPA suggests that a HI greater than one indicates that the associated exposure scenario has a potential to result in adverse noncancer health effects and additional evaluation may be necessary. Although the potential for adverse health effects increases as the HI value increases, the level of concern does not increase linearly. This is because RfDs do not have equal accuracy or precision and are not based on the same severity of toxic effects.

Noncancer health risks associated with lead are quantitatively characterized with the EPA Lead Uptake/Biokinetic Model, Version 0.5 ("UBK Model"). The UBK model was designed to estimate the blood lead levels in children 0 to 6 years of age, based on multi-media lead exposures. The model accounts for the potential environmental and maternal sources of lead (air, diet, drinking water, dust, soil, and the lead concentration in the mother's blood during gestation) for which numerous fundamental assumptions are used.

Cancer risks which are described as the incremental probability that an individual will develop cancer in their lifetime are estimated by multiplying the estimated chemical-specific CDI by the respective cancer slope factor (CSF). The cancer risk range of 10^{-4} to 10^{-6} is established as generally acceptable by EPA. In other words, the probability that one additional person out of 10,000 to 1,000,000 could develop cancer as a result of their exposure is considered an acceptable risk.

The estimated HIs and probability of cancer risks are summarized in Tables 2 through 6.

8.4 UNCERTAINTY ASSESSMENT

It must be recognized that the assessment of cancer risks and noncancer hazards by available (generally indirect) methods can provide only crude estimates of risk and this should be borne in mind in making regulatory decisions about permissible exposure concentrations in environmental media.

EPA evaluated the uncertainty of the risk assessment and identified elements of the risk assessment that would tend to overestimate or underestimate potential exposure and risk to individuals within the study area. Risk uncertainties specific to this HHRA are summarized in Table 7.

TABLE 2: Estimated Hazard Indices for Individuals Living On or Adjacent to Impacted Areas			
Exposure Pathway	**Contaminant**	**Typical Estimate[1]**	**High-end Estimate[2]**
Soil Ingestion[3]	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. Typical estimate is for an adult.
2. High-end estimate is for a young child (<6 years).
3. Chronic daily intake (CDI) was estimated based on mercury levels measured in surface soil at the MS004 sample area in Dayton.

TABLE 3: Estimated Hazard Indices for Recreational Land Use In and Around Impacted Areas			
Exposure Pathway	**Contaminant**	**Typical Estimate[1]**	**High-end Estimate**
Soil Ingestion[2]	Mercury	0.01	0.24
	Arsenic	0.002	0.10
Dust and/or Vapor Inhalation	Mercury	0.002	0.016
	Arsenic	0.00003	0.0003
Hazard Index		0.01	0.36

1. Both the typical and high-end estimates are for a school age child (7 - 18 years of age).
2. Chronic daily intake (CDI) was estimated based on mercury levels measured in surface soil
   at the TP007 sample area in Sixmile Canyon.

TABLE 4: Estimated Hazard Indices for Consumption of Fish and Waterfowl			
Indicator Species/Location	**Contaminant**	**Typical Estimate[1]**	**High-end Estimate**
White Bass/Carson River Above Lahontan	Mercury	3.5	6.5
Walleye/Lahontan Reservoir	Mercury	2.6	4.9
White Bass/Carson River Below Lahontan	Mercury	1.1	2.1
White Bass/Indian Lakes	Mercury	2.2	4.1
White Bass/Washoe Lake	Mercury	0.6	1.2
Shovelers/Carson Lake	Mercury	1.4	2.0
Shovelers/Stillwater	Mercury	0.5	0.8
Mallards/Carson Lake	Mercury	0.3	0.6
Mallards/Stillwater	Mercury	0.2	0.5
1. Both typical and high-end estimates are for an adult.			

TABLE 5: Potential Cancer Risks for Individuals Living On or Adjacent to Impacted Area			
Exposure Pathway	**Contaminant**	**Typical Estimate[1]**	**High-end Estimate**
Soil Ingestion[2]	Arsenic	3 E-6	4 E-5
Dust and/or Vapor Inhalation	Arsenic	1 E-6	4 E-6
Cancer Risk		4 E-6	4 E-5

1. Both the typical and high-end estimates are for an adult (life-time resident).
2. Chronic daily intake (CDI) was estimated based on arsenic levels measured in surface soil
in Dayton.

TABLE 6: Potential Cancer Risks for Recreational Landuse in Impacted Areas			
Exposure Pathway	**Contaminant**	**Typical Estimate**	**High-end Estimate**
Soil Ingestion[2]	Arsenic	4 E-8	1 E-5
Dust and/or Vapor Inhalation	Arsenic	2 E-8	2 E-7
Cancer Risk		6 E-8	1 E-5

1. Both the typical and high-end estimates are for a school-age child (7 - 18 years).
2. Chronic daily intake (CDI) was estimated based on arsenic levels measured in surface soil
in Sixmile Canyon.

TABLE.7: Summary of Site Specific Uncertainties Associated with Risk Estimates		
Uncertainty Factor	**Effect of Uncertainty**	**Comment**
Exposure point concentrations used for volatile mercury.	May over- or underestimate risk	Exposure point concentrations used for volatile mercury were derived from the method detection limit and were not actually measured. Therefore, levels of volatile mercury in indoor and ambient air may actually be more or less than the exposure point concentration.
Exposure point concentrations for mercury levels in surface soil on the alluvial fan.	May overestimate risk	Exposure point concentrations used to evaluate incidental ingestion of soil on the alluvial fan were derived from a data set which included samples from the area of transport where tailings from Sixmile Canyon are deposited. Current residential areas on the alluvial fan are north of the area of transport. Mercury levels measured in samples collected from current residential areas did not exceed 25 mg/kg.
Exposure point concentrations for mercury levels in surface soil on the flood plain.	May overestimate risk	Exposure point concentrations used to evaluate incidental ingestion of soil on the flood plain were derived from the highest concentrations detected on the flood plain. The 95 UCL for all of the samples collected from the flood plain (18.20 mg/kg) is a factor of 20 less than the value used to estimate the high-end risks for this scenario.
Use of an indicator species to estimate mercury exposure associated with consumption of fish and waterfowl.	May overestimate risk	To the extent that the actual diets include lesser contaminated fish and waterfowl, the indicator species approach used in this HHRA is likely to overestimate exposures.
Arsenic which was identified in tailings and at historic millsites was not measured in fruit and vegetables.	May underestimate risk	Arsenic can also be taken up by plants.
Cancer slope factors for arsenic	May overestimate risks	Slope factors are based on a 95th percent UCL derived from a linearized model. Considered unlikely to underestimate risks.
Cancer risk estimates assume there is no threshold.	May overestimate risks	Possibility that some threshold exists.
Reference doses (RfDs) for mercuric mercury are derived from animal studies.	May over- or underestimate risks	Extrapolation from an animal to human may induce error because of differences in absorption, pharmacokinetics, target organs, enzymes, and population variability.

8.5 ECOLOGICAL RISK ASSESSMENT

The ecological assessment for the CRMS is presently ongoing and the results of this study will be presented in the remedial investigation report for OU-2. The focus of this study is to assess the severity of ecological risks and impacts associated with mercury in the Carson River system. Mercury is unique among metals in its tendency to bioaccumulate and biomagnify in higher trophic levels. Bioaccumulation most readily occurs in aquatic environments where mercury is methylated and then either ingested or absorbed by aquatic organisms. This ecological assessment is most concerned with the diversity of wildlife which are supported by the Carson River watershed and are part of the aquatic food chain. In particular, the Lahontan Reservoir and wetland areas below Lahontan Dam provide significant habitat for large populations of migrating and resident water birds.

The outcome of this ecological assessment will be an understanding of how severely wildlife are impacted or threatened by the present levels of mercury in the Carson River system as well as an understanding of what factors regulate mercury cycling in the Carson River system. This information will provide the basis for evaluating methods to reduce mercury concentrations in fish, waterfowl, and other biota. If there is any evidence that current loading from point and diffuse sources will achieve this end, then further soil remediation may occur to reduce loading. At this time, the only remedial action objective is to reduce direct human exposure to mercury contaminated surface soil.

