



# Public Health Assessment for

**MOLYCORP, INC.  
QUESTA, TAOS COUNTY, NEW MEXICO  
EPA FACILITY ID: NMD002899094  
FEBRUARY 28, 2005**

**U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
PUBLIC HEALTH SERVICE**

Agency for Toxic Substances and Disease Registry

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

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

In addition, this document has previously been provided to EPA and the affected states in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. The revised document was released for a 30-day public comment period. Subsequent to the public comment period, ATSDR addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes the public health assessment process for this site, unless additional information is obtained by ATSDR which, in the agency's opinion, indicates a need to revise or append the conclusions previously issued.

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Molycorp, Inc.

Final Release

**PUBLIC HEALTH ASSESSMENT**

MOLYCORP, INC.

QUESTA, TAOS COUNTY, NEW MEXICO

EPA FACILITY ID: NMD002899094

Prepared by:

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## List of Acronyms

ADHD	Attention Deficit Hyperactivity Disorder	MRL	Minimal Risk Level
AL	Action Level	NOAEL	No Observed Adverse Effect Level
ATV	All-Terrain Vehicle	NPDES	National Pollutant Discharge Elimination System
ATSDR	Agency for Toxic Substances and Disease Registry	NPL	National Priorities List
COC	Contaminant of Concern	PAH	Polycyclic Aromatic Hydrocarbon
COPD	Chronic Obstructive Pulmonary Disease	PCB	Polychlorinated biphenyl
CREG	Cancer Risk Evaluation Guide	PM <sub>10</sub>	Particulate Matter less than 10 microns in diameter
CSF	Cancer Slope Factor	ppm	part per million
CV	Comparison Value	RBC	Risk-based Concentration
EMEG	Environmental Media Evaluation Guide	RCRC	Rio Colorado Reclamation Committee
EPA	U.S. Environmental Protection Agency	PRG	Preliminary Remediation Goal
ESI	Expanded Site Inspection	RfD	Reference Dose
HOD	Health Outcome Data	RI	Remedial Investigation
LOAEL	Lowest Observed Adverse Effect Level	RMEG	Reference Media Evaluation Guide
MCL	Maximum Contaminant Level	SSL	Soil Screening Level
mg/kg/day	milligram per kilogram per day	TAG	Technical Assistance Grant
MMD	Mining and Mineral Division	TCDD	Tetrachlorodibenzodioxin
		TEF	Toxicity Equivalency Factor

TEQ	Toxicity Equivalency Quotient	$\mu\text{g/L}$	microgram per liter
TSP	Total Suspended Particulates	$\mu\text{g/m}^3$	microgram per cubic meter
TUI	Tolerable Upper Intake		

## Summary

The Molycorp site is a molybdenum mining operation located in and around Questa, New Mexico. The site comprises mining operations east of town, a pipeline used to transport waste tailings, and a tailings impoundment facility west of town. Waste rock and tailings have contributed heavy metals to surface water in the Red River and groundwater downgradient from the mine facilities. Metals-contaminated dust has also been released from the tailings facility, and many spills and other releases of tailings from the pipeline have occurred over the years, potentially spreading metals contamination into the water and land around the Red River and acequias (irrigation ditches).

On the basis of available information, the Agency for Toxic Substances and Disease Registry (ATSDR) has made the following conclusions about the Molycorp site:

- Information about use of private wells and their levels of contamination in the past was limited. Some of the wells potentially used for private consumption in the past have levels of arsenic, cadmium, iron, magnesium, manganese, molybdenum, zinc, fluoride, or sulfate high enough to have increased the risk of adverse health effects, to varying degrees, if people drank water from the affected wells regularly. No adverse health effects are likely today as long as people avoid drinking contaminated well water.
- Information about levels of dust blowing from tailings piles toward Questa was also limited. Using available data and professional judgment, rough “worst case” estimates of past exposures indicated that exposures to metals contaminants from breathing in tailings dust were too low to result in short- or long-term health effects. However, intermittently high dust levels in the 1970s, 1980s, and (to a lesser extent) the 1990s could have resulted in short-term eye and respiratory irritation and an increased risk of respiratory problems in sensitive groups (people with asthma or other respiratory disease, the elderly, and children). Recent studies indicate that adverse health effects are unlikely today.
- Questa municipal water meets applicable water quality standards and is not expected to cause adverse health effects. Although there is no evidence of it occurring, even if people occasionally drank tap water with tailings particles or tailings-related contaminants in it, estimated contaminant exposures would be too low to result in adverse health effects.

ATSDR has made the following recommendations about the Molycorp site:

- People should avoid drinking water from wells shown to be contaminated. The most highly contaminated wells should be decommissioned to prevent people from drinking the water. People who drink water from private wells are encouraged to have the well water quality tested regularly.
- Continue dust mitigation/suppression at the tailings facility as long as suspendable tailings are present. People in sensitive groups (people with asthma or other respiratory disease, the

elderly, and children) should limit outdoor activity on dry, windy days or if dust levels appear to be high.

- To improve the community's acceptance of Questa's water supply, ATSDR supports the planned upgrading of the municipal water system to remove water lines from tailings.



## **I. Purpose and Health Issues**

The Molycorp site was proposed for the National Priorities List (NPL) on May 11, 2000. The Agency for Toxic Substances and Disease Registry (ATSDR) is required by Congress to conduct public health activities on all sites proposed for the NPL. In this public health assessment, ATSDR evaluates the public health significance of the Molycorp site. ATSDR reviewed available environmental data, potential exposure scenarios, and community health concerns to determine whether adverse health effects are possible. In addition, this public health assessment recommends actions to prevent, reduce, or further identify the possibility for site-related adverse health effects.

## **II. Background**

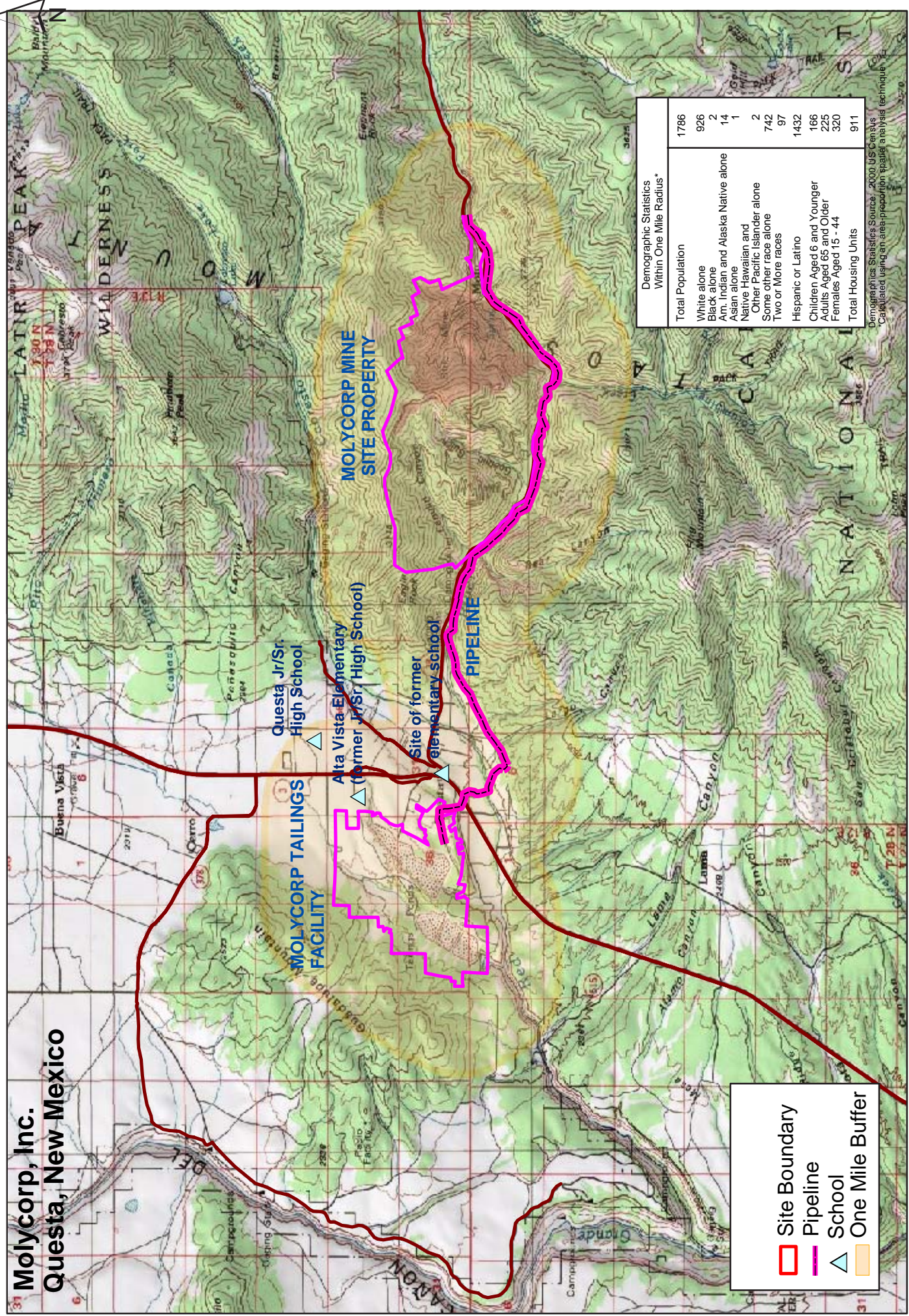
### **A. Site Description**

This description comes from the New Mexico Environment Department (NMED) Expanded Site Inspection report and other site documents [1,2]. The Molycorp NPL site is located in Taos County, New Mexico, near the town of Questa. It includes a molybdenum mining and processing area east of town, a tailings disposal area containing wastes from the mining process west of town, and a pipeline which transports the tailings from the mine to the tailings facility. As shown in Figure 1, the mine area, approximately 3 square miles in area, is located about 5 miles east of Questa. The tailings disposal facility covers about 1 square mile and is located less than 2 miles west of Questa. The tailings pipeline follows the Red River most of the way to the tailings facility. It also crosses and parallels the acequias, ditches that provide irrigation and other water to the community.

Molybdenum has been, and is still, mined from the mountains east of Questa since the 1920s. The rock is mined, crushed and processed to obtain the molybdenum. Waste rock (rock with no commercial value) is piled in several areas around the site. Tailings (fine remains of crushed rock after product removal) are mixed with water and pumped through a pipeline into large ponds at the tailings facility. The solid tailings settle out of the water, and are covered after drying. Waste rock and tailings have contributed heavy metals to surface water in the Red River and groundwater downgradient from mine facilities [2]. Metals-contaminated dust has also been released from drying tailings west of town. Many spills and other releases of tailings from the pipeline have occurred over the years, potentially spreading metals contamination into the water and land around the Red River and acequias [5,6]. Concerns have also surfaced about the physical stability of some of the waste rock piles, especially at Goat Hill Gulch.

The Molycorp mine includes underground workings, an open pit, the mill site, and waste rock dumps at Capulin Canyon, Spring Gulch, Sulphur Gulch, Blind Gulch, Goat Hill Gulch, and the Sugar Shack area adjacent to the Red River. The Molycorp tailings impoundment includes two large ponds and two smaller ponds [3].

Figure 1. Site Map and Demographic Information



## **B. Site Operational History**

Molycorp began underground molybdenum mining operations at the site in 1920, constructing a mill in 1923. In 1965, Molycorp began open pit operations, which required the construction of tailings impoundments to dispose of the large quantities of waste. Open pit mining continued until 1983, when the operation returned to underground mining. Pipelines located above the ground surface along the Red River transport the tailings from the mill site to the tailings impoundments. The water left over after the tailings settle out is channeled to Pope Lake before being discharged to the Red River [4]. The company installed surface water diversion ditches in 1974 to divert surface water runoff around the tailings impoundments [1]. It built seepage barriers below the dams in 1975 to allow collection of leachate from the tailings impoundments in groundwater recovery wells. All the groundwater and surface water collected is diverted around residences below the dams to a designated National Pollutant Discharge Elimination System (NPDES) permitted outfall [3]. In 1983, Molycorp built an ion exchange plant near Pope Lake to treat water from the tailings impoundments and store it in Pope Lake before discharge to the Red River [3]. This treatment plant received water from the tailings impoundments only if it reached a certain elevation, and according to Molycorp, has not been used or needed for several years [see public comments, page 82]. Market conditions forced the mine to halt operations from 1991–1994 and for other periods; however, Molycorp continues to mine from underground operations today.

In the 1980s citizens began protesting the problem of dust blowing from the tailings impoundments into Questa [5]. This was reported in local newspapers to be a particular problem at the Questa Junior/Senior High School (now Alta Vista Elementary), with the extremely high levels of dust prompting a student walkout. In response to protests, complaints, and media attention, Molycorp changed the procedure for drying tailings at the impoundments. Molycorp provide the following information: Beginning in 1993 (during a mine-shutdown) large areas of unused tailings were covered with an alluvial soil and seeded to minimize the potential windblown tailings. With the re-starting of operations in 1996 and continuing today, operations covers unused areas of tailings with surfactant, water or a soil cover to minimize the potential for windblown tailings off-site [see public comments, page 82].

## **C. Demographics**

The town of Questa has approximately 1,864 residents [7]. Figure 1 shows demographic information for the population within a 1-mile radius of the site (including the mine property, tailings impoundment area, and pipeline). According to the 2000 US Census, 1,786 people, including 166 children younger than 6 years of age, live within a 1-mile radius of the site [7]. This population is approximately 80% Hispanic. The racial makeup of the population is 52% White; 42% some other race alone; 5% two or more races; and less than 1% each Black, American Indian or Alaska Native, Asian, or Native Hawaiian or other Pacific Islander [7].

In the 2001–2002 school year, 202 children attended the Alta Vista Elementary/Intermediate School (grades K–6), and 276 children attended Questa Junior/Senior High School [8]. Junior and senior high school age children from surrounding communities are bused to Questa to attend

school. From its construction in the late 1960s until a new school was built in the 1990s, the junior/senior high school was located where the Alta Vista school is now.

#### **D. Land and Natural Resource Use**

Questa lies at an elevation of about 7,500 feet in north central New Mexico, about 20 miles south of the Colorado border and 20 miles north of Taos. The surrounding land is mountainous, with some peaks reaching more than 10,000 feet in elevation. Questa is located at and around the intersection of state highways 522 and 38 [1].

The soils in the area have a naturally high mineral content. Some areas of natural erosion (known as hydrothermal scars) present in the vicinity of Questa may contribute to metals levels in area soil and waters [9].

Land in the area around the Molycorp property is used primarily for farming, recreation, and residential use. Although ATSDR did not tour the entire perimeter of the mine property, the boundaries observed were either fenced or posted with “private property” signs. Reportedly, the site is not completely fenced; however, ATSDR received no reports of frequent trespassing on Molycorp property itself. One citizen reported that it was possible to access the tailings impoundment property and that all-terrain vehicle (ATV) riders used that area as a cut-through (personal communication, private citizen, September 30, 2003). The tailings pipeline is not completely fenced off from the public and runs through residential and recreational areas. Releases from the pipeline have been reported in areas that are easily accessible to the public.

The Red River runs in a westerly direction on the south side of the mine, Questa, and tailings impoundments on its way to the Rio Grande River approximately 5 miles downstream of Questa [1]. Two tributaries enter the Red River around Questa: Columbine Creek, which enters the river from the south directly across from the mine, and Cabresto Creek, which enters from the north close to town. Eagle Rock Lake is also located on the course of the Red River, about ½ mile east of town. The Red River, Columbine Creek, Cabresto Creek, Fawn Lakes, and Eagle Rock Lake are all listed as trout fishing waters by the New Mexico Department of Game and Fish [10]. The Red River below Questa is stocked with rainbow trout grown in a fish hatchery run by the New Mexico Department of Game and Fish, located 2 miles downstream from the tailings impoundments [11]. Fishing is common along the Red River, and hunting in the land around the Molycorp property is reported to occur regularly. The native fishery has reportedly declined significantly since the 1970s, although the cause of this decline has not been definitively determined [1].

The Village of Questa maintains a municipal water supply drawn from two wells and stored in two tanks with a combined capacity of 130,000 gallons [12]. In 2000, the system served 768 connections and approximately 1800 people. Tailings from Molycorp were apparently used to backfill water lines when the municipal system was added in 1968 [13]. In addition to the municipal supply, there are several private wells registered for domestic use in Questa and in surrounding areas that could potentially be affected by contaminants from the mining process. The usage rates and contaminant levels of many of these wells remains unknown.

### III. Discussion

#### A. Data Used

The environmental sampling data evaluated in this document came from the following sources:

- Data collected during the remedial investigation. The U.S. Environmental Protection Agency (EPA) provided validated data through November 2003 [14]. The database provided also included some historical data.
- Private well sampling data provided by private citizens.
- Private well sampling performed by the New Mexico Environment Department (NMED) Drinking Water Bureau [15].
- Spring sampling data provided by the Rio Colorado Reclamation Committee (RCRC), a local group funded by a Technical Assistance Grant (TAG) from EPA.
- Air sampling data and air permit data provided by the NMED Air Quality Bureau [16].

The conclusions reached in this document are based on the data available at this time and might be modified based on the results of additional samples that will be collected during the remedial investigation process.

ATSDR visited the site to better understand the physical setting of the site and its relationship to the people living and working nearby.<sup>1</sup> During these site visits, staff observed the following:

- Tailings spills had occurred at several locations along the tailings pipeline. The pipeline runs along the Red River and acequias in some areas.
- Entrances to the mine site and tailings facility were gated, but access was unrestricted along most of the tailings pipeline.
- Residences were located near sites of former tailings spills, the tailings pipeline, sites of seeps from waste rock piles, and the tailings facility. Livestock and agricultural land were observed near and downgradient of the tailings pipeline and/or tailings facility.
- The former Questa Junior/Senior High School (now Alta Vista Elementary) is about ¼ mile northeast of the tailings piles. The land in between appears vacant with no hills or obstructions that might prohibit dust from blowing onto the school.
- The land use in the general area is mostly rural, agricultural, and forest land, with residential and commercial use mainly in Questa and along the roads.

ATSDR met with residents during a public meeting about the site.<sup>2</sup> ATSDR also spoke to residents and other concerned community members by telephone. The community expressed many health concerns, which are discussed in the Community Health Concerns section of this document. In addition, residents provided the following information about community use of the site:

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<sup>1</sup> Site visits were conducted on June 25, 2003 (ATSDR staff Lisa Hayes, Patrick Young, Leslie Campbell, Debra Joseph, and Kris Larson) and August 27–28, 2003 (ATSDR staff Jill Dyken, Lisa Hayes, and Patrick Young).

<sup>2</sup> A public meeting was held by ATSDR staff in Questa on June 25, 2003. ATSDR staff were also available to meet with the public on June 26, 2003. In addition, ATSDR staff attended an EPA public meeting held on August 27, 2003 and spoke with community members after this meeting.

- People live in areas along the pipeline where tailings spills have occurred.
- Access to the tailings impoundment area is not completely restricted; however, residents rarely enter the area. It is sometimes used as a cut-through by ATV riders.
- Private wells were located downgradient from tailings impoundments and waste rock piles. It is not known how many of these wells are being used for drinking water purposes today.
- People use water from acequias for irrigation and other household uses. Some of the acequias run near the tailings pipeline and were reported to have been affected by tailings spills in the past.
- Citizens reported that municipal water line breaks are thought to result in tailings being introduced into drinking water, because water lines are thought to be buried in tailings.

## **B. Evaluation Process**

The process by which ATSDR evaluates the possible health impact of contaminants is summarized here and described in more detail in Appendix A. The first step involves screening the available data for contaminants of concern (COCs). ATSDR uses comparison values (CVs) to determine which chemicals to examine more closely. CVs are concentrations of chemicals in the environment (air, water, or soil) below which no adverse human health effects should occur. Exceeding a CV does not mean that health effects will occur, just that more evaluation is needed. ATSDR also considers sampling location and data quality; exposure probability, frequency, and duration; and community health concerns in determining which chemicals to evaluate further.

If a chemical contaminant is selected for further evaluation, the next step is to identify which chemicals and exposure situations could be a health hazard. Child and adult exposure doses are calculated for COCs in site media (e.g., soil, groundwater, surface water, sediment, or fish). Exposure doses are the estimated amounts of a contaminant that people come in contact with under specified exposure situations. These exposure doses are further screened by comparing them to appropriate health guidelines for that chemical, including ATSDR's minimal risk level or EPA's reference dose. Health guideline values are considered safe doses; that is, health effects are unlikely below this level. If the exposure dose for a chemical is greater than the health guideline, then the exposure dose is compared to known health effect levels: lowest observed adverse effect levels, the lowest exposure dose that was found to result in health effects in toxicological studies; or no observed adverse effect levels, the highest exposure dose that was found to result in no adverse health effects in toxicological studies. These effect levels are identified in ATSDR's toxicological profiles. If the COC is a carcinogen, the cancer risk is also estimated. These comparisons are the basis for stating whether the exposure is a health hazard.

## **C. Exposure Pathways and Contaminants of Concern**

The following sections describe the various ways people could come into contact with contaminants at the site; each of these ways is called an exposure pathway. Appendix B summarizes the possible exposure pathways for the Molycorp site. If people are unlikely to be exposed to contaminants in a given pathway, then that pathway will not be evaluated further for human health risks.

### ***1. Ingestion of Groundwater from Private Wells***

Although many people in Questa use municipal water for drinking water and household purposes, several private wells located near the mine and tailings facility have been affected by potential site contaminants. Especially in the past, people could have been exposed to contaminants in private well water. According to private citizens, people formerly drank and bathed in wells that were found to be contaminated. Most homes served by these wells have not been connected to the municipal water system. Although the people are not thought to use the water now, the contaminated private wells have not been abandoned and could still be used (although some are not functional). Therefore, it is possible that people could drink this water now or in the future. Groundwater potentially contaminated by the site has been monitored during the remedial investigation by sampling seeps, springs, monitoring wells, extraction wells, and private wells in and around the site. In addition to data from the EPA remedial investigation, ATSDR reviewed historical private well sampling data provided by private citizens and results from NMED testing of private wells in 2001. Table 1 shows the contaminants that were detected at least once above the corresponding drinking water CV in any of these groundwater samples. The second column in Table 1 shows the highest concentration of these contaminants measured in “potential drinking water wells,” defined as any private well or other well ever used or potentially used for drinking purposes. For any one well, if samples were collected over time, those results were averaged.

**Table 1. Groundwater Contaminants Detected Above Comparison Values for Drinking Water [14]**

<b>Contaminant</b>	<b>Highest Concentration Detected in Any Groundwater Sample, µg/L</b>	<b>Highest Concentration Detected in Potential Drinking Water Well (average over time), µg/L</b>	<b>Comparison Value (CV) for Groundwater in µg/L</b>	<b>CV Source (Defined in Appendix A)</b>
2,4,6-Trinitrotoluene	9	No Detections	1	CREG
Aluminum	950,000	40,820	20,000	iEMEG
Ammonia	7,000	Below Comparison Value	3,000	iEMEG
Antimony	174	153	4	RMEG
Arsenic	218	26	3 / 0.02	EMEG/CREG
Barium	1,360	Below Comparison Value	700	RMEG
Beryllium	280	72	20	RMEG
Bis (2-ethylhexyl) phthalate	31	Below Comparison Value	600 / 3	EMEG/CREG
Boron	3,000	1,650	100	iEMEG
Cadmium	250	49	2	EMEG
Chlorine	21,000	21,000	1,000	RMEG
Chromium	503	49	30	RMEG/hexavalent chromium
Cobalt	4,300	153	100	iEMEG
Copper	7,490	894	300	iEMEG
RDX	4	No Detections	0.3	CREG
Fluoride	180,000	25,836	500	EMEG
Iron	420,000	139,000	11,000	EPA Region 9 PRG
Lead	1,660	42	15	EPA AL
Magnesium	1,060,000	110,687	30,000	Recommended Daily Allowance
Manganese	259,000	22,407	500	RMEG
Molybdenum	3,300	2,270	50	RMEG
Nickel	19,200	775	200	RMEG
Nitrate	87,000	Below Comparison Value	20,000	RMEG
Nitrite	4,200	Below Comparison Value	1,000	RMEG
Selenium	71	Below Comparison Value	50	EMEG
Sulfate	9,370,000	1,166,364	500,000	Health-based value from EPA
Thallium	3	Below Comparison Value	2	EPA Region 9 PRG
Vanadium	152	75	30	iEMEG
Zinc	31,400	8,600	3,000	EMEG

The greatest exposures probably occurred in the past when people may have been regularly using private well water. Very little is known about how much well water people drank and what levels of contaminants that water may have contained. However, ATSDR attempted to answer people's questions about the health effects that might have resulted from potential past exposures to contaminated drinking water. Estimates of potential past exposure doses were made for the contaminants that were measured at least once above the corresponding comparison value in potential drinking water wells (second column in Table 1). *However, there is a great deal of*



*uncertainty in this estimation.* ATSDR assumed that adults or children drank and bathed in water containing the highest time-averaged contaminant level, every day for many years. Exposure assumptions are detailed in Appendix A. The estimated exposure dose was then compared with health guideline values and toxicologic information for each contaminant. To evaluate the risk for cancer for carcinogenic compounds, we assumed people drank water with the highest contaminant concentration for 30 years. The following sections describe this evaluation for the COCs detected above the comparison values in wells that could potentially have been used for drinking.

Metals (Aluminum, Antimony, Arsenic, Beryllium, Boron, Cadmium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Molybdenum, Nickel, Vanadium, Zinc)

### Aluminum

Drinking and bathing in drinking water containing the highest level of aluminum would result in an estimated dose for children of 4 mg/kg/day, which is higher than the intermediate minimal risk level for aluminum of 2 mg/kg/day. No chronic minimal risk level for aluminum was available. The estimated adult dose of 1.2 mg/kg/day is lower than the minimal risk level and would not be expected to result in adverse health effects. The highest estimated child dose is less than one tenth of the intermediate duration no observed adverse effect level for neurotoxicity found in a mouse study, 62 mg/kg/day [17]. Therefore, past exposure to the highest level of aluminum in well water would be unlikely to result in health effects in healthy individuals. However, some people could be especially susceptible to aluminum exposure. People who have renal (kidney) failure have a reduced ability to excrete aluminum, ingest aluminum compounds as part of their treatment, may absorb aluminum present in the water used for dialysis, and may absorb more aluminum gastrointestinally. Increased aluminum body burdens in these patients has been associated with skeletal toxicity (abnormal bone mineralization known as osteomalacia, bone pain, fractures, and adjoining muscle problems) as well as blood and neurological problems. The highest level of aluminum measured in a potential drinking water well corresponds to child and adult dosages of 4 and 1.2 mg/kg/day, respectively. For comparison, recommended dosages of aluminum-containing medications can contribute 12–71 mg/kg/day aluminum for antacid/antiulcer products and 2–10 mg/kg/day from buffered analgesics. Although generally recognized as safe dosages, recent studies observed osteomalacia in healthy individuals following long-term use of aluminum-containing antacids. Although the levels measured in drinking water wells are not expected to result in adverse health effects in healthy individuals, aluminum in drinking water may contribute to body burdens and health problems in people with compromised renal function or with high aluminum body burdens for other reasons.

### Antimony

Both child and adult highest estimated doses (0.015 mg/kg/day and 0.005 mg/kg/day, respectively) from drinking and bathing in drinking water containing the highest level of antimony would be higher than the oral reference dose for antimony of 0.004 mg/kg/day. The oral reference dose is based on a rat study that found a lowest observed adverse effect level of 0.35 mg/kg/day for decreased lifespan and changes in blood cholesterol and sugar levels [18]. Other rat studies found less serious cardiovascular effects at a lowest observed

adverse effect level of 0.075 mg/kg/day [19]. It is unlikely that adverse health effects would result from past ingestion of antimony in water from drinking water wells around the site.

#### Arsenic

The child dose, 0.0026 mg/kg/day, from drinking and bathing in water with the highest level of arsenic is higher than the minimal risk level of 0.0003 mg/kg/day. The minimal risk level is based on human epidemiologic studies which found a no observed adverse effect level of 0.0008 mg/kg/day and a lowest observed adverse effect level of 0.014 mg/kg/day for skin changes [20]. The estimated child dose is higher than the no observed adverse effect level but 5 times lower than the lowest observed adverse effect level. The adult dose of 0.0008 mg/kg/day would be equal to the no observed adverse effect level. Past regular drinking of water with this level of arsenic could have increased the risk of noncancerous adverse health effects. Arsenic is a known carcinogen [20]. Drinking the highest level of arsenic in water for a 30-year period would result in a low-to-moderate increased risk of developing cancer.

#### Beryllium

Drinking and bathing in water containing the highest level of beryllium measured over time would result in estimated child and adult exposure doses of 0.008 and 0.005 mg/kg/day, respectively, higher than the minimal risk level of 0.002 mg/kg/day. The minimal risk level is based on a dog study which estimated that a dose of 0.6 mg/kg/day resulted in an increase in the incidence of small intestine lesions [21]. The estimated doses for drinking the highest concentrations of beryllium in water are more than 100 times smaller than this level. Past regular drinking of water with this level of beryllium would not be expected to result in adverse health effects.

#### Boron

Adverse health effects are not likely from exposure to boron by drinking and bathing in water with the highest level of boron. The estimated child and adult doses, 0.17 and 0.05 mg/kg/day, respectively, are both higher than the intermediate minimal risk level of 0.01 mg/kg/day [22]. The intermediate minimal risk level is based on a study which found a lowest observed adverse effect level of 13.6 mg/kg/day for reversible developmental toxicity in dogs. The estimated doses are 80 to 270 times lower than the lowest observed adverse effect level. They are also lower than the dietary tolerable upper intake level of 0.3 mg/kg/day for boron established by the Institute of Medicine and the oral reference dose of 0.2 mg/kg/day [23,18].

#### Cadmium

Drinking and bathing in water containing the highest level of cadmium measured over time would result in estimated child and adult exposure doses of 0.005 and 0.0017 mg/kg/day, respectively. The estimated dose for children is in between the no observed adverse effect level of 0.0021 mg/kg/day and a lowest observed adverse effect level for serious kidney problems of 0.0078 mg/kg/day found in human studies [24]. Regular drinking of water containing this level of cadmium could result in kidney problems. Of the 46 wells potentially used for drinking water in the past, 7 had cadmium levels similar to the

maximum and high enough to increase the risk of serious kidney problems in small children regularly drinking the water. All adult estimated doses are lower than the no observed adverse effect level, so adverse health effects are less likely in adults who drank this water. Animal data indicate that cadmium is a probable human carcinogen [24]. However, there is no oral cancer slope factor for cadmium, so it is not possible to estimate the carcinogenic risk.