8.6 RISK ASSESSMENT CONCLUSIONS

The conclusions of the HHRA for the CRMS are as follows:

- The contaminants of potential concern (COPCs) for the CRMS are *mercury, arsenic* and *lead*. Mercury was imported to the region during the Comstock era (1859 - 1900) to process ore. Although mercury is also naturally occurring in the region, such sources are not considered important relative to the large amount of mercury imported to the region during the Comstock era. Arsenic and lead are naturally occurring trace metals in the region which were concentrated in the environment by natural and anthropogenic processes.

- The highest concentrations of the COPCs are found at and around historic millsites and extant tailing piles. The COPCs also occur in areas where discharged tailings and other eroded material from historic millsites have come to be deposited. These areas include: the alluvial fan below Sixmile Canyon, the flood plain of the Carson River below New Empire, the active channel of the Carson River below New Empire, Lahontan Reservoir, Carson Lake, Stillwater, Indian Lakes and Washoe Lake.

- Although the soil ingestion pathway is important for all of the COPCs, the significance of this pathway varies according to the land use (i.e., residential, occupational and recreational) and according to the concentration of the COPC in surface soil. For residential land use, mercury was detected in surface soil at levels which translate into a HI>1 for a young child (< 6 years of age). For recreational or open land use areas (i.e., Brunswick, Sixmile Canyon, Gold Canyon, Lahontan Reservoir, Indian Lakes, and Washoe Lake beach areas), none of the COPCs were found to occur in surface soil at levels which are considered significant for this exposure pathway.

- Inhalation of airborne contaminants does not appear to be an exposure pathway of concern for any of the COPCs irrespective of the land use scenario (HI<1).

- Ingestion of ground water does not appear to be an exposure pathway of concern for any of the COPCs.

- Incidental ingestion of surface water and sediment while swimming does not appear to be an exposure pathway of concern for any of the COPCs.

- Consumption of produce grown in contaminated soil was found to be a complete exposure pathway for mercury. However, this pathway does not appear to be of concern (HI<1).

- Individuals who consume fish or waterfowl from the Carson River system should be cautioned that the risks are proportional to the amount and type of fish and waterfowl consumed. Using an indicator species approach, typical HI estimates for selected indicator species were found to exceed 1 for the consumption of white bass from the Carson River above and below Lahontan Reservoir and Indian Lakes; and for consumption of walleye from Lahontan Reservoir. Also using an indicator species approach, typical HI estimates were found to exceed 1 for the consumption of shovelers from the Carson Lake area. Because fish and waterfowl from the Carson River system are contaminated with mercury, it is recommended that pregnant or nursing mothers and young children (< 6 years) not consume fish or waterfowl from this drainage.

9.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

This section presents the comparative analysis of the remediation alternatives considered to prevent incidental ingestion of surface soils where mercury levels in surface soil exceed 80 mg/kg in existing residential areas. This comparative analysis is a summary of the Feasibility Study Report for the Carson River Mercury Site prepared by Ecology and Environment, Inc., and dated December 20, 1994 ("FS"). The purpose for the FS was to identify, screen and evaluate remedial alternatives to achieve the remedial action objective for OU-1.

9.1 DESCRIPTION OF REMEDIATION ALTERNATIVES

The basic remediation alternatives which were considered in the FS are as follows:

- No Action
- Institutional Controls
- Capping
- Ex-situ stabilization
- In-situ stabilization
- Ex-situ treatment/Land Disposal

With exception for Alternative 1, the FS identified numerous methods and technologies for each of these alternatives. For example, as part of Alternative 5, eight different remediation technologies were identified for treating mercury contaminated soil. Different methods and technologies were also identified for institutional controls, capping, excavation, disposal, restoration, and containment. All of these technologies and methods were screened according to effectiveness, implementability, and cost in order to limit the number of alternatives which were further evaluated in the detailed analysis.

The alternatives that were retained through this screening process and were evaluated in the detailed analysis are as follows:

Alternative 1- No Action

The "No Action" alternative serves as a baseline for comparing other remedial alternatives. Under the this alternative, the areas of concern are neither addressed by engineering measures nor institutional controls. Thus, there are no costs associated with this alternative.

Alternative 2 - Institutional Controls

Institutional controls are measures to protect public health by controlling access to the areas of concern but not by physically addressing the impacted surface soils. The types of institutional controls that were considered for the current areas of concern include deed restrictions, posting signs, and erecting fences.

Alternative 3 - Capping

This alternative consists of paving over the surface soil to prevent exposure to the soil. As necessary, soil would be excavated to make space for paving, but as much soil as possible would be left in place. The excavated soil would be transported to an off-site landfill for disposal. Equipment required for excavation would include backhoes, loaders and hand tools.

Paving would consist of covering exposed soil with asphalt or concrete. In order to ensure the integrity of the cap, annual inspection of the paved areas would be required so that cracks and other breaks could be repaved. Site restoration would consist of replacing fences and other structures to the extent possible. However, trees and vegetation would not be replaced in the capped areas.

As part of this alternative, deed or construction restrictions might also be required to prevent disturbance of subsurface mercury remaining onsite, and/or to require health and safety measures for the protection of onsite workers and residents during any future subsurface construction. If such restrictions are necessary, then the specifics of the restrictions would be determined as part of the remedial design.

Alternative 4 - Excavation and Off-Site Land Disposal with or without Treatment

This alternative, which is the remedial alternative that EPA is selecting in the ROD, includes options for disposing of some or all of the contaminated soil at a municipal landfill, and ex-situ treatment if warranted by the total mercury levels at specific locations. Whether excavated soil will require treatment before disposal depends on whether these soils exceed the mercury standards for the toxicity characteristic leachate procedure (TCLP) set forth in 40 C.F.R. § 261.24[1]. If TCLP tests determine that certain portions of the excavated soils exceed the TCLP standards (0.2 mg/l), then those excavated soils which exceed the TCLP standard will receive ex-situ treatment before disposal at a RCRA municipal landfill or, alternatively, will be taken to a RCRA hazardous waste landfill. However, if the excavated soils do not exceed the TCLP standard, then excavated soils will be disposed of at a RCRA municipal landfill without treatment. Based on data developed as part of the remedial investigation, excavated soils are not expected to exceed the TCLP standard.

In the event that treatment is required before disposal at a municipal landfill, then this alternative sets forth performance standards for treatment in lieu of a specific treatment alternative. Thus, if treatment is found to be necessary, then any technology that meets the prescribed performance standards can be employed. The performance standards that would be applied to a treatment technology are set forth in the Nevada Bureau of Mining Regulation and Reclamation Guidance Document for Alternate Use of Mine Waste Solids-Disposal Outside of Containment, dated May 3, 1994. This

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[1] As discussed further in Section 8.2.2 below, EPA has determined that the wastes being remediated at the CRMS are exempt from the definition of hazardous waste under Section 3001(b)(3)(A)(ii), and 40 C.F.R. §261,4(b)(7), (the "Bevill amendment" provision). Nevertheless, EPA has determined that, based on certain guidance from the Nevada Bureau of Mining and on public health considerations, contaminated soils that exceed TCLP standards should not be disposed of in a municipal landfill without treatment.

document prescribes criteria for evaluating if material is acceptable for alternate uses. Based on the FS, the technologies that would most likely be used for treating contaminated soil are either gravity separation or a conventional mining technology (i.e., cyanidation).

In the event that the excavated soil does not exceed the TCLP standard, then this alternative involves excavation of surface soil, disposal at a municipal landfill, and restoration of excavated areas. Both alternatives involve excavation of contaminated surface soil (estimated to go to depth of approximately 2 feet below ground surface), and site restoration. Site restoration would involve returning the affected area to pre-excavation conditions which may include replacing fences, structures, and vegetation. Potential institutional controls would be the same as described for Alternative 3.