#### Chromium

Most of the available data did not specify the type of chromium detected. When the type was not specified, ATSDR conservatively assumed the reported concentrations to be chromium (VI), which is more toxic than chromium (III). The estimated exposure doses for children, 0.005 mg/kg/day, is only slightly higher than the oral reference dose of 0.003 mg/kg/day [18]. This dose is over 100 times lower than the dose that resulted in gastrointestinal pain and blood effects in a chronic exposure human epidemiologic study of 0.57 mg/kg/day; it is also about 10 times lower than the dose that resulted in dermatitis in a human study of 0.036 mg/kg/day [25]. The estimated adult dose of 0.001 mg/kg/day is lower than the oral reference dose. No adverse health effects are expected from past exposure to chromium from drinking or bathing in well water.

#### Cobalt

Adverse health effects are not likely from drinking and bathing in water with the highest level of cobalt. The estimated dose for a child drinking water containing the highest amount of cobalt was 0.015 mg/kg/day, higher than the intermediate duration minimal risk level of 0.01 mg/kg/day. No chronic minimal risk level was available for cobalt. The intermediate minimal risk level is based on a lowest observed adverse effect level of 1 mg/kg/day, which caused a reversible increase in the number of red blood cells in adult male volunteers [26]. The estimated child dose is 60 times lower than this lowest observed adverse effect level and is not likely to have resulted in adverse health effects. The estimated adult dose of 0.004 mg/kg/day is lower than the minimal risk level.

#### Copper

No adverse health effects are expected from drinking and bathing in water with the highest level of copper. The estimated child and adult doses, 0.09 and 0.03 mg/kg/day, respectively, are both higher than the intermediate minimal risk level of 0.02 mg/kg/day. No chronic minimal risk level was available for copper. The intermediate minimal risk level is based on a no observed adverse effect level of 0.315 mg/kg/day for liver effects found in a human study [27]. Because the estimated doses are lower than the no observed adverse effect level, adverse health effects are unlikely from past exposure to copper in well water.

#### Iron

Only one of the private wells tested contained iron at a level above the comparison value, and only one time point of testing for that well was available. Assuming this value represents the average iron concentration in the well, drinking and bathing in water from this well would result in estimated exposure doses to children and adults of 14 and 4 mg/kg/day, respectively. Severe toxic effects are not likely from exposure doses less than

20 mg/kg of body weight [23,28]. The Institute of Medicine has established tolerable upper intake levels for iron ranging from 40 mg/day for infants and children (about 4 mg/kg/day) to 45 mg/day for teenagers and adults (about 0.6 mg/kg/day) [23]. The adult tolerable upper intake level is based on a lowest observed adverse effect level for gastrointestinal effects of 70 mg/day, and the child tolerable upper intake level is based on a no observed adverse effect level of 40 mg/day. For the highest concentration of iron measured, the estimated intakes are high enough to result in gastrointestinal effects such as nausea, constipation, diarrhea, or vomiting. In addition, long-term exposure could cause clinical effects such as accumulation of iron in the liver [29]. The actual risk of health effects occurring from drinking from this one private well depends on the actual concentration of iron in the water and how much water was actually drunk. High iron levels would give the water an unpleasant taste. For the other private wells, iron levels were too low to result in adverse health effects.

### Lead

Levels of lead in children's blood of 10 micrograms per deciliter ( $\mu\text{g}/\text{dL}$ ), and perhaps lower, have been associated with small decreases in IQ and slightly impaired hearing and growth. A slope factor for the increase in blood lead concentration per increase in water lead concentration for infants has been calculated as 0.04  $\mu\text{g}/\text{dL}$  blood per microgram per liter ( $\mu\text{g}/\text{L}$ ) lead for water lead levels above 15  $\mu\text{g}/\text{L}$  [30]. The corresponding slope factor for school children was found to be 0.03  $\mu\text{g}/\text{dL}$  per  $\mu\text{g}/\text{L}$ . Only 4 out of the 46 potential drinking water wells tested contained lead at a level above the EPA action level of 15  $\mu\text{g}/\text{L}$ . At the highest concentration of 42  $\mu\text{g}/\text{L}$  lead measured, the predicted increases in blood lead concentrations for infants and school children are 1.3  $\mu\text{g}/\text{dL}$  and 1.7  $\mu\text{g}/\text{dL}$ , respectively. Although the highest levels of lead measured were clearly higher than drinking water standards and not acceptable, it is unlikely that this past exposure to lead in well water contributed significantly to children's overall body burden of lead.

### Magnesium

The estimated child dose, 11 mg/kg/day, from drinking and bathing in water with the highest level of magnesium is higher than the tolerable upper intake level of 5 mg/kg/day [31]. The adult dose of 3 mg/kg/day is lower than this level. In studies of people taking magnesium supplements, levels around the tolerable upper intake level resulted in mild diarrhea and other mild gastrointestinal effects. In other studies, no adverse effects were noted at the same magnesium levels [31]. The likelihood of people experiencing any adverse effects from drinking magnesium in well water would be lower because the dose would be spread out over the entire day.

### Manganese

Epidemiologic studies suggest an association between ingesting water containing elevated concentrations of manganese and the development of neurological symptoms. However, each of the studies had uncertainty regarding the exposure level or whether the effects were solely attributable to manganese, so that no lowest observed adverse effect level, no observed adverse effect level, or minimal risk level could be identified [32]. Studies with rats have shown a lowest observed adverse effect level for neurological changes as low as

1 mg/kg/day, lower than the estimated child dose of 2.3 mg/kg/day and only slightly higher than the adult dose of 0.8 mg/kg/day. Also, humans appear to be more sensitive to manganese than are other animals [32]. If people regularly drank well water with the highest levels of manganese, their exposure could have increased the risk of neurological effects. However, how much manganese-contaminated water people actually drank is unknown. EPA's secondary maximum contaminant level for manganese, 50 µg/L, is set for aesthetic reasons. Water containing higher levels of manganese (over 22,000 µg/L) would have a bitter metallic taste, would be black to brown color, and would cause black staining on household goods [33]. The highest levels of manganese measured in well water were thousands of times higher than the secondary MCL and would likely have been unacceptable as a regular drinking water source.

### Molybdenum

The estimated highest child and adult exposure doses (0.23 and 0.07 mg/kg/day, respectively) were higher than the oral reference dose of 0.005 mg/kg/day. The oral reference dose is based on a human epidemiological study that found a lowest observed adverse effect level of 0.14 mg/kg/day for increased serum uric acid levels and prevalence of a gout-like sickness in Armenian villagers [18]. A dietary tolerable upper limit of 0.03 mg/kg/day is derived from a rat study in which adverse reproductive effects were encountered at molybdenum levels exceeding the no observed adverse effect level of 0.9 mg/kg/day [23]. Molybdenum is known to interfere with copper metabolism in ruminant animals (grazing animals that "chew their cud," such as sheep or cows); the resulting copper deficiency is reported to cause the animal's hair/wool to turn white [23,29,34]. This is a problem with ruminant animals in particular because high dietary molybdenum reacts with moderate to high dietary sulfur in the rumen (the first stomach) to form thiomolybdates. These compounds greatly reduce copper absorption, and certain thiomolybdate species can be absorbed and interfere systemically with copper metabolism [35]. This interaction between thiomolybdates and copper does not occur to a significant degree in humans [36,37]. Although the exact effect of molybdenum intake on copper status in humans remains to be clearly established, individuals who don't take in enough dietary copper or can't process it correctly could be at increased risk of molybdenum toxicity [23]. If people regularly drank water containing the highest levels of molybdenum measured, they could have had an increased risk of adverse health effects such as gout-like symptoms. The actual risk of health effects occurring depends on the actual concentration of molybdenum in the water and how much water was actually drunk. Only 4 out of the 46 wells tested had average molybdenum levels that would result in doses above the tolerable upper intake, and we do not know how much, how often, and for long people actually drank that water.

Recent studies have reported that molybdenum does not interfere with copper processing in humans [23]. ATSDR staff found no reference to hair color changes in humans from molybdenum exposure in case reports, toxicological studies, and epidemiologic studies reviewed for this report, so it is impossible for us to explain local residents' reports of children in Questa whose hair turned white after drinking molybdenum-contaminated water. The anecdotal reports ATSDR received stated that children's hair turned white starting at the tips. A metabolic cause, if any, would cause hair to turn white starting at the

roots. An apparent whitening of hair tips could be an optical effect if the ends of hairs were frayed or otherwise damaged [38]. However, due to the limited nature of the information available on effects and exposure events that took place years ago, it is impossible for ATSDR to speculate about the cause of the described hair color effects. Molybdenum is not stored at high levels in the body, and exposure of the children to contaminated well water was reportedly stopped relatively quickly [39]. For these reasons, it is unlikely that these children would suffer long-term adverse health effects from this exposure to molybdenum.

#### Nickel

The estimated doses for children and adults drinking and bathing in water containing the maximum concentration of nickel are 0.08 and 0.023 mg/kg/day, respectively. The adult dose is only slightly more than EPA's oral reference dose of 0.02 mg/kg/day for soluble nickel salts and more than 100 times smaller than the no observed adverse effect level of 5 mg/kg/day for decreased body and organ weights in a rat study [18,40]. Although the child dose is higher than the oral reference dose, it is still more than 60 times smaller than the no observed adverse effect level. Oral exposure to nickel has caused skin reactions in sensitive people at doses as low as 0.009 mg/kg/day. In general, reactions are considered unlikely for doses less than the oral reference dose [40]. It is unlikely that health effects occurred from exposure to nickel in well water.

#### Vanadium

No adverse health effects are expected from drinking and bathing in water with the highest level of vanadium. The estimated dose for children was 0.008 mg/kg/day, at least 40 times lower than effect levels for chronic and intermediate oral exposures to vanadium found in animal studies [41]. The estimated adult dose of 0.002 mg/kg/day is lower than the minimal risk level of 0.003 mg/kg/day.

#### Zinc

The child dose, 0.9 mg/kg/day, from drinking and bathing in water with the highest level of zinc is higher than the minimal risk level of 0.3 mg/kg/day [42]. The adult dose of 0.2 mg/kg/day is lower than this level. Chronic and intermediate exposure minimal risk levels are based on changes in blood chemistry seen in women given zinc supplements for 10 weeks. The changes were observed at a lowest observed adverse effect level of 1 mg/kg/day [42]. Children who were regularly exposed to the highest levels of zinc in groundwater may have had changes in blood chemistry, including lower red blood cell counts and lower HDL cholesterol. The actual risk of adverse health effects depends on how much zinc was present in the water and how much water children actually drank.

## Other Inorganics (Chlorine, Fluoride, Sulfate)

### Chlorine

There was only one detection of chlorine in all the wells tested. This detection was at a level that could cause eye or throat irritation or stomach discomfort [33]. However, chlorine is a very volatile and reactive substance; it would not be expected to remain in water at this level for any length of time. None of the other wells tested had any detections, so it is possible that the chlorine detection reported in Table 1 was an anomaly.

### Fluoride

Small amounts of fluoride in drinking water are generally conceded to have a beneficial effect in reducing tooth decay, especially in children. However, intake of excessive fluoride can result in dental fluorosis, with effects ranging in severity from cosmetic discoloration to pitted and weakened tooth enamel. Excess fluoride intake can also cause skeletal fluorosis, with effects ranging from increased bone density to severe crippling deformity, and an increased prevalence of bone fractures in the elderly [29,43]. A dose of 10–20 mg/day (equivalent to about 0.5 mg/kg/day for a 10-year old child) for at least 10 years is considered necessary for the development of crippling skeletal fluorosis [29,43]. Human epidemiological studies showed a chronic no observed adverse effect level for fluoride of 0.15 mg/kg/day and a lowest observed adverse effect level of 0.25 mg/kg/day for increased fracture rate [43]. The estimated child and adult exposure doses, 2.6 and 0.75 mg/kg/day, respectively, are significantly higher than both the no observed adverse effect level and the level commonly cited as leading to skeletal fluorosis. People who regularly drank well water that contained this level of fluoride for a long time have a greater risk of dental fluorosis, crippling skeletal fluorosis, and bone fractures. Of the 21 wells tested that showed detections for fluoride, 9 had average levels of fluoride that would result in an increased risk.

The actual risk of these health effects depends on the actual intake of fluoride and the nutritional status of the individual, among other factors. Fluoride is a naturally occurring mineral at the site, and it is not yet known whether fluoride levels are elevated as a result of mine operations.

### Sulfate

Human studies have shown that sulfate induces a laxative effect in people who are suddenly exposed to concentrations greater than 500,000 µg/L [44]. The highest concentration of sulfate measured in any one well (and about one third of the wells total) contained sulfate at a concentration higher than this level. People appear to develop a tolerance to drinking water with high sulfate concentrations over periods of 7–10 days [44]. Thus, any effects due to drinking well water with high sulfate concentrations in the past were likely to be transient.

## Summary—Ingestion of Groundwater from Private Wells

According to private citizens and others, people do not drink water from known contaminated private wells currently; however, municipal water is not available as an alternate water source for most of the wells, and contaminated wells have not been decommissioned, so drinking could

still occur. In the past, people might have drunk contaminated well water regularly. On the basis of the limited information available, regular drinking of water from some of the wells in the past could have increased the risk for adverse health effects. The levels of arsenic, cadmium, fluoride, iron, magnesium, manganese, molybdenum, sulfate, and zinc were great enough in some wells that regular drinking of water containing the highest levels could increase the risk of adverse health effects, to varying degrees (see the applicable discussion above for each contaminant). The actual risk of adverse health effects occurring depends on how much and how often people actually drank contaminated water and what the contaminant levels in that water actually were. Although reportedly no one in the area is drinking from contaminated wells now, if drinking of water from these wells were to commence again, adverse health effects could result.

## ***2. Inhalation of Tailings Dust***

People downwind of the tailings piles could be exposed to contaminants by breathing in dust blowing off of the piles. There are anecdotal reports of high levels of dust being blown into Questa from the tailings piles, especially before operational changes to minimize dust were implemented sometime in the 1990s. Although past data are limited, ambient air monitoring performed near the former junior/senior high school showed some exceedances of the 24-hour standard for total suspended particulates (TSP) in the 1970s and 1980s. Community members and historical newspaper articles reported that dust in the school, and in Questa in general, was very heavy at times during this period. The dust produced a visible “white cloud,” accumulated in thick layers on school desks each day, and restricted outdoor activities.

In the 1990s, Molycorp changed operating practices at the tailings impoundment facility, restricting the size of uncovered areas and using dust deterrents (personal communication, Randy Mercer, New Mexico Department of Health, June 2003). However, dust is still occasionally reported, especially on windy days [45].