Long-term Sampling and Response Plan

With exception for Alternative 1, certain institutional controls were considered to be an additional part of each of the described alternatives. These institution controls, which will be known as the 'Long-term Sampling and Response Plan," are to manage impacted areas that will not be remediated as part of this operable unit. The FS did not evaluate remediation alternatives for impacted areas in Sixmile Canyon and adjacent to the Carson River between New Empire and Dayton because these areas do not pose health risks with the current land use (non-residential). In the event that residential development is proposed in these areas or other areas where mercury levels may exceed 80 mg/kg, then certain procedures described in the Long-term Sampling and Response Plan will be followed.

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, 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.

The Long-term Sampling and Response Plan Guidelines will be developed by EPA as part of the remedial design for this operable unit. The guidelines will be administered through NDEP's Bureau of Corrective Actions. However, development within the boundaries of the specified areas will be monitored through NDEP's Bureau of Water Pollution Control which reviews sewerage facility plans for new developments made up of five or more subdivisions. For smaller developments, the county planning offices will notify NDEP of proposed developments and NDEP will contact the developer. The Long-term Sampling and Response Plan does not provide for NDEP to enforce the implementation of the guidelines. Rather, NDEP will notify EPA of any recalcitrant parties and EPA will have the discretion of using the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Sections 104 and 106 authorities to enforce compliance with the guidelines..

9.2 DETAILED ANALYSIS OF ALTERNATIVES

This section provides an explanation of the criteria used to select the remedy, and the analyses of the remedial action alternatives in light of those criteria, highlighting the advantages and disadvantages of each of the alternatives.

9.2.1 CRITERIA

The alternatives were evaluated using nine criteria. These criteria, which are listed below, are derived from requirements contained in the National Contingency Plan (NCP), 40 C.F.R. § 300 et seq. and CERCLA Section 121(b) and 121(c).

Overall Protection of Human Health and the Environment - The assessment against this criterion describes how the alternative, as a whole, achieves and maintains protection of human health and the environment.

Compliance with ARARs - The assessment against this criterion describes how the alternative complies with ARARs as well as any advisories, criteria, and guidance that the lead and support agencies have agreed are "to be considered."

Long-term Effectiveness and Permanence - The assessment of alternatives against this criterion evaluates the long-term effectiveness of alternatives in maintaining protection of human health and the environment after response objectives have been met.

Reduction of Toxicity, Mobility, and Volume Through Treatment - The assessment against this criterion evaluates the anticipated performance of the specific treatment technologies an alternative may employ.

Short-term Effectiveness - The assessment against this criterion examines the effectiveness of alternatives in protecting human health and the environment during the construction and implementation of a remedy until response objectives are attained.

Implementability - This assessment evaluates the technical and administrative feasibility of alternatives and the availability of required goods and services.

Cost - This assessment evaluates the capital and operation and maintenance (O&M) costs of each alternative.

State Acceptance - This assessment reflects the State's (or support agency's) apparent preferences among or concerns about alternatives.

Community Acceptance - This assessment reflects the community's apparent preferences among or concerns about alternatives.

9.2.2 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

Section 121(d) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. Section 121(d) requires that remedial actions at Superfund sites comply with all the requirements of Federal or State environmental or facility siting laws, which are known in the Superfund program as Applicable or Relevant and Appropriate Requirements (ARARs).

This section summarizes the Federal and State statutes and regulations which EPA has determined are the ARARs for the selected remedial alternative for OU 1 of the CRMS.

<u>Definition of ARARs</u>

ARARs are defined as standards or requirements that are found to be either "applicable" or "relevant and appropriate" to the conditions and circumstances found at the site. Guidance for identifying ARARs may be found in the National Contingency Plan (55 Fed. Reg. 8741 et. seq. March 8 1990) and CERCLA Compliance With Other Laws Manual, Part I, Overview of RCRA Clean Water Act and Safe Drinking Water Act, OSWER Directive 9234.1-01 (August 1988) and CERCLA Compliance with Other Laws Manual Part II Clean Air Act, State Requirements and Other Environmental Statutes, OSWER Directive 9234.1-02 (August 1989).

"Applicable" requirements are defined as those cleanup standards of control, and other substantive environmental protection requirements, criteria or limitations promulgated under Federal or State law that specifically address or regulate a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a Superfund site. "Applicability" implies that the remedial action or the circumstances at the site satisfy all of the jurisdictional prerequisites of a requirement.

"Relevant and Appropriate" requirements are defined as those standards of control, and other substantive environmental protection requirements, criteria or limitations promulgated under Federal or State law, that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site or to the remedial action alternatives. For example, requirements may be relevant and appropriate if they would be "applicable" but for jurisdictional restrictions associated with the requirement.

In addition to legally binding laws and regulations, EPA or the State may identify other non-promulgated advisories, criteria or guidance as "To Be Considered" requirements (TBCs). If no ARARs address a particular situation, or if existing ARARs do not ensure protectiveness, then advisories, criteria or guidelines are to be considered (TBCs) to set cleanup goals. If such an advisory, criterion or guideline is selected in the ROD, then it becomes a requirement that the remedial action must meet.

Section 121(e) implicitly states that no Federal, State, or local permits (administrative requirements) are required for remedial actions conducted entirely on site. However, these on-site remedial actions must meet the substantive requirements of ARARs. Any action which takes place off-site, however, is subject to the full requirements of Federal, State, and local regulations. Requirements which are applicable to offsite actions are not ARARs and are not "frozen" at the time the ROD is signed. Rather, all requirements--whether substantive or administrative--which exist at the time of the offsite action must be met.

State Requirements as ARARS

Under CERCLA, all Federal requirements may be ARARs for a particular site; State requirements may be considered ARARs provided that they are:

- Promulgated standards, with full weight of law;
- More stringent than Federal requirements;
- Identified to EPA in a timely manner;
- Found not to result in a statewide prohibition on land disposal; and
- Consistently applied statewide.

ARAR Categories

ARARs have been divided into three categories: (1) chemical-specific, (2) location-specific, and (3) action-specific requirements. Not all requirements fall neatly into these categories; some requirements may overlap and encompass more than one category. The three categories are defined as follows:

Chemical-specific requirements are usually health or risk-based numerical values or methodologies that set limits on concentrations of specific hazardous substances, pollutants and contaminants that may be found in, or allowed to discharge into, the environment.

Action-specific ARARs are technology or activity-based requirements which set limitations on actions taken with respect to removal, treatment or disposal of hazardous substances.

Location-specific requirements set restrictions on concentrations of contaminants or conduct of activities solely because they occur in a special location. These ARARs relate to the geographic or physical location of the site, such as in a wetland, floodplain, wildlife reserve or historic site.

The legal requirements determined to be ARARs for the remedial action selected in this ROD are as follows:

Chemical-specific requirements

Nevada Contaminated Soil and Ground Water Remediation Policy, June 25, 1992.

There are no promulgated Federal or Nevada regulations which govern soil cleanup levels for the type of remedial action selected in this ROD. However, the Nevada Contaminated Soil and Ground Water Remediation Policy, although not promulgated, contains soil cleanup standards that have previously been identified as "to be considered." After further review, and in the absence of other promulgated standards, EPA has determined that the cleanup standards in this policy should apply to the remedial action selected in the ROD.

The intent of this policy is to provide a rational and concise process for determining remediation standards for soil and ground water. Section A.5 of the policy recommends particular cleanup levels in cases where ingestion or dermal exposure is of primary concern and groundwater has not been impacted nor is expected to be. For the COPCs at the CRMS, the cleanup levels are as follows:

mercury	20 mg/kg
arsenic	80 mg/kg
lead	no standard

Section C of the policy states that site specific cleanup levels may be used in place of those set forth in the policy if the site specific levels are developed according to a scientifically valid risk assessment. For the CRMS, EPA performed a human health risk assessment and developed a surface soil standard for mercury of 80 mg/kg based on this risk assessment. Thus, this standard will be used in lieu of the cleanup level recommended in the policy. EPA did not develop a site specific standard for arsenic; therefore, the cleanup level recommended in the policy is pertinent and will be followed.