### *Implications of Past Inhalation of Dust (1970s and 1980s)*

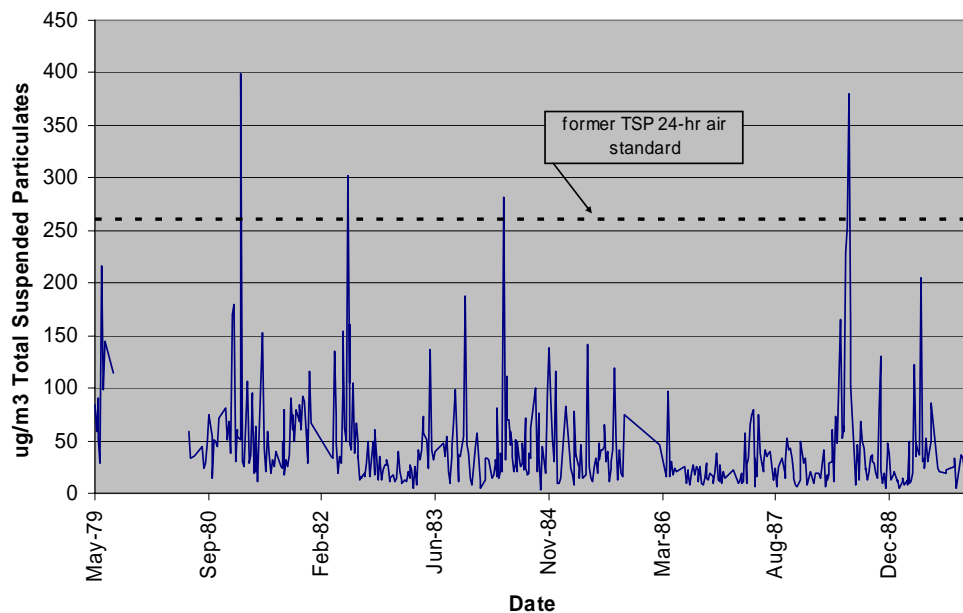
The data for past levels of dust in air, especially for short-term peaks in dust, are limited. **It is impossible to accurately estimate past exposures** of teachers and children at the former junior/senior high school or others in the surrounding community. Because of the community concerns relating to these past exposures, however, ATSDR used the limited information available and professional judgment to form a general idea of the public health consequences that might have resulted from past exposure to wind-blown tailings dust.

NMED’s Air Quality Bureau operated an ambient air monitoring station on the south side of the former Questa Junior/Senior High School to monitor 24-hour averages of TSP from 1979 through 1989 [16]. The sampling was performed on one out of five to seven days. Figure 2 shows that EPA’s former 24-hour air quality standard for TSP,  $260 \mu\text{g}/\text{m}^3$ , was exceeded at the Questa monitoring station on four sampling occasions. 24-hour standards are set to protect the majority of individuals from adverse health effects. Exceeding the standard, even slightly, increases the risk of adverse health effects for sensitive groups, such as people with asthma or other respiratory disease, the elderly, and children (greater exceedances eventually increase the risk of health effects in the general population) [47]. Scientific studies conducted in other places



and published in the 1980s and 1990s showed that a 1%–5% increase in total deaths, and a 10%–50% increase in respiratory or chronic obstructive pulmonary disease hospital admissions in the elderly, resulted for every 100  $\mu\text{g}/\text{m}^3$  increase in TSP, although these effects may be caused more by fine particles not expected to be as prevalent in tailings dust. Coarser particles present in dust are more likely to accumulate in the respiratory system and aggravate health problems such as asthma [48–50]. Short-term exposures to dust in Questa are likely to have been higher than the 24-hour average, increasing the chances that exposed individuals would experience eye, nose, and throat irritation. These symptoms would likely have lessened when the dust level went down and/or exposure to the dust was stopped. To summarize, the limited data indicate that *short-term adverse health effects, including eye and respiratory irritation and respiratory problems in sensitive groups, were possible during periods of high dust levels.*

**Figure 2. 24-Hour Total Suspended Particulate Data from NMED Air Quality Bureau Monitoring, Questa, NM: 1979-1989 [16]**



In addition to health effects from inhalation of particulate matter in general, ATSDR evaluated the potential for health effects resulting from intake of contaminants present in inhaled dust.

Assumptions made in performing these evaluations include the following:

- 1) *All the particles are respirable*—This overestimates the dose because only particles less than about 10 micrometers ( $\mu\text{m}$ ) are small enough to penetrate deeply into the lung where contaminants can be effectively absorbed. No size distribution of dust particles was available.
- 2) *All the dust particles are tailings*—This also overestimates the dose because the dust would actually include a fraction of inert mineral from other sources besides tailings.
- 3) *All metals contaminants are in a highly absorbable form*—Some of the metals may have been weathered to chemical forms that are not so easily absorbed.

The evaluation of contaminant exposures from inhalation of dust was performed in two ways. First, exposure from direct intake of contaminants from inhaled dust through the respiratory

system into the bloodstream was evaluated. Because toxicological effects might differ, inhalation of dust was also evaluated assuming that inhaled dust was absorbed in the gastrointestinal system (as would happen if dust was coughed up and then swallowed). Contaminant concentrations used in performing these evaluations were from sampling of tailings reported in the RI database through November 2003, summarized in Table 2 [14]. ATSDR assumed that the composition of tailings in the 1970s and 1980s was similar to this more recent tailings composition.

**Table 2. Chemical Composition of Tailings from the Molycorp Site [14]**

Contaminant	Concentration, mg of contaminant per kg of tailings		Contaminant	Concentration, mg of contaminant per kg of tailings	
	Highest	Average		Highest	Average
Aluminum	32,200	12,200	Lead	192	77
Ammonia	16	11	Magnesium	18,400	7,940
Antimony	1	1	Manganese	1,130	608
Arsenic*	8	4	Molybdenum*	1,510	283
Barium	220	99	Nickel	58	27
Beryllium	18	3	Phosphorus	1,690	1,030
Bismuth	8	7	Potassium	15,500	5,810
Cadmium	3	1	Scandium	9	7
Calcium	28,800	17,400	Selenium	2	1
Chromium	175	64	Silver	6	1
Cobalt	20	9	Sodium	1,900	404
Copper	295	137	Strontium	253	122
Fluoride	8	3	Sulfate	15,600	3,450
Fluorine* <sup>†</sup>	5,780	4,330	Thallium	1	0
Gallium	10	10	Titanium	1,000	855
Iron*	31,900	17,100	Uranium	3	1
Lanthanum	30	15	Vanadium	84	39
			Zinc	366	160

\* Maximum levels are above soil comparison values and/or typical soil levels.  
<sup>†</sup> Reported fluorine concentration in soil refers to total fluorine; a minimal amount is likely to be in the most highly reactive elemental form.

#### Direct Uptake of Inhaled Tailings Dust

The potential for inhalation of tailings dust to result in health effects was evaluated for short- and long-term exposures. Contaminant air concentration that people might breathe in was calculated using the following equation:

$$\text{Air Conc} \left( \frac{\mu\text{g contaminant}}{\text{m}^3 \text{air}} \right) = C_{\text{contam}} \left( \frac{\text{mg contaminant}}{\text{kg tailings}} \right) \times C_{\text{dust}} \left( \frac{\mu\text{g tailings}}{\text{m}^3 \text{air}} \right) \times 10^{-9} \frac{\text{kg}}{\mu\text{g}} \times 10^3 \frac{\mu\text{g}}{\text{mg}}$$

For short-term exposure, ATSDR assumed the contaminant concentration ( $C_{\text{contam}}$ ) was the highest measured in tailings and that the dust level in the air ( $C_{\text{dust}}$ ) was  $400 \mu\text{g}/\text{m}^3$  (the highest TSP concentration shown in Figure 2). For long-term exposure, ATSDR assumed  $C_{\text{contam}}$  was the average concentration in tailings and that  $C_{\text{dust}}$  was  $50 \mu\text{g}/\text{m}^3$  (the average of the 24-hour TSP measurements shown in Figure 2).

The short-term air concentrations were all at least 100 times lower than occupational standards. Intermittent exposures to these levels are not expected to have resulted in adverse health effects. Long-term air concentrations of contaminants were lower than available air CVs, with the exception of chromium. This contaminant was estimated at an average long-term concentration of  $0.0036 \mu\text{g}/\text{m}^3$ , higher than the CREG for hexavalent chromium of  $0.00008 \mu\text{g}/\text{m}^3$ . ATSDR does not consider this exceedance to indicate a past exposure of concern, however, because most chromium in soil is present as less toxic chromium (III), not hexavalent chromium (chromium [VI]). Also, only a fraction of the chromium in dust would be bioavailable, or easily absorbed into the bloodstream. The estimated average chromium concentration is within typical chromium levels measured in urban environments in the United States [25]. *In summary, on the basis of the limited past data, past short- or long-term exposures through inhalation of tailings dust are not expected to have resulted in adverse health effects.*

#### Indirect Ingestion of Inhaled Tailings Dust

Inhalation of dust was also evaluated assuming that inhaled dust was absorbed in the gastrointestinal system (as would happen if dust was coughed up and then swallowed). To obtain the exposure dose in milligrams contaminant per kilogram body weight per day (mg/kg/day), the following equation was used:

$$ED \left( \frac{\text{mg}}{\text{kg} \cdot \text{day}} \right) = \frac{C_{\text{contam}} \left( \frac{\text{mg}}{\text{kg tailings}} \right) \times C_{\text{dust}} \left( \frac{\mu\text{g tailings}}{\text{m}^3 \text{air}} \right) \times 10^{-9} \frac{\text{kg}}{\mu\text{g}} \times R_{\text{inh}} \left( \frac{\text{m}^3 \text{air}}{\text{hr}} \right) \times T \left( \frac{\text{hr}}{\text{day}} \right)}{BW(\text{kg})}$$

where ED is exposure dose,  $C_{\text{contam}}$  is the concentration of contaminant in tailings,  $C_{\text{dust}}$  is dust concentration in air,  $R_{\text{inh}}$  is the inhalation rate, T is the hours of exposure per day, and BW is body weight.

Because short-term dust concentrations could be significantly higher than the 24-hour average, ATSDR estimated a “worst case” ingestion/inhalation exposure by assuming a 10-year old child was exposed to respirable particles containing the highest concentration of each contaminant of concern measured in tailings. The exposure was assumed to be to a level of respirable particles of  $4800 \mu\text{g}/\text{m}^3$  for 1 hour a day and a concentration of  $400 \mu\text{g}/\text{m}^3$  for 8 hours per day. The rate of inhalation during exposure was assumed to be  $1.9 \text{ m}^3$  per hour (inhalation rate for children engaged in heavy activity), and the child was assumed to weigh 36 kg (80 pounds, mean weight for a 10-year-old child) [51]. Finally, it was assumed that all tailings dust breathed in was coughed up and swallowed, and that 100% of each contaminant was absorbed from the gastrointestinal tract.

All of the estimated doses were at least 10 times smaller than the corresponding health guideline. *Therefore, no adverse health effects from any of the contaminants inhaled from tailings dust in the 1970s and 1980s are expected.*

### *Implications of Past Inhalation of Dust (1990s)*

For later dates, ambient monitors measured a subset of TSP consisting of particulate matter smaller than 10 microns in diameter (PM<sub>10</sub>). Monitors measured PM<sub>10</sub> levels at the junior/senior high school; both hourly and 24-hour average values were available. Figure 3 shows that the 24-hour PM<sub>10</sub> measurements were within regulatory requirements from 1993–1999. As shown in the hourly PM<sub>10</sub> results (Figure 4), short-term air concentrations can be significantly higher than the 24-hour averages; however, there are no health-based standards for short-term PM<sub>10</sub> levels. All 24-hour average PM<sub>10</sub> values were less than the 24-hour air quality standard. As with TSP, the 24-hour standard was developed to protect most individuals from adverse health effects. Exceeding the standard may be unhealthy for sensitive groups like people with asthma or other respiratory disease, the elderly, and children [47]. Risk estimates from total mortality epidemiologic studies suggest that an increase of 10 µg/m<sup>3</sup> in the 24-hour PM<sub>10</sub> level is associated with increased risks of adverse health effects of 0.5%–1.5%, with even higher risks possible for elderly subpopulations and for those persons with preexisting respiratory conditions [52,48]. As indicated by intermittent peaks in Figure 3 and as reported by people in the Questa community, on some days PM<sub>10</sub> levels were appreciably elevated due to wind blowing dust from the Molycorp tailings facility. *The short-term (hourly) PM<sub>10</sub> increases might have increased the risk of adverse health effects, especially for sensitive populations.*

To determine whether inhalation or indirect ingestion of contaminants in PM<sub>10</sub> in the 1990s could increase the risk of adverse health effects, ATSDR assumed that PM<sub>10</sub> made up 60% of the total suspended particulate matter breathed in and that contaminant concentrations were the same for all the dust. Estimated doses for both inhalation and ingestion of tailings dust were calculated in the same way as for the 1970s and 1980s data described above. The estimated doses were lower than the “worst case” estimates from the 1970s and 1980s and were lower than applicable health guidelines. *Therefore, no adverse health effects from any of the contaminants inhaled from tailings dust in the 1990s are expected.*

### *Implications of Present Inhalation of Dust*

According to comments received by ATSDR, “as recently as January 2003 blowing tailings dust in Questa resulted in complaints to state agencies about the problem” [45]. Molycorp performed two studies between February 2003 and February 2004 to assess potential impact to local air quality from the tailings facility [46]. No exceedances of the 24-hour or annual PM<sub>10</sub> standards were observed in monitors located in three locations potentially impacted by the tailings facility, and analysis of dust suggested that local soils contributed more to dust than did tailings [46]. *No adverse health effects from current exposure to tailings dust or tailings contaminants in dust are expected. However, as in other areas, sensitive populations could experience adverse health effects from short-term peaks in dust, regardless of the source.*

Figure 3. 24-Hour PM10 Data from NMED Air Quality Bureau Monitoring, Questa, NM: 1993–1999 [16]