Nevada Bureau of Mining Regulation and Reclamation Guidance Document for Alternate Use of Mine Waste Solids-Disposal Outside of Containment dated May 3, 1994.

This guidance document describes the types of tests (i.e., Toxicity Characteristic Leaching Procedure, EPA Method 1311) and the respective criteria which should be used to determine if mine waste solids are acceptable for alternate uses. Under the selected remedy, if any excavated soils exceed TCLP levels, then the soils will undergo treatment. The purpose for this guidance is to ensure that mine wastes, particulary spent heap leach material, is not placed in unmanaged disposal facility (i.e., without a liner, monitoring system, etc.,) unless certain prescribed tests, including TCLP, demonstrate that metals are not mobile or leachable and that the material will not generate acid drainage. Although not promulgated, EPA has previously identified this guidance document as "to be considered." After further review, and in the absence of other promulgated standards, EPA has determined that, in the event any of the wastes are treated, the test procedures and criteria set forth in this policy should apply. Also according to this guidance, EPA has determined that if any portion of the excavated material does not meet TCLP standards, then the material must be treated before disposal at a RCRA municipal landfill or the material must be disposed of at a RCRA hazardous waste landfill.

Action-specific Requirements

Discussion of the Resource Conservation and Recovery Act.

EPA has determined that requirements relating to hazardous waste under the Resource Conservation and Recovery Act (RCRA), Subtitle C, 42 U.S.C. §6921 et seq., and the regulations promulgated thereunder, are not ARARs for the selected remedial action. The basis for this determination is that the wastes to be remediated under this ROD are mining wastes that are exempt from the definition of hazardous waste under RCRA Section 3001(b)(3)(A)(ii), 42 U.S.C. §6921(b)(3)(A)(ii), and 40 C.F.R. Section 261.4(b)(7) (also known as the "Bevill amendment").

Pursuant to 40 C.F.R. §261.4(b)(7), the Bevill exclusion provides that "solid waste from the extraction, beneficiation and processing of ores and minerals (including coal), including phosphate rock and overburden from the mining of uranium ore [are not hazardous wastes]. For purposes of §261.4(b)(7), beneficiation of ores and minerals is restricted to the following activities: crushing, grinding, washing, dissolution, crystallization, filtration, sorting, sizing, drying, sintering, pelletizing, briquetting, calcining to remove water and/or carbon dioxide, roasting in preparation for leaching...gravity concentration, magnetic separation, electrostatic separation, floatation, ion exchange, solvent extraction electrotwinning, precipitation, amalgamation, and heap, dump, vat, tank, and insitu leaching."

40 C.F.R. §261.4(b)(7) also provides that solid waste from the processing of ores and minerals includes only twenty specific wastes that are set forth in that subsection.

Since the wastes at the CRMS stem from gold and silver ore mining and milling activity that occurred in the middle of the nineteenth century, it is difficult to say with certainty whether or not the waste involved at the CRMS fall within the Bevill exclusion. However, based upon available information, the wastes stem from beneficiation and extraction of minerals; such wastes are exempt from the definition of hazardous waste under RCRA. Accordingly, EPA has concluded that RCRA regulations are not ARARs for the CRMS.

The selected remedial action will involve disposal of the wastes offsite. Laws and regulations that are pertinent to off-site activity are not ARARs per se, and thus are not frozen at the time the ROD is signed. Rather, the pertinent requirements which exist at the time of the offsite action must be met. In light of the Bevill exemption, the wastes disposed of off-site would not be subject to RCRA regulation. However, in order to ensure that public health is protected and given the recommended procedures in the Nevada Bureau of Mining Regulation and Reclamation Guidance of May 3, 1994, EPA has determined that excavated wastes that exceed the mercury standards for the TCLP test (i.e., TCLP exceeds 0.2 mg/l) will either be treated and disposed of at a municipal landfill or, alternatively, will be disposed of at a hazardous waste landfill. As noted previously, Based on the data EPA has reviewed to date, EPA believes that little if any of the contaminated soils will exceed the TCLP standard for mercury.

Nevada Bureau of Mining Regulation and Reclamation Guidance Document for Alternate Use of Mine Waste Solids-Disposal Outside of Containment dated May 3, 1994.

As discussed above in reference to chemical-specific requirements, EPA has determined that the test procedures and criteria set forth in this criteria should be followed in the event any of the wastes are subject to treatment.

Nevada Administrative Code §445.734 (Fugitive Dust Emissions).

Nevada Administrative Code §445.734 requires that the handling, transporting or storing of any material be performed in a manner which does not allow controllable particulate matter to become airborne. The excavation of contaminated soils will need to comply with this requirement.

<u>Location-Specific ARARs</u>

Executive Order No. 11988; 40 C.F.R. §6.302(b); 40 C.F.R. Part (Appendix A).

These requirements provide that within areas subject to a one percent or greater chance of flooding in any given year, actions shall be taken to reduce the risk of flood loss, minimize the impact of floods on human safety, health and welfare, and restore and preserve the natural and beneficial values of flood plains. Since certain of the areas where remedial action will be taken are within a 100 year flood plain, these requirements are applicable to the extent that the remedial action should be performed in such a manner that it does not increase the risk of flood loss.

Executive Order on Protection of Wetlands Exec. Order No. 11990.

This Executive Order requires Federal agencies to avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands, as defined in Executive Order 11990, §7(c), and 40 C.F.R. Part 6, Appendix A, §4(j). Since certain of the areas where remedial action will occur are adjacent to the Carson River, this requirement is applicable to the extent that the selected remedial action should be performed in such a manner that it avoids any adverse impact on wetlands.

Clean Water Act §404; 40 C.F.R. Part 230; 33 C.F.R. Part 320-330.

These requirements protect wetlands, as defined in 40 C.F.R. §230.3(t) and 33

C.F.R. §328.3(b), by prohibiting the discharge of dredged or fill material without a permit, and taking actions to avoid adverse effects, minimize potential harm, and preserve and enhance wetlands to the extent possible. Since certain areas where remedial action will occur are adjacent to the Carson River, these requirements are applicable.

Archaeological and Historic Preservation Act, 16 U.S.C. §469, 40 C.F.R. §6.301(b) and (c).

This Federal law and the pertinent regulation establishes procedures to preserve historical and archaeological data which might be destroyed through alteration of terrain as a result of Federal activity. Given the limited scope and area of the selected remedial action, EPA believes that it is unlikely that any historical property or archaeological remains will be encountered. However, in the event any such property or data are encountered, EPA will comply the required procedures to ensure that such property or data are preserved.

9.2.3 COMPARATIVE ANALYSIS

This section evaluates the relative performance of the alternatives described in Section 8.1 with respect to the nine criteria so that the advantages and disadvantages associated with each cleanup option are clearly presented. This analysis is described herein according to each of the nine criteria.

<u>Overall Protection of Human Health and the Environment</u>

The scope of this OU-1 is to only address human health risks associated with direct exposure to surface soils bearing mercury in excess of 80 mg/kg and is not attempting to address environmental risks. Methods to address environmental risks will be evaluated as part of OU-2.

For the residential yards, Alternatives 3 and 4 satisfy this criterion. With Alternative 1, the impacted yards would not be addressed in any manner and the risks described in Section 7.4 would not be reduced. Alternative 2 is also not considered to adequately reduce human health risks because the residential yards remain impacted and it is difficult to control access to residential yards, especially by young children. Both Alternatives 3 and 4 provide protection of human health by eliminating the exposure pathway of concern and thereby reducing the human health risks. Alternative 3 eliminates the exposure pathway by capping the impacted areas and Alternative 4 eliminates the exposure pathway by removing the impacted soil from the residential yards.