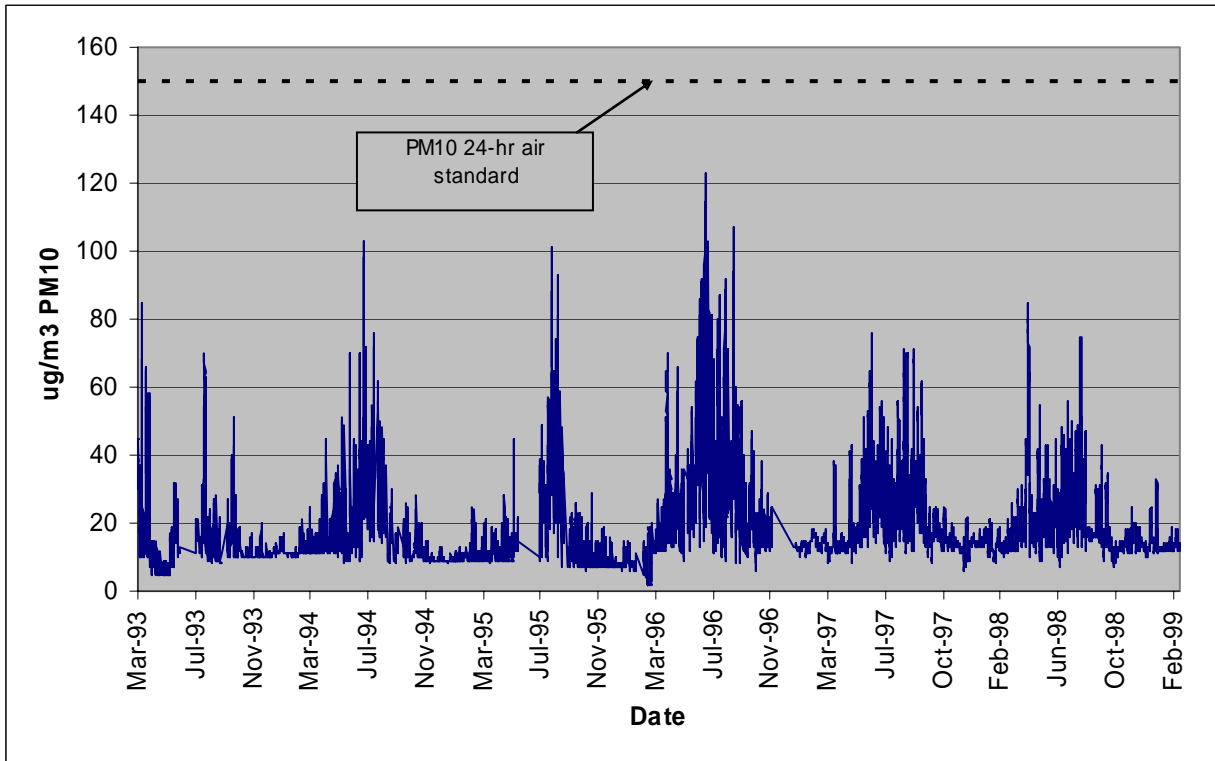
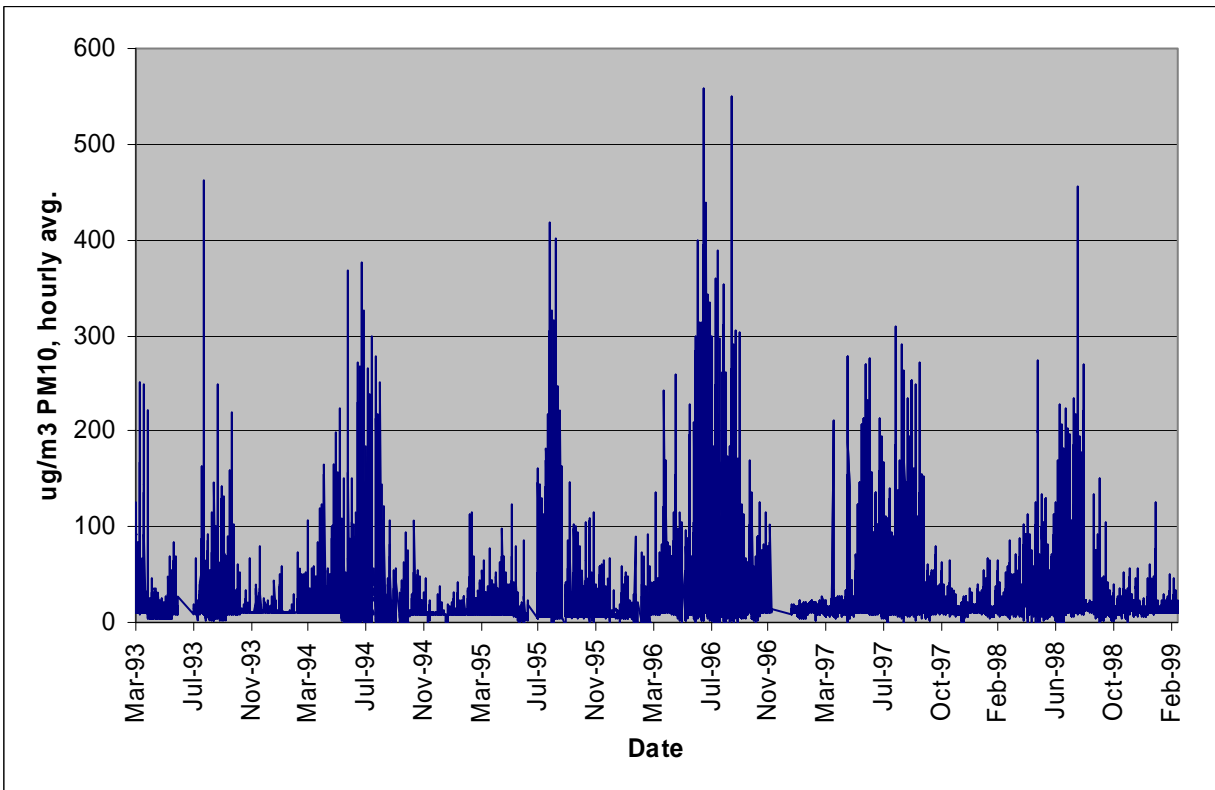


Figure 4. Hourly PM10 Data from NMED Air Quality Bureau Monitoring, Questa, NM: 1993–1999 [16]



### 3. Incidental Ingestion of Soil or Tailings

People who are in areas where tailings are present could come into contact with them or soil contaminated by them. People could get particles of tailings or soil on their skin, or they might accidentally eat or breathe in the particles. Surface soil and tailings from several areas around the site (mine site, tailings impoundments, and other locations) have been sampled and analyzed for contaminants. In our initial screening, we conservatively assumed that people would contact the tailings as much as they would the soil. Table 3 lists the contaminants found in tailings and surface soil at levels above soil CVs.

**Table 3. Tailings or Surface Soil Contaminants Detected Above Comparison Values for Soil [14]**

Contaminant	Average concentration, parts per million (ppm)	Maximum concentration, ppm	Comparison Value (CV) for soil in ppm	CV Source (Defined in Appendix A)
<b>Tailings:</b>				
Arsenic	4	8	0.5	CREG
Fluorine	4,330	5,780	2,000	RMEG
Iron	17,100	31,900	23,000	EPA Region 9 PRG
Molybdenum	283	1,510	300	RMEG
<b>Surface Soil:</b>				
Aroclors (1248, 1254, 1260)	4.64	140	0.22	EPA Region 9 PRG
Arsenic	4	186	0.5	CREG
Cadmium	0.8	19.9	10	EMEG
Chromium	33	1,725	200	RMEG / hexavalent chromium
Copper	93	5,870	2,000	iEMEG
Iron	24,240	156,000	23,000	EPA Region 9 PRG
Lead	97	4,290	400	SSL
Manganese	610	4,650	3,000	RMEG
Molybdenum	1,153	189,000	300	RMEG
Thallium	0	33	5.2	EPA Region 9 PRG
Vanadium	39	2,580	200	iEMEG
PAH TEQ	1.8	24	0.09	EPA SSL

For further screening, we estimated worst-case exposure doses for the contaminants listed in Table 3. The exposures were estimated for adults or children as young as 1 year old who contact the average concentrations in surface soil or tailings 4 times a week for 9 months out of the year, over many years. Appendix A provides details of the assumptions used to perform these calculations. For almost all of the contaminants, estimated exposure doses resulting from this exposure are lower than health guideline values and therefore are not expected to result in health effects. Estimated exposure to Aroclors and to molybdenum was greater than the corresponding health guideline value and will be evaluated further in the following paragraphs.

### Aroclors

Aroclor is a trade name applied to different mixtures of polychlorinated biphenyls (PCBs) used commercially before 1980. There are differences in PCB composition between the different Aroclor products. To be conservative, the concentrations of Aroclor 1248, 1254, and 1260 detected in each soil sample were added to obtain a “worst case” estimate of potential dose. The estimated child exposure dose of 0.000075 mg/kg/day was higher than the minimal risk level of 0.00002 mg/kg/day, and the adult dose (0.00001 mg/kg/day) was lower than the minimal risk level [53]. The minimal risk level is derived from an animal study that found a lowest observed adverse effect level for decreased antibody response of 0.005 mg/kg/day. The estimated child and adult doses are 60–500 times smaller than the lowest observed adverse effect level. In addition, the samples where Aroclors were detected were exclusively taken from the mine site. Because access is limited and it would be extremely unlikely for a child to spend any time on site, actual exposure is likely to be negligible. Therefore, exposure to Aroclors in soil is not expected to result in any adverse health effects to generally exposed children or adults.

### Molybdenum

The estimated child exposure dose of 0.011 mg/kg/day is higher than the oral reference dose of 0.005 mg/kg/day, but it is lower than the dietary tolerable upper limit of 0.03 mg/kg/day [23]. The estimated adult dose is lower than the oral reference dose. Therefore, no adverse health effects would be expected from exposure to molybdenum in surface soil.

## ***4. Incidental Ingestion/ Dermal Contact—Surface Water***

Contaminated groundwater and water from seeps and springs may enter surface water in the Red River or acequias. Spills from the tailings pipeline might also contribute to surface water contamination. No use of this water for drinking water purposes was identified, but people who wade or swim in surface waters on the site will get surface water on their skin and might accidentally ingest some of the surface water. To identify contaminants of concern in surface water for direct incidental contact, we used CVs that were 10 times the corresponding drinking water CVs. This assumes that incidental ingestion and dermal exposure would be one-tenth as much as regular drinking water exposure, so that the concentration of contaminant would need to be 10 times as much to result in the same dose. As shown in Table 4, 18 contaminants were detected above the corresponding surface water CVs.

**Table 4. Surface Water or Seep Contaminants Detected Above Comparison Values for Surface Water [14]**

Contaminant	Average concentration in surface water, micrograms per liter ( $\mu\text{g/L}$ )	Maximum concentration in surface water, $\mu\text{g/L}$	Comparison Value (CV) for surface water in $\mu\text{g/L}$ *	CV Source (Defined in Appendix A)
Aluminum	68,271	1,560,000	200,000	Drinking water iEMEG $\times 10$
Antimony	20	139	40	Drinking water EMEG $\times 10$
Arsenic	20	230	0.2	Drinking water CREG $\times 10$
Benzo(a)pyrene	0.1	0.1	0.050	Drinking water CREG $\times 10$
Beryllium	45	536	200	Drinking water RMEG $\times 10$
Cadmium	37	661	20	Drinking water EMEG $\times 10$
Chromium	83	729	300	Drinking water RMEG $\times 10$
Cobalt	323	4,740	1,000	Drinking water iEMEG $\times 10$
Copper	553	13,900	3,000	Drinking water iEMEG $\times 10$
Fluoride	5,762	208,000	22,000	Drinking water R9 PRG $\times 10$
Iron	50,306	1,290,000	110,000	Drinking water R9 PRG $\times 10$
Lead	39	3,020	150	Drinking water AL $\times 10$
Magnesium	47,664	1,200,000	650,000	Drinking water TUI $\times 10$
Manganese	20,248	675,000	5,000	Drinking water RMEG $\times 10$
Molybdenum	176	4,000	500	Drinking water RMEG $\times 10$
Nickel	424	10,400	2,000	Drinking water RMEG $\times 10$
Sulfate	734,184	22,000,000	2,500,000	Drinking water SMCL $\times 10$
Zinc	5,852	164,000	30,000	Drinking water EMEG $\times 10$

\* Surface water CV calculated as 10 times the drinking water CV because incidental surface water ingestion was assumed to be one-tenth of the normal drinking water ingestion.

For further screening, worst-case exposure doses for the contaminants listed in Table 4 were then estimated for adults or children 6 years or older who contact the average concentrations in surface water or seeps 4 times a week for 6 months out of the year, over many years. Details of the assumptions used to perform these calculations can be found in Appendix A. All estimated exposure doses resulting from this exposure are lower than health guideline values and therefore are not expected to result in health effects.

### ***5. Incidental Ingestion/ Dermal Contact—Sediment***

People who swim in the river might accidentally ingest some of the river sediments or get the sediments on their skin. Sediment CVs were not available, so sediment CVs were set at 10 times the corresponding soil CV. This is because it was assumed that sediment would be contacted one-tenth as much as soil particles, so that the concentration of contaminant would need to be 10 times as high for the same dose. As shown in Table 5, arsenic, cadmium, and molybdenum were detected above the corresponding sediment CVs.



**Table 5. Sediment Contaminants Detected Above Comparison Values for Sediment [14]**

Contaminant	Average concentration in sediment, parts per million (ppm)	Maximum concentration in sediment, ppm	Comparison Value (CV) for sediment in ppm*	CV Source (Defined in Appendix A)
Arsenic	5	16	5	Soil CREG × 10
Cadmium	23	3,820	100	Soil EMEG × 10
Molybdenum	66	19,400	3,000	Soil RMEG × 10
* Sediment CV calculated as 10 times the soil CV because sediment ingestion was assumed to be one-tenth of the average soil ingestion.				

For further screening, worst-case exposure doses for the contaminants listed in Table 5 were then estimated for adults or children 6 years or older who contact the average concentrations in sediment 4 times a week for 6 months out of the year, over many years. Appendix A provides details of the assumptions used to perform these calculations. Estimated exposure doses resulting from this exposure are lower than health guideline values and therefore are not expected to result in health effects.

## D. Potential Exposure Pathways

### 1. Ingestion of Questa Municipal Water

The Village of Questa's municipal water is obtained from groundwater drawn from two supply wells located generally on the northeast side of the village, west of the Sangre de Cristo mountain front [12,54]. The wells draw groundwater from 295 feet and 350 feet below ground surface [12]. These wells are subject to the federal Safe Drinking Water Act and the New Mexico Drinking Water Regulations. They undergo routine testing for inorganic chemicals (including metals), organic chemicals, radiochemicals, and microbiological contaminants. The only violations reported for the Questa water system are four instances of excess coliform, an indicator of possible bacterial contamination (in September 1996, August 1999, November 2001, and January 2002) [55]. The New Mexico state legislature has designated funding for upgrading the water system [56]. Biological contamination, while an important public health issue, does not appear to be related to operations at the Molycorp mine and will not be evaluated further.

Routine testing has shown the Questa source water to meet drinking water standards for metals [57]. However, it was recently brought to light that many of the municipal water lines were buried in tailings from Molycorp operations when the lines were installed in 1968 as part of the village's efforts to upgrade and install the current water system [13]. Many citizens expressed concern that these tailings or contaminants leached from the tailings could enter the water lines through breaks in the lines, especially at times when there is a loss of pressure in the system, and result in contaminated water at residential taps. To address these questions, the Village of Questa and EPA collected water samples from several residential taps in Questa in September 2003 [58,59]. All metals levels in these samples were well below drinking water standards and/or ATSDR comparison values. *No adverse health effects from drinking this water are expected.*

Some individuals felt that the September 2003 tap sampling may not have been representative of times when tailings or other contaminants entered the system. They raised the possibility that

contaminants could enter municipal lines on an intermittent basis, on the basis of local residents' reports that home filters were being clogged with solids at an unusually high rate. Although some homes have filters to remove suspended materials that may be present in the water, it is possible that people at homes without filters could drink water containing suspended tailings, if tailings did intermittently enter the water lines. We emphasize that *we have no evidence showing that water from municipal water lines has been infiltrated with suspended tailings, or further that people have drunk such water*. However, to address the questions we have received about whether such contamination could result in adverse health effects, ATSDR evaluated potential health effects, if this were to occur, using "worst case" assumptions about potential tailings contamination.

The "worst case" assumptions made are described here. We assumed that residential water lines were, twice a week, contaminated with tailings used to bury the lines. We assumed that the water would contain a level of suspended solids, consisting purely of tailings, of 150 milligrams of tailings solids per liter of water. This level of suspended solids would appear "dirty" to the naked eye and it would be unlikely people would drink a large quantity of it. To be conservative, however, we further assumed that an adult would drink 2 liters, and a small child would drink 1 liter, per day of this water. We also assumed that each contaminant present in the tailings suspended in the water was at the maximum level detected in any tailings sampled during the remedial investigation. Using these assumptions, potential exposure doses were calculated for each of the contaminants. All the estimated "worst case" doses were lower than health guideline values. *Therefore, in the unlikely event people regularly drank water containing some tailings, adverse health effects would not be expected.*

Some individuals also raised the possibility that during times of wet soil conditions, the water in the tailings bed could become acidic due to pyrite generation in the tailings and leach metals out of the tailings. This contaminated water might then enter the municipal water lines if the lines were depressurized. ATSDR considers this exposure pathway very unlikely, because groundwater would be unlikely to be in contact with tailings for a long enough time and to become acidic enough to leach significant amounts of metals out of the tailings. In addition, only a small amount of the groundwater would be likely to enter the water lines during a time of depressurization. Once normal water pressure was restored, any extraneous water would be immediately diluted and restored to a normal pH, such that any dissolved metals would fall back out of solution. ATSDR considers potential exposures through this scenario would only be a small fraction of the "worst case" calculations for drinking of suspended tailings in the preceding paragraph.