For the Dayton Ditch, Alternatives 2, 3, and 4 satisfy this criterion. Again, Alternative 1 would not address the defined risks in any manner. It is noted that the

Dayton Ditch may pose less of a health risk than the other areas because (1) mercury levels measured in the Dayton Ditch are relatively low (maximum = 109 mg/kg, minimum = 9 mg/kg, and n = 4); and (2) the action level assumes that a young child is exposed to contaminated soil 350 days per year which is considered a conservative estimate for the ditch. Alternative 2 would satisfy this criteria if access to the ditch is effectively controlled. Unlike the residential yards, the Dayton Ditch is not private property and thus it is feasible to use fencing to control access. With a fence erected along the stretch of the Dayton Ditch that extends through Dayton, access would be minimized and the health risks would thereby be reduced. Alternative 3 would entail lining the ditch channel with either rip-rap, cement, grass, or with a combination of these. This would effectively reduce exposure to mercury contaminated soils presently deposited in this reach of the Dayon Ditch. However, this would not ensure that additional contaminated soils are not deposited in this reach of the ditch in the future. Thus, it is not known whether this alternative would satisfy this criterion in the future. Alternative 4 would entail excavating the contaminated soils from the Dayton Ditch which would effectively reduce exposure to mercury contaminated soils presently deposited in this reach of the Dayon Ditch and would satisfy this criterion. However, as with Alternative 3, it is unknown whether this alternative would satisfy this criterion in the future.

Compliance with ARARs

As discussed in greater detail in Section 8.2.2, EPA has determined that the contaminated soils being addressed in this ROD are probably exempt from regulation under RCRA by virtue of the Bevill Amendment. Thus RCRA requirements are not ARARs for this OU. The only other directly applicable or relevant and appropriate requirements (as distinguished from guidance and advisories "to be considered") are certain action-specific and location specific requirements which would only be pertinent to alternatives 3 or 4 and which alternatives 3 or 4 would meet. Thus it would appear that any of the remedial alternatives would comply with directly applicable or relevant and appropriate requirements.

In addition, however, EPA has identified two Nevada guidance documents that are pertinent to the remedial alternatives for this OU and has determined that the recommended procedures should be followed. The two Nevada guidance documents are: the Nevada Contaminated Soil and Groundwater Remediation Policy, dated June 25, 1992, which provides cleanup standards for soil; and the Nevada Bureau of Mining regulation and Reclamation Guidance Document for Alternate Use of Mine Waste Solids/Disposal Outside of Containment, dated May 3, 1994, which provides that in appropriate circumstances (such as where the use or displacement of the wastes may degrade surface water or ground water) mining wastes should be evaluated under the TCLP procedures.

EPA has determined that the standards and procedures provided in these guidance documents are pertinent to the risk-reduction objectives of this OU and that the selected remedial alternative should comply with them. Both remedial alternatives 3 and 4 would meet the criteria of the two Nevada guidance documents. Alternative 4 would unequivocally meet the criteria and Alternative 3 would meet the criteria assuming that Nevada considered the capping to be sufficiently protective.

Long-term Effectiveness and Permanence

For the residential yards, Alternatives 3 and 4 would satisfy this criterion. Since Alternatives 1 and 2 are not considered protective of human health for the reasons previously described, these alternatives would not provide long-term effectiveness and permanence.

Alternative 3 mitigates human exposure by placing a cap over the impacted areas. Given that this alternative does not attempt to address the full depth of the surface soil horizon and thereby may leave behind soils with concentrations exceeding 80 mg/kg, it is possible that periodic monitoring may be required to ensure the integrity of the cap (i.e., 5 year reviews). However, even if cracks were to form on the cap, any contamination exposed by cracks would not pose significant health risks. This is because the average mercury concentration over the impacted area would still be much less than 80 mg/kg. On the other hand, if portions of the cap were purposely removed for excavation (i.e., utility repairs or installations), then the excavated soil and the exposed area might be of concern. Thus, the long-term effectiveness would depend on the residual levels of mercury contamination and the effectiveness of the institutional controls. Because such long-term institutional controls are difficult to enforce, this is considered a disadvantage for Alternative 3.

Alternative 4 mitigates exposure by removing the contaminated surface soil from the impacted area and replacing it with clean fill. As with Alternative 3, there is a potential for leaving behind mercury concentrations exceeding 80 mg/kg. However, the advantages with this alternative are that: (1) a larger amount of the contaminated soil is removed from the impacted areas than is the case with Alternative 3, by excavating to a maximum depth of 2 feet below ground surface, and thus less impacted soil is left behind, and (2) it is less likely that institutional controls will be required with Alternative 4 because it is less likely that impacted soil will be left behind and the mercury concentrations at 2 feet below ground surface and greater will be better defined as a result of confirmation sampling. In light of this criterion, Alternative 4 is considered the better alternative for addressing impacted yards.

For the Dayton Ditch, Alternative 1 would provide no added risk reduction and thus this criterion is not applicable. Alternative 2 does not attempt to remove mercury contaminated soil from the Dayton Ditch and thus, the long-term effectiveness and permanence depends on the long-term effectiveness of the institutional controls. It is not possible to predict how effectively the fence will reduce access nor is it possible to predict how long the fence will be properly maintained. Therefore, these uncertainties are disadvantages for Alternative 2. Both Alternatives 3 and 4 would effectively address the contaminated soil and sediments presently deposited in the Dayton Ditch but it is unknown whether future runoff will deposit significant levels of contamination in the ditch. Alternatives 2, 3, and 4 compare about the same against this criterion.

Reduction of Toxicity, Mobility, or Volume Through Treatment

For both the residential yards and the Dayton Ditch, only Alternative 4 may include treatment and thereby may be evaluated according to this criterion. Treatment will become part of Alternative 4 if a significant portion of the impacted soil does not attain TCLP standards for mercury and thereby is a characteristic hazardous waste (see Section 8.1). In the event that excavated soils are found to be characteristic hazardous waste, then treatment will be required before disposal at a municipal landfill. In lieu of specifying a treatment technology, this alternative sets forth performance standards for a treatment technology. Thus, if treatment is found to be necessary, then any technology that meets the prescribed performance standards can be employed. The performance standards that would be applied to a treatment technology are set forth in the Nevada Bureau of Mining Regulation and Reclamation Guidance Document for Alternate Use of Mine Waste Solids-Disposal Outside of Containment, dated May 3, 1994. Based on the FS, the technologies that would most likely be used for treating contaminated soil are either gravity separation or a conventional mining technology (i.e., cyanidation).

Any technology for treating mercury contaminated soil is, at best, only capable of separating mercury from the soil matrix. Mercury, which is an element of the Earth, cannot be broken down or reduced in mass. Thus, despite what technology is used to treat soil, the treatment products will always include concentrated mercury and clean soil. Given that there are several technologies that are equally capable of recovering mercury from soil, this alternative could include any one of the technologies which are capable of achieving the specified performance standards. The performance standards which are specified in the referenced guidance document satisfy this criterion by reducing the toxicity of the soil and reducing the mobility of the mercury.

Short-term Effectiveness

In protecting human health and the environment during the construction and implementation phase, Alternatives 1 and 2 pose little to no hazards to human health and environment while Alternatives 3 and 4 do include implementation activities which might create hazards for nearby residents and for workers. Both Alternatives 3 and 4 include excavation. The principal hazards for both residents and workers associated with excavation are: (1) generation of suspended dust; (2) operation of heavy equipment; and (3) the traffic of haul trucks in residential areas. These hazards will be thoughtfully considered in the remedial design and effective measures will be employed to minimize these hazards. These measures may include: performing the work when the winds are least strong, using dust suppressants to control emissions, properly covering staged material and material in the haul trucks to control dust emissions, using traffic controllers to monitor and regulate traffic, and relocating residents. The only environmental hazard is surface erosion of excavation areas and staging piles. This hazard will be minimized by performing the work during the dry season and maintaining covers over staged soil and excavated areas. Both Alternatives 3 and 4 will require approximately four weeks per area to achieve the remedial action objective. In summary, Alternatives 1 and 2 pose little to no hazards to human health and environment while Alternatives 3 and 4 each pose the same hazards and require about the same amount of time to implement.

Implementability

Technical implementability does not apply to Alternative 1.