Questa is in the process of replacing the municipal water system [60]. This will remove any question about the possibility of tailings entering the system.

## ***2. Ingestion of Garden Vegetables***

In addition to direct incidental contact with surface water contaminants, people who use the surface water to irrigate crops or garden vegetables might be indirectly exposed to surface water contaminants. In summer 2003, representative beans, zucchini, and lettuce from gardens in Questa and were sampled and tested for metals [14]. ATSDR estimated an average dose for each contaminant using typical consumption rates for each vegetable [51]. All the estimated doses were below health guideline values and therefore are not expected to result in adverse health effects.

Sampling of washed and unwashed vegetation in the area indicated that some contaminants might be present in soil or dust on the surfaces of vegetation. To minimize the chance for exposure to contaminants, crops and vegetables grown using surface water in the area should be washed before being eaten.

## ***3. Ingestion of Fish from the Red River***

In addition to direct incidental contact with surface water and sediment contaminants, people who eat fish from the river might be indirectly exposed to contaminants. EPA performed sampling of fish from the Red River in fall 2002 and fall 2003 as part of the remedial investigation. According to an EPA informational bulletin published in April 2004, the fish sampling results showed that all metals in fish tissue were below levels that could present a health risk. Arsenic in tissue samples of rainbow trout raised at the Red River Fish Hatchery were above the screening level, but further testing showed that the arsenic was in an organic form posing little or no human health threat. In addition, the source of the arsenic was traced to the fish food used at the hatchery [62].

Because most of the fish caught and consumed from the Red River are hatched in the Red River Fish Hatchery, they do not live in contaminant-impacted areas of the Red River long enough to build up appreciable amounts of contaminants in their tissues. They are, however, susceptible to surface water contamination, and a number of fish kills have been attributed to spills of tailings or other mine-related contaminants [6].

## **E. Physical Hazards**

Long-term stability of the waste rock piles has been questioned. The following information was obtained from the Mining and Mineral Division (MMD) of the New Mexico Energy, Minerals, and Natural Resources Department [63]. A Stability Review Committee (SRC) has been established to examine the failure risk of all waste rock piles. The SRC includes representatives from the Village of Questa, Amigos Bravos, NMED, MMD, and Molycorp. Molycorp submitted a plan for the Goathill North Rock Pile Mitigation Project Final Design to MMD and NMED on May 27, 2004. On June 16, 2004, MMD and NMED issued a joint letter of approval. Completion of the mitigation project is slated for August 2005. Analysis of the other rock piles continues.

## **F. Child Health Considerations**

ATSDR recognizes that infants and children might be more vulnerable to exposures than adults in communities faced with contamination of their air, water, soil, or food. This vulnerability is a result of the following factors:

- Children are more likely to play outdoors and bring food into contaminated areas.
- Children are shorter, so they are more likely to breathe dust, soil, and heavy vapors close to the ground.
- Children are smaller, resulting in higher doses of chemical exposure per body weight.
- The developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages.

Because children depend completely on adults for risk identification and management decisions, ATSDR is committed to evaluating their special interests at the site.

The major exposure pathways for children around the Molycorp site are past inhalation of dust from tailings piles and past ingestion of contaminated groundwater from private wells. At present, children's main exposure pathways are incidental ingestion and skin contact with surface water and sediment and incidental ingestion of surface soil. These present exposure pathways are not expected to result in appreciable exposure of children to site contaminants. Refer to the appropriate section for discussion of the possible health effects for children to contaminants associated with the site.

## **G. Health Outcome Data**

Health outcome data can be used to give a more thorough evaluation of the public health implications of a given exposure. Health outcome data can include mortality information (for example, the number of people who have died from a certain disease) or morbidity information (for example, the number of people in an area who have a certain disease or illness).

To thoroughly evaluate health outcome data as it relates to a hazardous waste site, four elements are necessary:

- 1) the presence of a completed human exposure pathway,
- 2) sufficiently high contaminant levels to result in measurable health effects,
- 3) a sufficient number of people in the completed pathway for the health effect to be measured, and
- 4) a health outcome database in which disease rates for populations of concern can be identified.

To our knowledge, an official database containing disease rates for the Questa area is not available. Even if it were, contaminant levels for pathways that would have affected the general population (soil, surface water, sediment) were not and are not high enough to result in an increased risk of adverse health effects. In the past, the general population might have occasionally been exposed to enough dust blowing off of the tailings piles to increase the risk of short-term eye and respiratory irritation and respiratory effects in sensitive groups. However, these past health effects cannot be measured effectively today. Dust levels measured in the 1990s

(and expected to be similar today) are within ambient air quality standards and not likely to result in measurable adverse health effects in the general population. Also in the past, people who regularly drank highly contaminated private well water could have experienced adverse health effects as a result of their exposure to contaminants. However, because few details are known about each individual's specific activities and the exact level of contaminants they might have been exposed to, it is impossible to directly and definitely link their potential past exposure with past or current health status.

## **H. Community Health Concerns**

An earlier version of this document was released for public comment in September 2002. ATSDR received several comments about the lack of sufficient contact with and notification of the community. In response to these comments and through negotiations with community members, ATSDR issued a revised public health assessment for the site. In the revised document, we evaluated additional exposure pathways and community health concerns, attempted to address many of the concerns expressed about the previous document, and included additional data collected during EPA's remedial investigation. ATSDR presented and discussed the findings of the revised public health assessment to the Questa community on September 22 and 23, 2004. Public comments were accepted on the revised public health assessment from September 5 to October 22, 2004. This final version of the public health assessment addresses the written comments received, which are included in their entirety with ATSDR responses in Appendix D.

ATSDR staff spoke with local residents in a public availability session held June 25, 2003 in Questa and after an EPA public meeting held in Questa on August 27, 2003. During the meetings, ATSDR asked community members to share their health concerns related to contaminants at the site. ATSDR also collected health concerns from community members by email and by telephone. Community members thought a number of health problems might be related to contaminants at the Molycorp site; these are listed in Table 6. The next section summarizes what is known about the relation of these health problems to contaminants at the Molycorp site.

Table 6. Health Concerns Expressed by Community Members

Health Problem	Comment	Any association with contaminants found at this site?	How do the levels at this site compare?
<b>Immune System Problems:</b>			
Allergies		None known.	N/A
Immune system deficiencies		Very high blood lead levels associated with immune system changes [30].	Lead not found at high enough levels to result in elevated blood lead levels
Chronic fatigue syndrome		None known.	N/A
Thyroid problems		None known.	N/A
<b>Neurological Problems:</b>			
Alzheimer's disease	Genetic factors thought to play a causal role [64].	Conflicting reports on association with aluminum intake [65].	Estimated exposure to aluminum not high enough to result in adverse health effects.
Bell's palsy	Partial or complete paralysis on one side of the face; usually temporary	No; cause of this condition is probably viral [66].	N/A
Mental disturbances	Including stress disorders, anxiety, mood swings, panic attacks, depression, bipolar disorder, attention deficit and hyperactivity disorder (ADHD)	Very high levels of lead, manganese have been associated with ADHD, behavioral problems, and psychiatric disturbance [30,32]. Stress from living near hazardous wastes may influence mental state more than the waste itself [67].	Estimated exposure to lead not high enough to cause effects. Some private wells used for drinking in the past had manganese levels high enough to increase the risk for adverse effects. People in community could have experienced stress from community conflicts, litigation related to the site.

Health Problem	Comment	Any association with contaminants found at this site?	How do the levels at this site compare?
Learning disabilities		Elevated levels of lead in children's blood associated with learning disabilities and cognitive impairment [30]. Some studies have linked excessive manganese ingestion with learning disabilities [32].	Lead not found at high enough levels to result in elevated blood lead levels in children. Some private wells used for drinking in the past had manganese levels high enough to result in adverse effects. Other manganese estimated exposures not high enough to cause effects.
Migraine and cluster headaches		None known. Stress or anxiety can trigger migraines or cluster headaches [68].	N/A
Hearing loss and ear problems		Some studies have indicated that very high blood lead levels adversely affect auditory function in children [30].	Lead not found at high enough levels to result in elevated blood lead levels in children.
Nerve problems		Excessive arsenic, manganese exposures can lead to neuropathy [20,32].	No arsenic levels were high enough to result in adverse health effects. Some private wells used for drinking in the past had manganese levels high enough to result in adverse effects. Other manganese estimated exposures not high enough to cause effects.
<b>Musculoskeletal Problems:</b> Tooth discoloration and decay		Very high fluoride levels can result in tooth discoloration or weakening of the enamel [43].	Some private wells that supplied drinking water in the past had fluoride levels high enough to cause tooth problems. Fluoride was not elevated in Questa municipal water.

Health Problem	Comment	Any association with contaminants found at this site?	How do the levels at this site compare?
Bone problems		Very high fluoride levels can result in increased bone fractures in the elderly or skeletal fluorosis [43]. High body burdens of aluminum could contribute to abnormal bone mineralization and other bone problems in especially susceptible people such as those with renal failure.	Some private wells that supplied drinking water in the past had fluoride levels high enough to cause bone problems. Fluoride was not elevated in Questa municipal water. Some private wells contained aluminum which may contribute to bone problems in people with high aluminum body burdens.
Osgood Schlatter disease	Knee pain common in athletic teenagers	Caused by overuse during exercise and sports, especially during the teenage growth spurt [69].	N/A
Fibromyalgia		None known.	N/A
Muscle aches and strains		None known.	N/A
<b>Other Problems:</b>			
Hepatitis		None known	N/A
Kidney problems	Renal problems	Ingesting lead or cadmium associated with renal problems [30,24]. Inhaling beryllium or cadmium increased risk of renal diseases [21,24].	7 out of 46 private wells tested had cadmium levels high enough to increase the risk of serious kidney effects in children. Elevated contaminant levels in surface soil, surface water, sediment, and other private wells used for drinking in the past, but estimated exposure not high enough to cause kidney problems.



Health Problem	Comment	Any association with contaminants found at this site?	How do the levels at this site compare?
Gastrointestinal problems		Very high levels of sulfate in drinking water can cause diarrhea and other gastrointestinal problems until people get acclimated (7–10 days) [44]. Very high intakes of some metals can lead to gastrointestinal distress (nausea, abdominal pain, etc.)	Some private wells that supplied drinking water in the past had sulfate levels high enough to result in adverse effects. Sulfate was not elevated in Questa municipal water. One private well had iron levels high enough to cause gastrointestinal distress. Elevated metals levels in surface soil, surface water, sediment, and the other private wells used for drinking in the past, but estimated exposure not high enough to cause this effect.
Hypertension	High blood pressure	Some studies have found associations between arsenic in drinking water or elevated blood lead levels and hypertension [20,30].	No arsenic or lead levels were high enough to result in increased risk of hypertension.
Chronic respiratory problems	Including asthma, chronic obstructive pulmonary disease (COPD)	Particulate matter in air can aggravate asthma and contribute to COPD [47,48,52]. Breathing some metals can lead to COPD.	Occasionally, past particulate levels were high enough to increase risk of respiratory problems. No metals levels were high enough to increase the risk of disease.
White discoloration of fingernails	Also known as leukonychia	Very high levels of selenium can cause nail deformity and loss; not known to be associated with discoloration.	Selenium levels measured in site media not high enough to result in disease.
Bulging eyeballs	Typically associated with thyroid disease or tumors of the eye	None known.	N/A

Health Problem	Comment	Any association with contaminants found at this site?	How do the levels at this site compare?
Whitening of hair tips		Although molybdenum can cause hair whitening in grazing animals, this does not occur in humans [34–37].	N/A
Skin rashes		Allergic contact dermatitis can result from exposure to metals [61].	Exposure to metals in tailings and soil is too low to result in skin effects.

In addition to concerns about specific health problems, community members expressed other concerns about exposures and public health implications of contaminants from the site, listed below.

**Concern:** *What is the potential for people to be exposed to contaminants through the Questa municipal water supply, considering that the water lines are known to have been buried in tailings from the mine?*

**Response:** As described in the “Ingestion of Questa Municipal Water” section of this document beginning on page 27, source water for the municipal system was tested and found to meet water quality standards for metals. However, because at least some water lines leading to residences are buried in tailings, there is the potential for contaminated tailings to seep into the water lines during times of depressurization. This would likely be intermittent. Residential tap sampling in the fall of 2003 detected no contaminants exceeding water quality standards. ATSDR performed “worst case” calculations assuming a resident occasionally drank water containing a moderate amount of suspended tailings. These calculations indicated that *no short-term or long-term health effects would be expected*. Further details can be found in the “Ingestion of Questa Municipal Water” section of this document beginning on page 27.

**Concern:** *What are the health implications of eating fish from the Red River?*

**Response:** According to an EPA informational bulletin published in April 2004, fish sampling along the Red River showed that all metals in fish tissue were below levels that could present a health risk. Arsenic in tissue samples of rainbow trout raised at the Red River Fish Hatchery was above the screening level, but further testing showed that the arsenic was in an organic form posing little or no human health threat [62].

**Concern:** *What information on chronic respiratory problems and other health effects did you get from local health care providers?*

**Response:** For public health assessments, ATSDR evaluates health outcome data that is available in databases maintained by federal, state, or local agencies. No database containing disease rates for the Questa area was identified. If an appropriate health outcome database (containing data on health effects plausibly linked to potential exposures in the general population) becomes available, ATSDR will evaluate this data, upon request.

**Concern:** *I am concerned about the stability of waste rock piles in the Questa area.*

**Response:** The following information was obtained from the Mining and Mineral Division (MMD) of the New Mexico Energy, Minerals, and Natural Resources Department [63]. A Stability Review Committee (SRC) has been established to examine the failure risk of all waste rock piles. The SRC includes representatives from the Village of Questa, Amigos Bravos, NMED, MMD, and Molycorp. Molycorp submitted a plan for the Goathill North Rock Pile Mitigation Project Final Design to MMD and NMED on May 27, 2004. On June 16, 2004, MMD and NMED issued a joint letter of approval. Completion of the mitigation project is slated for August 2005. Analysis of the other rock piles continues.

**Concern:** *I am concerned about cases of metals poisoning in children and adults in the Questa area.*

**Response:** Some private wells are contaminated with metals at high enough levels to cause adverse health effects if people drank the water regularly. However, local citizens and federal officials stated that no one has drunk contaminated private well water since the late 1990s, so the private well pathway is incomplete and could not be responsible for poisonings that may have taken place within the past several years. ATSDR asked the community for information about how children or adults might come in contact with contaminants from the site, how often, and for how long. We did not receive specific information on these items, so we used generally conservative default assumptions in performing exposure estimates for other pathways of exposure (soil, surface water, sediment). None of the estimated exposures were high enough to result in an increased risk of any adverse health effects, including metals poisoning. ATSDR cannot speculate on the causes of any current metals poisoning cases in the community.

**Concern:** *How have the numerous tailings spills from the tailings pipeline affected my health?*

**Response:** ATSDR recognizes that numerous spills of tailings from the pipeline have taken place over the years. ATSDR evaluated direct exposures to tailings as part of the “Incidental Ingestion of Soil or Tailings” section beginning on page 24. In this section, ATSDR assumed that people would contact tailings in the same way they contact surface soil. Estimated exposures to contaminants in either pure tailings or in surface soil were too low to result in adverse health effects.

**Concern:** *I am concerned that some affected wells were just not tested.*

**Response:** According to a report in the *Albuquerque Journal* published on October 11, 2000, NMED offered testing of privately owned wells within a 2-mile radius of the tailings piles or in the Red River Valley area downriver from the mine [70]. A number of wells were sampled through this program. Some untested wells might contain contaminants that may or may not be related to the site. It is a good idea for people who drink from private wells to have the water tested regularly to ensure its safety. Testing for a limited number of water quality parameters, including nitrate, fluoride, and iron, can be requested through the New Mexico Environment Department field office in Taos (505-758-8808). Testing for other parameters can be performed by any commercial laboratory specializing in water quality.

**Concern:** *I am concerned about contamination of the acequias.*

**Response:** The acequias (irrigation ditches) are likely to contain levels of contaminants in sediment and surface water similar to the Red River. Incidental exposure to contaminants in surface water and sediment were too low to increase the risk of adverse health effects. To minimize the chance for exposure to contaminants on the surface of irrigated crops and vegetables, these items should be washed thoroughly before eating.

## IV. Health Hazard Category

The following hazard categorization, conclusions, and recommendations are based on data available at the time of the writing of this report. Additional environmental sampling data or changing exposure scenarios could alter these findings.

Estimated past exposures to arsenic, cadmium, iron, magnesium, manganese, molybdenum, zinc, fluoride, or sulfate in water from some private wells were potentially high enough to result in adverse health effects. Although no indication that anyone is currently drinking contaminated well water was found, the known contaminated wells have not been decommissioned, and the extent of groundwater contamination has not been fully defined.

Estimated past exposures to particulate matter blowing off of tailings piles were potentially high enough to result in adverse health effects. Current measurements of particulate matter blowing off of tailings piles indicate that dust levels are within ambient air standards.

In addition to the above exposure pathways, potential instability of waste rock piles presents an ongoing physical hazard to the community. Other completed and potential exposure pathways are not expected to result in adverse health effects.

Due to the potential for adverse health effects from exposure to contaminants and physical hazards associated with the site, ATSDR categorizes the site as a *public health hazard*.

## V. Conclusions

1. Information about use of private wells and their levels of contamination in the past was limited. Some of the wells potentially used for private consumption in the past have levels of arsenic, cadmium, iron, magnesium, manganese, molybdenum, zinc, fluoride, or sulfate high enough to have increased the risk of adverse health effects, to varying degrees, if people drank water from the affected wells regularly. No adverse health effects are likely today as long as people avoid drinking contaminated well water.
2. Information about levels of dust blowing off of tailings piles towards Questa was also limited. Using available data and professional judgment, rough “worst case” estimates of past exposures indicated that exposures to metals contaminants from breathing in tailings dust were too low to result in short- or long-term health effects. However, intermittently high dust levels in the 1970s, 1980s, and (to a lesser extent) the 1990s could have resulted in short-term eye and respiratory irritation and an increased risk of respiratory problems in sensitive groups (people with asthma or other respiratory disease, the elderly, and children). Recent studies indicate that adverse health effects are unlikely today.
3. Questa municipal water meets applicable water quality standards and is not expected to result in adverse health effects. Although there is no evidence of it occurring, even if people occasionally drank tap water with tailings particles or tailings-related contaminants in it, estimated contaminant exposures would be too low to result in adverse health effects.

## VI. Recommendations

1. People should avoid drinking water from wells shown to be contaminated. The most highly contaminated wells should be decommissioned to prevent people from drinking the water. People who drink out of private wells are encouraged to have the well water quality tested regularly.
2. Continue dust mitigation/suppression at the tailings facility as long as suspendable tailings are present. People in sensitive groups (people with asthma or other respiratory disease, the elderly, and children) should limit outdoor activity on dry, windy days or if dust levels appear to be high.
3. To improve the community's acceptance of Questa's water supply, ATSDR supports the planned upgrading of the municipal water system to remove water lines from tailings.

## VII. Public Health Action Plan

The public health action plan for the Molycorp site contains a description of actions that have been or will be taken at the site by ATSDR and/or other government agencies. The purpose of the plan is to ensure that this public health assessment not only identifies public health hazards at the site, but also outlines a plan of action to prevent or minimize the potential for adverse human health effects from exposure to site-related hazardous substances. ATSDR will follow up on this plan to ensure that it is implemented.

### Actions Completed

- □ ATSDR conducted two site visits to verify site conditions and to gather pertinent information and data for the site.
- □ ATSDR held a public meeting and two public availability sessions to inform the community about the findings of the public comment version of this public health assessment.
- ATSDR's Division of Health Education and Promotion worked with the Questa community to develop a Needs Assessment for health education related to the site. This document was used to assist in identifying community concerns addressed in this public health assessment.

### Planned Actions

- □ EPA will complete remedial investigation activities for the site.
- □ ATSDR will continue to work with federal and state environmental and health agencies and review the results of future investigations, as necessary.
- □ ATSDR's Division of Health Education and Promotion will provide health-related educational activities to the community, upon request.

ATSDR will re-evaluate and expand the public health action plan if needed. New environmental, toxicologic, or health outcome data or the results of implementing the above proposed actions might determine the need for additional actions at this site.

## **VIII. Public Comments**

This public health assessment was available for public review and comment at the Village of Questa Buildings in Questa, New Mexico from September 5, 2004 through October 22, 2004. The document was also available for viewing or downloading from the ATSDR web site.

The public comment period was announced to local media outlets. The public health assessment was also sent to federal, state, and local officials and community members. ATSDR presented and discussed the findings of the public health assessment with community members at a public meeting and availability session on September 22 and 23, 2004 at Saint Anthony's Parish in Questa, New Mexico. Fact sheets summarizing the findings of the public health assessment were also provided to the community.

Comments were received from several organizations and private citizens. They can be found in Appendix D, along with ATSDR's responses to them.

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## Appendix A. Explanation of Evaluation Process

### A. Screening Process

In evaluating these data, ATSDR used comparison values (CVs) to determine which chemicals to examine more closely. CVs are the contaminant concentrations found in a specific media (air, soil, or water) and are used to select contaminants for further evaluation. CVs incorporate assumptions of daily exposure to the chemical and a standard amount of air, water, and soil that someone might inhale or ingest each day.

As health-based thresholds, CVs are set at a concentration below which no known or anticipated adverse human health effects are expected to occur. Different CVs are developed for cancer and noncancer health effects. Noncancer levels are based on valid toxicologic studies for a chemical, with appropriate safety factors included, and the assumption that small children (22 pounds) and adults are exposed every day. Cancer levels are based on a one-in-a-million excess cancer risk for an adult eating contaminated soil or drinking contaminated water every day for 70 years. For chemicals for which both cancer and noncancer levels exist, we use the lower level to be protective. Exceeding a CV does not mean that health effects will occur, just that more evaluation is needed.

CVs used in this document are listed below:

*Environmental Media Evaluation Guides (EMEGs)* are estimated contaminant concentrations in a media where noncarcinogenic health effects are unlikely. EMEGs are derived from the Agency for Toxic Substances and Disease Registry's (ATSDR) minimal risk level (MRL).

*Cancer Risk Evaluation Guides (CREGs)* are estimated contaminant concentrations that would be expected to cause no more than one additional excess cancer in one million persons exposed over a lifetime. CREGs are calculated from the U.S. Environmental Protection Agency's (EPA) cancer slope factors (CSFs).

*Reference Media Evaluation Guides (RMEGs)* are estimated contaminant concentrations in a media where noncarcinogenic health effects are unlikely. RMEGs are derived from EPA's reference dose (RfD).

*Preliminary Remediation Goals (PRGs)* are the estimated contaminant concentrations in a media where carcinogenic or noncarcinogenic health effects are unlikely. The PRGs used in this public health assessment were derived using provisional reference doses or CSFs calculated by EPA's Region 9 toxicologists.

*Risk-Based Concentrations (RBCs)* are the estimated contaminant concentrations at which carcinogenic and noncarcinogenic health effects are not expected to occur as a result of exposure. The RBCs used in this public health assessment were derived using provisional reference doses or CSFs calculated by EPA's Region 3 toxicologists.

*EPA Action Levels (ALs)* are the estimated contaminant concentrations in water of which additional evaluation is needed to determine whether action is required to eliminate or reduce exposure. Action levels can be based on mathematical models.

*EPA Soil Screening Levels (SSLs)* are estimated contaminant concentrations in soil at which additional evaluation is needed to determine if action is required to eliminate or reduce exposure.

Some CVs may be based on different durations of exposure. Acute duration is defined as exposure lasting 14 days or less. Intermediate duration exposure lasts between 15 and 364 days, and chronic exposures last 1 year or more. Comparison values based on chronic exposure studies are used whenever available. If an intermediate or acute comparison value is used, it is denoted with a small *i* or *a* before the CV (e.g., iEMEG refers to the intermediate duration EMEG).

## **B. Determination of Exposure Pathways**

ATSDR identifies human exposure pathways by examining environmental and human components that might lead to contact with contaminants of concern (COCs). A pathway analysis considers five principal elements: a source of contamination, transport through an environmental medium, a point of exposure, a route of human exposure, and an exposed population. Completed exposure pathways are those for which the five elements are evident, and indicate that exposure to a contaminant has occurred in the past, is now occurring, or will occur in the future. Potential exposure pathways are those for which exposure seems possible, but one or more of the elements is not clearly defined. Potential pathways indicate that exposure to a contaminant could have occurred in the past, could be occurring now, or could occur in the future. The identification of an exposure pathway does not imply that health effects will occur. Exposures might be, or might not be, substantive. Therefore, even if exposure has occurred, is now occurring, or is likely to occur in the future, human health effects might not result.

ATSDR reviewed site history, information on site activities, and the available sampling data. On the basis of this review, ATSDR identified numerous exposure pathways that warranted consideration. Additional information regarding the completed and potential exposure pathways identified for the Molycorp site is provided in Appendix B of this public health assessment. Summaries of these pathways are discussed below.

## **C. Evaluation of Public Health Implications**

The next step is to take those contaminants present at levels above the CVs and further identify which chemicals and exposure situations are likely to be a health hazard. Child and adult exposure doses are calculated for the site-specific exposure scenario, using our assumptions of who goes on the site and how often they contact the site contaminants. The exposure dose is the amount of a contaminant that gets into a person's body. Following is a brief explanation of how we calculated the estimated exposure doses for the site.



***Ingestion of Groundwater***

Exposure doses for groundwater ingestion were calculated using the highest time-averaged concentration for a contaminant in a well, in milligrams per liter (mg/L), multiplied by the EPA default drinking water rate of 2 L/day for adults or 1 L/day for children. The multiplication product was divided by the average weight for an adult (70 kg or 154 pounds), or for a 1-year-old child (10 kg or 22 pounds).

***Inhalation of Tailings Dust***

For short-term exposure to contaminants via inhalation of fugitive dust from the tailings facility, the highest contaminant concentration detected in tailings (in mg/kg) was multiplied by the highest total suspended particulate concentration measured in ambient monitoring in the 1980s (in  $\mu\text{g}/\text{m}^3$ ). For long-term exposure, the average contaminant concentration measured in tailings was multiplied by the average TSP concentration. The multiplication product was multiplied by a conversion factor of  $10^{-6}$  to obtain an effective air concentration of each contaminant in  $\mu\text{g}/\text{m}^3$ .

Exposure from indirect ingestion of inhaled dust was estimated by multiplying the highest contaminant concentration detected in tailings (in mg/kg) by an assumed concentration of total suspended particulates (in  $\mu\text{g}/\text{m}^3$ ), a conversion factor of  $10^{-9}$   $\mu\text{g}/\text{kg}$ , the exposure time in hours per day, and an assumed inhalation rate of 1.9 cubic meters per hour ( $\text{m}^3/\text{hour}$ ) for children engaged in heavy activity. The multiplication product was divided by the average weight for a 10-year old child, 36 kg (80 pounds) to obtain the dose in mg/kg/day. The assumed TSP concentrations and times were  $4800 \mu\text{g}/\text{m}^3$  for 1 hour plus  $400 \mu\text{g}/\text{m}^3$  for 8 hours each day.

***Incidental Ingestion of Soil or Tailings***

Exposure doses for ingestion of contaminants present in soil from the source areas were calculated using the average concentration measured in the source areas, in milligrams per kilogram (mg/kg), or parts per million (ppm), multiplied by the soil ingestion rate for adults (100 mg/day) or children (200 mg/day). The multiplication product was divided by the average weight for an adult, 70 kg (154 pounds) or a 1-year-old child, 10 kg (22 pounds). The resulting dose was then multiplied by factors of 4/7 and 9/12, because the exposure was assumed to occur 4 times per week for 9 months out of the year.

***Incidental Ingestion of Surface Water***

Exposure doses for ingestion of contaminants from surface water were calculated using the average concentration measured in the surface water, in milligrams per liter (mg/L), multiplied by an incidental surface water ingestion rate of 0.02 L/day for adults or 0.01 L/day for children. These ingestion rates are 1/100th of the EPA default drinking water rates. The multiplication product was divided by the average weight for an adult (70 kg or 154 pounds), or for a 6-year-old child (23 kg or 51 pounds). The resulting dose was then multiplied by a factor of 104/365, because the exposure was assumed to occur 4 days per week during 6 months of the year.

### ***Incidental Ingestion of Sediment***

Exposure doses for ingestion of contaminants from the sediment were calculated using the average concentration measured in the sediment, in mg/kg or ppm, multiplied by 1/10th of the soil ingestion rate, 10 mg/day for adults or 20 mg/day for children. The multiplication product was divided by the average weight for an adult (70 kg or 154 pounds), or for a 6-year-old child (23 kg or 51 pounds). The resulting dose was then multiplied by a factor of 104/365, because the exposure was assumed to occur 4 days per week during 6 months of the year.

### ***Dermal (Skin) Exposure***

In this public health assessment, we evaluated dermal exposure to groundwater, soil and/or tailings, surface water, and sediment. Dermal absorption depends on numerous factors including the area of exposed skin, anatomic location of exposed skin, length of contact, concentration of chemical on skin, chemical-specific permeability, soil adherence, medium in which the chemical is applied, and skin condition and integrity. Because chemicals differ greatly in their potential to be absorbed through the skin, each chemical needs to be evaluated separately and is discussed as needed in the main body of the public health assessment. The assumed receptor body weights, exposure frequency, and exposure duration are the same as described in the above calculations of the ingestion route. The skin surface area and soil-to-skin adherence factors used in this public health assessment were taken from EPA's *Exposure Factor Handbook*.<sup>1</sup> Absorption factors and other chemical-specific factors were taken from the ATSDR *Toxicological Profile* for each specific chemical.