There are no foreseen technical obstacles for erecting a fence around the boundaries of the Dayton Ditch, Alternative 2. However, accessing the ditch during peak flow events is a special consideration. During peak flow events, the culverts which pass beneath Highway 50 and Pike Street can become obstructed by debris. In such events, access to the culverts is necessary to remove debris and prevent flooding. Thus, if a fence is erected along the ditch, a gate or some other means of access will be required at the culverts. A potential administrative factor for this alternative is ensuring that the fence is properly maintained in perpetuity. If necessary, long-term maintenance of the fence would have to become part of the State Superfund Contract for this operable unit.

The excavation component of Alternatives 3 and 4 is technically straight forward with only minor considerations. Technically, the excavation should be easy to carry out using standard equipment that is readily available. The only foreseen technical issues are: (1) excavating material near the banks of the Carson River (see MS001-SA on Figure 4), and (2) excavating material near unstable slopes and structures (MS004-SA on Figure 4). At MS001-SA, it is possible that excavation and backfilling activities will require reshaping the river bank in order to fill in a ditch and create an evenly graded area. In order to ensure that any buried material and the disturbed top soil resists erosion, erosion control measures will have to implemented. Although there is a large variety of erosion control measures, it will be a challenge to find the best measure for this area. At MS004-SA, the impacted area is near the toe of hillside. Based on a cursory examination of this hillside, it appears that it is not stable. Thus, if any excavation is necessary at the toe of this hillside, it will be a challenge to control sloughing. Finally, there are two small sheds within the impacted area which appear to be unstable structures. If it is necessary to excavate material from around these structures, it may be necessary to destroy these sheds and replace the structures.

The excavation component for Alternatives 3 and 4 may pose some administrative and logistical challenges. At MS003-SA, it appears that the impacted soil extends beneath several mobile homes. Rather than attempting to excavate between the trailers which are very restrictive spaces, it may be more efficient to move the mobile homes before excavating the areas. If relocation is necessary, between 10 and 15 households will have to be relocated during the period of excavation. It is estimated that the period of excavation will be approximately 4 weeks, which includes disconnecting utilities as well as inventorying, moving, and storing all of the property and structures associated with each mobile home. The principal challenges associated with relocation include: coordinating with residents, accommodating all of the needs of the residents during the excavation period, and providing temporary residency in Dayton where there are no motels or hotels. A possible way to manage the relocation with the least disruption to residents is to relocate trailers to a nearby trailer park. It is believe that this would minimize the effort associated with moving personal items and would minimize disruption to daily lives. This and other options will be further evaluated as part of the remedial design.

Finally, Alternative 4 may include soil treatment. Although there are various technologies for recovering mercury from soil, the best technology for treating soil will depend on the species of mercury in the soil matrix. Mercury speciation was performed as part of the remedial investigation but the results were inconclusive. The results clearly demonstrated what fraction of the mercury is mercuric chloride (information required for the risk assessment) but did not conclusively determine the relative fractions of elemental mercury and mercuric sulfide. If treatment is required, further speciation analyses or bench scale testing may be necessary for identifying the best treatment technology.

Cost

The cost estimates for residential yards are described in Table 8. Cost estimates for Alternatives 3 and 4 were not developed for the Dayton Ditch because it was recognized that the costs for these alternatives would be significantly greater than institutional controls and because the risks associated with this area do not warrant these alternatives.

State and Public Acceptance

The Feasibility Study and the Proposed Plan fact sheet were reviewed by Nevada Division of Environmental Protection (NDEP) and they expressed support for Alternative 4 for the residential yards and opposed Alternative 2 for the Dayton Ditch. In a letter dated March 29, 1995, the State of Nevada (NDEP) concurred with EPA's selected remedy for OU-1 of the CRMS.

The Proposed Plan fact sheet was provided to the communities of Dayton and

Silver City and public hearings were conducted in Dayton and Silver City on January 18 and 19, 1995, respectively. The Proposed Plan fact sheet solicited written comments from the communities and comments were also recorded at the public hearings. The majority of the comments EPA received from the public expressed skepticism regarding the health risks associated with mercury in surface soil and the

TABLE 8: Cost Estimates for Residential Yards

Alternative	Capital Cost	Operation & Maintenance Cost	30 Year Present Worth
1	$0	$0	$0
2	NA[a]	NA	NA
3	$543,000[b]	$0	$543,000
4a	$2,090,000[c]	$0	$2,090,000
4b	$4,792,095[d]	$0	$4,792,095
4c	$829,834[e]	$0	$829,834

a. Not applicable because institutional controls were not considered a viable alternative for residential yards.

b. Assumes excavation and replacement of 1005 cubic yards of soil, disposal without treatment at a municipal landfill, paving over 67,500 square feet, and installation of 400 feet of fence around the Dayton Ditch.

c. Assumes excavation and replacement of 6000 cubic yards of soil, disposal without treatment at a hazardous waste landfill ($150/ton), and installation of 400 feet of fence around the Dayton Ditch.

d. Assumes excavation and replacement of 6000 cubic yards of soil, treatment at $500/ton, and disposal at a municipal landfill ($10/ton), and installation of 400 feet of fence around the Dayton Ditch.

e. Assumes excavation and replacement of 6000 cubic yards of soil, disposal without treatment at a municipal landfill ($10/ton), and installation of 400 feet of fence around the Dayton Ditch..

value of any type of remediation. However, the owners of impacted parcels did not object to Alternative 4. The communities also expressed some concern with Alternative 2 for the Dayton Ditch. Residents are mainly concerned with the aesthetics of a fence and that a fence would cause problems during peak flow events when access to the culverts can be essential to remove large debris and avoid flooding.

10.0 SELECTED REMEDY

Based upon consideration of the requirements of CERCLA, the detailed analysis of the alternatives, and comments from the State and the public, EPA has selected Alternative 4 for the residential yards and Alternative 1 for the Dayton Ditch.

The selected remedy for the five residential yards is to excavate contaminated surface soil (estimated to go to a depth of approximately 2 feet below ground surface), dispose of the soil at a RCRA municipal landfill if the soils do not exceed TCLP standards, and restore the excavated areas. Approximately 5000 cubic yards of soil will be excavated and disposed of as part of this response action. If it is determined that all or part of the excavated soil exceed TCLP standards, then the excavated soil will either be treated and disposed of at a RCRA municipal landfill or disposed of at a RCRA hazardous waste landfill. Which of these sub-alternatives that will be used will depend on which sub-alternative is found to be more cost effective and the logistics of implementing each sub-alternative. In the event that subsurface soil is impacted and is not addressed, then this remedy may also include institutional controls which would prescribe handling and disposal requirements for any future excavations within the impacted area.

Both Alternatives 3 and 4 were considered to be viable alternatives for residential yards, however, Alternative 4 was selected over Alternative 3 based on "long-term effectiveness and permanence." Both Alternatives 3 and 4 are considered to be protective of human health and both of the alternatives achieve all of the ARARs for this operable unit. Issues regarding implementability and short-term effectiveness are very similar for Alternatives 3 and 4 because both alternatives include excavation. In the unlikely event that Alternative 4 includes treatment or disposal at a RCRA Subtitle C disposal facility, then there may be more implementability issues and factors than there are for Alternative 3. The capital cost for Alternative 3 is estimated to be less than for any of the scenarios presented for Alternative 4. Among the three scenarios presented for Alternative 4, it is most likely that this alternative will not require either treatment or disposal at a hazardous waste landfill. Thus, the cost comparison was based primarily on the estimated cost for Alternative 4c in Table 8.1. Although the estimated capital cost for Alternative 3 is less than for Alternative 4c, Alternative 4 was selected based on "long-term effectiveness and permanence." Alternative 4 requires that soil is excavated to a maximum depth of 2 feet below ground surface or to the depth of contamination. Alternative 3 would require minimal excavation to prepare the surface for the cap and it is likely that institutional controls would be required to address future exposure to subsurface contamination or to address the uncertainty. Because a larger amount of contaminated soil is removed with Alternative 4 and because this alternative will require more rigorous confirmation sampling to define the depth of excavation, it is less likely that institutional controls would be required to manage residual contamination or to address any uncertainty regarding subsurface contamination. Although it is not possible to project costs for institutional controls at this time, EPA believes that the cost for Alternative 3 would be augmented by institutional control costs. In light of this criterion, Alternative 4 is considered the better alternative.

The selected remedy for the Dayton Ditch is no action. EPA selected no action for the Dayton Ditch because the health risks for this area are not great enough to warrant response actions such as excavation or lining the ditch and the State of Nevada and the community do not support addressing the area with institutional controls (i.e., restricting access with a fence). Although EPA has selected no action for the Dayton Ditch, additional samples will be collected from the ditch during the remedial design to further evaluate the level of impact. In the event that EPA determines that some form of remediation is warranted, then EPA will document this remedy selection in an "Explanation of Significant Differences (ESD)" or ROD amendment, or the area will be addressed as part of OU-2.

Alternative 2 was originally proposed by EPA for the Dayton Ditch which would have entailed fencing the ditch to restrict access and thereby reducing exposure. EPA selected this alternative over capping and excavation based on human health risks and cost. Although the Dayton Ditch is an actionable area based on the 80 mg/kg action level, the health risks are considered less significant than for the residential yards. The basis for this judgement is (1) the relatively low mercury levels measured in the Dayton Ditch (maximum = 109 mg/kg, minimum = 9 mg/kg, and n = 4); and (2) the action level assumes that a young child is exposed to contaminated soil 350 days per year which is considered a conservative estimate for the ditch. Given the relatively low risks, EPA could not justify the costs associated with either excavating or lining the ditch. Thus, EPA proposed restricting access with a fence. Although this alternative would provide some risk reduction, it is not considered to be significant enough to override the opposition expressed by the State of Nevada and the community of Dayton. Therefore, EPA is selecting Alternative 1 for the Dayton Ditch. EPA will collect additional samples from the ditch during the remedial design to further evaluate the level of impact. In the event that EPA determines that some form of remediation is warranted, then EPA will document this remedy selection in an Explanation of Significant Differences (ESD) or ROD amendment, or the area will be addressed as part of OU-2.

In summary, the selected remedy for OU-1 of the CRMS is as follows:

- Excavation of approximately 5000 cubic yards of contaminated soils, disposal at a RCRA municipal and/or hazardous waste landfill, and restoration of properties. In the event that there is residual contamination in the subsurface soil and it is not addressed, then this alternative may also include institutional controls; and

- 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."

11.0 STATUTORY DETERMINATIONS

As required under Section 121 of CERCLA, the selected remedial action is protective of human health, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost effective. The selected remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. However, because treatment of soils may not occur, this remedy may not satisfy the statutory preference for treatment as a principal element of the remedy.

The selected remedy is protective of human health in that it mitigates exposure to mercury which is equal to or exceeds 80 mg/kg in surface soil. The selected remedy is technically feasible and meets all of the ARARs which are pertinent to this operable unit.

Because this remedy will result in hazardous substances remaining on-site above health-based levels, a five-year review, pursuant to CERCLA Section 121, 42 U.S.C. Section 9621, will be conducted at least once every five years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

12.0 DOCUMENTATION OF SIGNIFICANT CHANGES

The remedy selected in this ROD is different from the remedy originally proposed by EPA. In the Proposed Plan fact sheet, EPA proposed fencing the Dayton Ditch in order to restrict access and thereby reduce exposure. Based on opposition expressed by the State of Nevada and the community of Dayton, the selected remedy for the Dayton Ditch is Alternative 1, No Action. The basis for this change is discussed in Section 10.

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PART III. RESPONSIVENESS SUMMARY

This section summarizes and responds to all significant comments received during the public comment period (32 days) on EPA's proposed plan for Operable Unit 1 (OU-1) of the Carson River Mercury Site (CRMS) in Storey, Lyon, and Churchill Counties, Nevada. This summary is divided into three sections. Section 1 provides a summary of the major issues raised as written comments. Sections 2 and 3 summarize the questions and comments made at the public meetings held in Dayton and Silver City on January 18 and 19, 1995, respectively. Copies of all of the written comments received by EPA are included in the CRMS Administrative Record, which are available for review at the information repositories. The transcript of the public meeting, including all of the questions and comments, is also available at the information repositories.

1.0 WRITTEN COMMENTS

1. Nevada Division of Environmental Protection

Comment: As part of the proposed plan for OU-1 of the CRMS, EPA is proposing institutional controls referred to as the "Long-term Sampling and Response Plan (LTSRP)" for non-residential areas that are impacted and, possibly, deed restrictions for any subsurface contamination that is not addressed. How will EPA ensure that these institutional controls are implemented and does EPA have the legal authority to enforce these institutional controls.

Response: The concern expressed by NDEP is also shared by EPA, especially for the LTSRP. First, EPA does have the legal authority to enforce compliance with institutional controls under CERCLA, Section 104 and 106. However, EPA believes that the LTSRP will be effectively implemented through public awareness. By now, it is commonly known that part of the Carson drainage is a Superfund site due to mercury and that there are liability risks related to purchasing property that is impacted by mercury. Given that EPA is unable to clearly delineate the exact boundaries of the Superfund site, prospective buyers, realtors, lending institutions, and environmental consultants should recognize the value of using prescribed guidelines for evaluating properties of interest. With regard to institutional controls at the impacted residential properties, EPA has selected Alternative 4, Excavation, in hope of minimizing the need for such institutional controls. However, if necessary, institutional controls will be utilized at those impacted properties if there is residual contamination in the subsurface soil and it is not addressed.

2. Nevada Division of Environmental Protection

Comment: In the Proposed Plan fact sheet, EPA indicates that there are no capital or future costs associated with Alternative 1, No Action, when this alternative should include future costs for long-term monitoring. Please explain.

Response: Based on the definition of "no action" EPA used in the Feasibility Study and the Proposed Plan fact sheet, no action does not include any future monitoring. Rather, long-term monitoring is considered a form of institutional controls. Thus there are no long-term monitoring costs associated with this alternative.

3. Sharon D. Hunt

Comment: The commenter believes that mercury contamination in Dayton is not a public health hazard based on the apparent well being of many of the residents who have spent their entire lives in the Dayton area. The commenter then suggests that Alternative 1, No Action, is the better alternative.

Response: EPA is addressing areas where mercury contamination in surface soil is equal to or greater than 80 mg/kg. This action level is based on the potential health risks for a young child (less than 6 years of age) who may ingest an average of 200 mg of soil per day. This action level, 80 mg/kg, translates to a level of exposure for a young child that is below the level at which adverse effects are expected to occur. These adverse effects are to the kidney progressing from swelling and redness to more serious effects such as proteinurea (proteins in the urine). By selecting an action level which is below the threshold for adverse effects, EPA is being protective of human health.

4. Sharon D. Hunt

Comment: First, the commentor would like to know what are the implications if her property, which presently appears to be impacted, is not addressed. Secondly, the commentor is concerned that the value of her property is already reduced due to the presence of mercury and she would like to know if her property will regain the full market value after cleanup. Finally, the commentor would like to know if the property will have limited landuse after the cleanup.

Response: As a result of the human health risk assessment, EPA has set forth an action level (80 mg/kg) which the Agency is using to determine if properties are impacted by mercury. In the event that a property owner objects to cleanup activities on his or her property, EPA may attempt to negotiate an agreement with the property owner, or EPA may issue an unilateral order to that property owner. Should EPA not address an impacted property, the property owner will be subject to some risks. First, there are the health risks which are discussed under Comment 3. Secondly, there are liability risks if an incident of mercury poisoning is attributed to the property. Finally, there are risks that the value of the property will be reduced and that the property owner will be unable to sell the property or borrow money against the property. If EPA addresses contamination on the property, the specifics of the cleanup will be documented in an appropriate manner. After cleanup, if no residual contamination remains on the property, there will be no land use limitations for the property. However, as discussed in the "Selected Remedy" section of the ROD, some institutional controls may be utilized in the event that residual contamination remains on the property.

5. Mickey Lawler, 21st Century Environmental Management, Inc.

Comment: The commenter requests the results from soil analyses, wildlife analyses, and TCLP analyses. The commentor also requests any maps which describe the distribution of mercury in surface soil.

Response: The Human Health Risk Assessment and Remedial Investigation Report for the Carson River Mercury Site, December 1994, which is available at the information repositories, contains results from all of the soil sampling and provides maps which describe where EPA collected samples and provides the respective levels. As part of this phase of the remedial investigation, seven soil samples which contained elevated mercury were analyzed using TCLP. These analyses were performed as preliminary test to determine if excavated soil would exceed TCLP. These results are discussed in this ROD and are included in the administrative record. Wildlife sampling is part of Operable Unit 2 (OU-2) of the remedial investigation and feasibility study, and thus there are no results to provide at this time. The final report for OU-2, which will contain the results from all wildlife sampling, is scheduled to be completed in October, 1995.

Comment: The commenter refers to 40 C.F.R. Part 268.42 and poses the following questions: (1) what is the sampling plan for determining the total mercury content of excavated soil, and (2) will the total mercury content affect how the soil is regulated and thereby addressed (i.e., if soils exceed 260 mg/kg and are thereby defined as "High Mercury" in the Land Disposal Restrictions)?

Response: The sampling plan for determining the total mercury content of excavated soil will be developed as part of the remedial design which is scheduled to be completed in the Fall, 1995. However, as is discussed in this ROD, mercury contaminated soil from the CRMS is exempt from Land Disposal Restrictions by virtue of the Bevill Amendment. Thus, even if the soils are found to exceed 260 mg/kg, the soils will not be addressed differently. However, if soils are found to exceed TCLP standards, the soils will have to be treated before disposal at a RCRA municipal landfill or disposed of at a RCRA hazardous landfill. If the soil is sent to a RCRA hazardous waste landfill, the soil will be subject to the regulations which govern the landfill.

Comment: The commentor requests additional information regarding the cost analysis for Alternative 4.

Response: A description of the cost analysis is provided in the Feasibility Study for the Carson River Mercury Site dated December 20, 1994. This study is available for review at the information repositories.

2.0 COMMENTS FROM DAYTON PUBLIC MEETING ON JANUARY 18, 1995

6. Harold Tracey

Comment: The commenter owns property in Dayton and believes that property values have dropped signficantly since the local media started releasing information regarding the Carson River Mercury Site. The commenter would like to receive compensation for the depreciation of real estate prices.

Response: This comment is concerning property values as they relate to the boundaries of the Carson River Superfund site and the public perception of the problem. For this site, EPA has not attempted to define the perimeter of the site because the extent of mercury contamination is too widespread. Thus, there has been an ongoing uncertainty about what areas are impacted and what areas are clean. Although EPA is unaware of any actual depreciation in real estate values, it is possible that this uncertainty might have some effect on real estate values in Dayton and other areas. Now that EPA has identified the historic millsites, established an action level, and has identified the impacted areas based on this action level, there should be less uncertainty as to whether a property is impacted. Also, by providing the State with prescribed sampling guidelines, EPA believes that property values will be less affected by uncertainty. With regards to what the local media reports, EPA only releases factual information to the media. Unfortunately, EPA has little control over how the information is relayed to the public through newspapers, radio, and television.

7. Victoria Predere

Comment: The commenter has been a resident of Dayton for over 60 years and she finds it difficult to believe that health risks that EPA is attempting to reduce are actually real.

Response: See Comment 3.

8. Don Dallas

Comment: The commenter does not understand why the Carson River is a Superfund

Site. The commenter is also concerned that EPA will not select Alternative 1, No Action, even if the community unanimously supports this alternative.

Response: The CRMS was added to the National Priorities List (NPL) in August, 1990 due to the widespread occurence of mercury. As with all Superfund sites, the site was evaluated and scored according to EPA's Hazard Ranking System (HRS) model. With the HRS model, a site is scored based on the contaminants of concern, the affected media, exposure pathways, the size and proximity of potentially exposed human populations, and the proximity of wildlife habitat. In order to be proposed for the NPL, a site must score above 28.5. The HRS score for the CRMS was 39. In the circumstance where a state does not have any Superfund sites, that state can propose a site for the NPL if that site is eligible according to the HRS. The CRMS was nominated by the State of Nevada as the State's first Superfund site.

The purpose for the proposed plan comment period is to provide the public an opportunity to comment on the response actions proposed by EPA. In the event that the public provides valid reasons for modifying the proposed remedy or selecting a different remedy, EPA will strongly consider those comments and EPA might change the remedy selection based on the comments. Although the prevailing opinion among the communities is that the health risks are not real and that Alternative 1 is the best alternative, EPA feels that remediation is warranted based on the reasons presented under Comment 3. Also, the owners of the impacted properties recognized the practical value of addressing the impacted areas and they support the proposed remedy.

9. Gloria Marsh

Comment: The commenter would like to know how EPA will formally document that a property is "clean" after remediation is complete.

Response: See Comment 4.

10. Harold Tracy

Comment: The commenter is concerned with the Long-term Sampling Response Plan. In particular, he is concerned that the LTSRP will impose regulations on privately owned property and will reduce the value of the land and reduce the chances for people to develop their land.

Response: The areas that will be managed with the LTSRP are areas that were found to be impacted or areas that are potentially impacted by mercury. Given that these areas are identified in the remedial investigation report, it is likely that if a landowner elects to develop in one of these impacted areas, mercury contamination will be an issue that the landowner will have to address. The purpose for the LTSRP is to provide the landowner with clear guidelines for assessing if mercury is a problem and, if necessary, guidelines for addressing the problem. By providing these guidelines, EPA feels that the inevitable costs associated with developing or transferring land that is impacted or is potentially impacted by mercury will be greatly reduced.

3.0 COMMENTS FROM SILVER CITY PUBLIC MEETING ON JANUARY 19, 1995

11. Tom Card

Comment: First, the commenter asks if EPA determined the species of mercury in surface soil and then he asks if elemental mercury is really a health hazard.

Response: As part of soil investigations EPA attempted to characterize the species of mercury in surface soil, but due to conflicting results from two different labs using two different procedures, EPA was unable to establish whether mercuric sulfide or elemental mercury is the predominant species. However, EPA was able to conclude that less than 10 percent of the total mercury is mercuric chloride, which is the most soluble form of inorganic mercury. It is true that elemental mercury is the least soluble form of mercury and, as a result, poses the least risk when ingested. Since EPA could not establish what is the predominant form of mercury in surface soil, the action level assumed that 90 percent is mercuric sulfide and 10 percent is mercuric chloride.

Comment: Based on the assumption that elemental mercury is the predominant form of mercury in the soil matrix, the commenter expresses skepticism about the health risks associated with exposure to soil and recommends Alternative 1, No Action, as the best alternative.

Response: See Comment 3.

Comment: The commenter is concerned that EPA will use outside contractors to perform all of the work associated with the remedial action and would like to see local contractors used to perform the work.

Response: To the maximum extent possible, EPA will attempt to use local contractors to perform the remediation work. It is important to note that before a contractor can be considered to perform the soil excavation work, the contractor will have to meet certain requirements for handling hazardous substances. Assuming that local contractors possess the required qualifications, EPA will attempt to employ them.

12. Mr. Laughlin

Comment: The commenter believes that the CRMS was added to the NPL for political reasons. The commentor also refers to the open hearths of the steel mills in Pittsburgh as more significant problems.

Response: See Comment 8.

13. Harold Tracy

Comment: The commenter questions whether EPA had access approval to perform sampling on the Ricci Ranch. Secondly, the commenter questions whether EPA used prison crews to perform sampling.

Response: Access was requested prior to accessing private property to perform sampling. There were a handful of properties where EPA was unable to contact the land owner prior to conducting sampling. In those instances, EPA proceeded with the sampling when there were no fences or signs that denied access. but sampling was carried out anyway because there were no fences or signs to prevent access. In response to the second comment, EPA only used professionals to perform field investigations and EPA never used a prison team.