### ***Ingestion of Biota***

Exposure doses for ingestion of garden vegetables were calculated using the average detected concentration of each contaminant measured in vegetable samples, in mg/kg or ppm, multiplied by average consumption rates of the vegetable of interest in grams per kilogram of body weight per day (g/kg/day), taken from EPA's *Exposure Factor Handbook*.<sup>1</sup> The calculated value was also multiplied by a conversion factor of 0.001 kilograms per gram.

## **D. Noncancer Health Effects**

The calculated exposure doses are then compared to an appropriate health guideline for that chemical. Health guideline values are considered safe doses; that is, health effects are unlikely below this level. The health guideline value is based on valid toxicological studies for a chemical, with appropriate safety factors built-in to account for human variation, animal-to-human differences, and/or the use of the lowest adverse effect level. For noncancer health effects, the following health guideline values are used.

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<sup>1</sup> Environmental Protection Agency (EPA). Exposure factors handbook. Washington (DC): US Environmental Protection Agency, Office of Research and Development; 1999. Rpt. No.: EPA/600/C-99/001.

***Minimal Risk Level (MRLs) —Developed by ATSDR***

An MRL is an estimate of daily human exposure – by a specified route and length of time – to a dose of chemical that is likely to be without a measurable risk of adverse, noncancerous effects. An MRL should not be used as a predictor of adverse health effects. A list of MRLs can be found at <http://www.atsdr.cdc.gov/mrls.html>.

***Reference Dose (RfD) —Developed by EPA***

An RfD is an estimate, with safety factors built in, of the daily, life-time exposure of human populations to a possible hazard that is not likely to cause noncancerous health effects. RfDs can be found at <http://www.epa.gov/iris>.

If the estimated exposure dose for a chemical is less than the health guideline value, then the exposure is unlikely to cause a noncarcinogenic health effect in that specific situation. If the exposure dose for a chemical is greater than the health guideline, then the exposure dose is compared to known toxicologic values for that chemical and is discussed in more detail in the public health assessment (see Discussion section). These toxicologic values are doses derived from human and animal studies that are summarized in the ATSDR *Toxicological Profiles*. A direct comparison of site-specific exposure and doses to study-derived exposures and doses that cause adverse health effects is the basis for deciding whether health effects are likely or not.

**E. Calculation of Risk of Carcinogenic Effects**

The estimated risk of developing cancer resulting from exposure to the contaminants was calculated by multiplying the site-specific adult exposure dose by EPA's corresponding CSF (which can be found at <http://www.epa.gov/iris> ). The results estimate the maximum increase in risk of developing cancer after 70 years of exposure to the contaminant.

The actual increased risk of cancer is probably lower than the calculated number, which gives a worst-case excess cancer risk. The method used to calculate EPA's CSF assumes that high-dose animal data can be used to estimate the risk for low dose exposures in humans. The method also assumes that no safe level exists for exposure. Little experimental evidence exists to confirm or refute those two assumptions. Lastly, the method computes the 95% upper bound for the risk, rather than the average risk, suggesting that the cancer risk is actually lower, perhaps by several orders of magnitude.<sup>2</sup>

Because of uncertainties involved in estimating carcinogenic risk, ATSDR employs a weight-of-evidence approach in evaluating all relevant data.<sup>3</sup> Therefore, the carcinogenic risk is described in words (qualitatively) rather than giving a numerical risk estimate only. The numerical risk estimate must be considered in the context of the variables and assumptions involved in their derivation and in the broader context of biomedical opinion, host factors, and actual exposure

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<sup>2</sup> US Environmental Protection Agency (EPA), Office of Emergency and Remedial Response. Risk assessment guidance for Superfund, volume 1, human health evaluation manual. Washington: US Environmental Protection Agency; 1989.

<sup>3</sup> Agency for Toxic Substances and Disease Registry (ATSDR). Cancer policy framework. Atlanta (GA): US Department of Health and Human Services; 1993.

conditions. The actual parameters of environmental exposures must be given careful consideration in evaluating the assumptions and variables relating to both toxicity and exposure.

### Appendix B. Exposure Pathways for Molycorp Site

Pathway Name	Environmental Media and Transport Mechanisms	Point of Exposure	Route of Exposure	Exposure Population	Time	Notes	Complete?
Groundwater	Infiltration to groundwater	Drinking water taps supplied by private wells	Ingestion, dermal exposure	Residents and workers drinking out of private wells near the site	Past, potential future	Population might have included young children	N – present Y – past, potential future
Tailings Dust	Dust blown off of tailings facility, transported in air	Areas affected by dust blowing off of tailings facility	Inhalation	Nearby residents, school children	Past, present, future	Population includes children	Y
Soil or tailings	Waste rock and tailings piles on site; dispersed to soil by wind or water erosion	Residential yards, schoolyard, or recreational areas	Incidental ingestion, dermal exposure	Workers, residents, visitors	Past, present, future	Population includes children	Y
Surface water	Ground water and surface water drainage through waste rock; tailings spills into surface water	Red River, ponds and creeks in area	Incidental ingestion, dermal exposure	Fishers, recreational users of Red River (children and adults)	Past, present, future	Population includes children	Y
Sediment	Tailings spills into surface waters; deposition from surface water	Red River, ponds and creeks in area	Incidental ingestion, dermal exposure	Fishers, recreational users of Red River (children and adults)	Past, present, future	Population might include children	Y
Fish	Bioaccumulation of contaminants from surface water and sediments into fish	Meal prepared using fish from Red River	Ingestion	Fishers and their families	Past, present, future	Population might include young children	N
Garden Vegetables/ Crops	Uptake of contaminants from surface water, groundwater into plants	Meal prepared using garden vegetables or crops	Ingestion	Residents and their families, purchasers of produce	Past, present, future	Population might include young children	N
Municipal Water	Infiltration of municipal water lines with tailings or tailings contaminants	Drinking water taps supplied by municipal system	Ingestion, dermal exposure	Residents drinking water from Questa municipal supply	Past, present, future	Population might include young children	N

## Appendix C. ATSDR Plain Language Glossary of Environmental Health Terms

The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal public health agency with headquarters in Atlanta, Georgia, and 10 regional offices in the United States. ATSDR's mission is to serve the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and diseases related to toxic substances. ATSDR is not a regulatory agency, unlike the U.S. Environmental Protection Agency (EPA), which is the federal agency that develops and enforces environmental laws to protect the environment and human health.

This glossary defines words used by ATSDR in communications with the public. It is not a complete dictionary of environmental health terms. If you have questions or comments, call ATSDR's toll-free telephone number, 1-888-42-ATSDR (1-888-422-8737).

<b>Absorption</b>	How a chemical enters a person's blood after the chemical has been swallowed, has come into contact with the skin, or has been breathed in.
<b>Acute Exposure</b>	Contact with a chemical that happens once or only for a limited period of time. ATSDR defines acute exposures as those that might last up to 14 days.
<b>Additive Effect</b>	A response to a chemical mixture, or combination of substances, that might be expected if the known effects of individual chemicals, seen at specific doses, were added together.
<b>Adverse Health Effect</b>	A change in body function or the structures of cells that can lead to disease or health problems.
<b>Antagonistic Effect</b>	A response to a mixture of chemicals or combination of substances that is <b>less</b> than might be expected if the known effects of individual chemicals, seen at specific doses, were added together.
<b>ATSDR</b>	The <b>A</b> gency for <b>T</b> oxic <b>S</b> ubstances and <b>D</b> isease <b>R</b> egistry. ATSDR is a federal health agency in Atlanta, Georgia that deals with hazardous substance and waste site issues. ATSDR gives people information about harmful chemicals in their environment and tells people how to protect themselves from coming into contact with chemicals.
<b>Background Level</b>	An average or expected amount of a chemical in a specific environment. Or, amounts of chemicals that occur naturally in a specific environment.
<b>Bioavailability</b>	See <b>Relative Bioavailability</b> .

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<b>Biota</b>	Used in public health, things that humans would eat – including animals, fish and plants.
<b>Cancer</b>	A group of diseases which occur when cells in the body become abnormal and grow, or multiply, out of control
<b>Cancer Slope Factor (CSF)</b>	The slope of the dose-response curve for cancer. Multiplying the CSF by the dose gives a prediction of excess cancer risk for a contaminant.
<b>Carcinogen</b>	Any substance shown to cause tumors or cancer in experimental studies.
<b>Chronic Exposure</b>	A contact with a substance or chemical that happens over a long period of time. ATSDR considers exposures of more than one year to be <i>chronic</i> .
<b>Completed Exposure Pathway</b>	See <b>Exposure Pathway</b> .
<b>Community Assistance Panel (CAP)</b>	A group of people from the community and health and environmental agencies who work together on issues and problems at hazardous waste sites.
<b>Comparison Value (CV)</b>	Concentrations of substances in air, water, food, and soil that are unlikely, upon exposure, to cause adverse health effects. Comparison values are used by health assessors to select which substances and environmental media (air, water, food and soil) need additional evaluation while health concerns or effects are investigated.
<b>Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)</b>	<b>CERCLA</b> was put into place in 1980. It is also known as <b>Superfund</b> . This act concerns releases of hazardous substances into the environment, and the cleanup of these substances and hazardous waste sites. This act created ATSDR and gave it the responsibility to look into health issues related to hazardous waste sites.
<b>Concentration</b>	How much or the amount of a substance present in a certain amount of soil, water, air, or food.
<b>Contaminant</b>	See <b>Environmental Contaminant</b> .
<b>Delayed Health Effect</b>	A disease or injury that happens as a result of exposures that may have occurred far in the past.

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<b>Dermal Contact</b>	A chemical getting onto your skin (see <b>Route of Exposure</b> ).
<b>Dose</b>	The amount of a substance to which a person may be exposed, usually on a daily basis. Dose is often explained as “amount of substance(s) per body weight per day”.
<b>Dose / Response</b>	The relationship between the amount of exposure (dose) and the change in body function or health that results.
<b>Duration</b>	The amount of time (days, months, years) that a person is exposed to a chemical.
<b>Environmental Contaminant</b>	A substance (chemical) that gets into a system (person, animal, or the environment) in amounts higher than the <b>Background Level</b> , or what would be expected.
<b>Environmental Media</b>	Usually refers to the air, water, and soil in which chemicals of interest are found. Sometimes refers to the plants and animals that are eaten by humans. <b>Environmental Media</b> is the second part of an <b>Exposure Pathway</b> .
<b>US Environmental Protection Agency (EPA)</b>	The federal agency that develops and enforces environmental laws to protect the environment and the public’s health.
<b>Epidemiology</b>	The study of the different factors that determine how often, in how many people, and in which people will disease occur.
<b>Exposure</b>	Coming into contact with a chemical substance. (For the three ways people can come in contact with substances, see <b>Route of Exposure</b> .)
<b>Exposure Assessment</b>	The process of finding the ways people come in contact with chemicals, how often and how long they come in contact with chemicals, and the amounts of chemicals with which they come in contact.
<b>Exposure Pathway</b>	<p>A description of the way that a chemical moves from its source (where it began) to where and how people can come into contact with (or get exposed to) the chemical.</p> <p>ATSDR defines an exposure pathway as having 5 parts:</p> <ol style="list-style-type: none"><li>1. Source of Contamination,</li><li>2. Environmental Media and Transport Mechanism,</li><li>3. Point of Exposure,</li><li>4. Route of Exposure, and</li></ol>



## 5. Receptor Population.

When all 5 parts of an exposure pathway are present, it is called a **Completed Exposure Pathway**. Each of these 5 terms is defined in this Glossary.

<b>Frequency</b>	How often a person is exposed to a chemical over time; for example, every day, once a week, twice a month.
<b>Hazardous Waste</b>	Substances that have been released or thrown away into the environment and, under certain conditions, could be harmful to people who come into contact with them.
<b>Health Effect</b>	ATSDR deals only with <b>Adverse Health Effects</b> (see definition in this Glossary).
<b>Indeterminate Public Health Hazard</b>	The category is used in Public Health Assessment documents for sites where important information is lacking (missing or has not yet been gathered) about site-related chemical exposures.
<b>Ingestion</b>	Swallowing something, as in eating or drinking. It is a way a chemical can enter your body (see <b>Route of Exposure</b> ).
<b>Inhalation</b>	Breathing. It is a way a chemical can enter your body (see <b>Route of Exposure</b> ).
<b>LOAEL</b>	Lowest <b>Observed Adverse Effect Level</b> . The lowest dose of a chemical in a study, or group of studies, that has caused harmful health effects in people or animals.
<b>Malignancy</b>	See <b>Cancer</b> .
<b>MRL</b>	Minimal <b>Risk Level</b> . An estimate of daily human exposure – by a specified route and length of time -- to a dose of chemical that is likely to be without a measurable risk of adverse, noncancerous effects. An MRL should not be used as a predictor of adverse health effects.
<b>NPL</b>	The <b>National Priorities List</b> . (Which is part of <b>Superfund</b> .) A list kept by the U.S. Environmental Protection Agency (EPA) of the most serious uncontrolled or abandoned hazardous waste sites in the country. An NPL site needs to be cleaned up or is being looked at to see if people can be exposed to chemicals from the site.
<b>NOAEL</b>	No <b>Observed Adverse Effect Level</b> . The highest dose of a chemical in a

	study, or group of studies, that did not cause harmful health effects in people or animals.
<b>No Apparent Public Health Hazard</b>	The category is used in ATSDR's Public Health Assessment documents for sites where exposure to site-related chemicals may have occurred in the past or is still occurring but the exposures are not at levels expected to cause adverse health effects.
<b>No Public Health Hazard</b>	The category is used in ATSDR's Public Health Assessment documents for sites where there is evidence of an absence of exposure to site-related chemicals.
<b>PHA</b>	<b>Public Health Assessment.</b> A report or document that looks at chemicals at a hazardous waste site and tells if people could be harmed from coming into contact with those chemicals. The PHA also tells if possible further public health actions are needed.
<b>Plume</b>	A line or column of air or water containing chemicals moving from the source to areas further away. A plume can be a column or clouds of smoke from a chimney or contaminated underground water sources or contaminated surface water (such as lakes, ponds and streams).
<b>Point of Exposure</b>	The place where someone can come into contact with a contaminated environmental medium (air, water, food or soil). Some examples include: the area of a playground that has contaminated dirt, a contaminated spring used for drinking water, or the backyard area where someone might breathe contaminated air.
<b>Population</b>	A group of people living in a certain area; or the number of people in a certain area.
<b>PRP</b>	<b>Potentially Responsible Party.</b> A company, government or person that is responsible for causing the pollution at a hazardous waste site. PRP's are expected to help pay for the clean up of a site.
<b>Public Health Assessment(s)</b>	See <b>PHA</b> .
<b>Public Health Hazard</b>	The category is used in PHAs for sites that have certain physical features or evidence of chronic, site-related chemical exposure that could result in adverse health effects.
<b>Public Health Hazard Criteria</b>	PHA categories given to a site which tell whether people could be harmed by conditions present at the site. Each are defined in the

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	<p>Glossary. The categories are:</p> <ul style="list-style-type: none"><li>- Urgent Public Health Hazard</li><li>- Public Health Hazard</li><li>- Indeterminate Public Health Hazard</li><li>- No Apparent Public Health Hazard</li><li>- No Public Health Hazard</li></ul>
<b>Receptor Population</b>	People who live or work in the path of one or more chemicals, and who could come into contact with them (See <b>Exposure Pathway</b> ).
<b>Reference Dose (RfD)</b>	An estimate, with safety factors (see <b>safety factor</b> ) built in, of the daily, life-time exposure of human populations to a possible hazard that is <u>not</u> likely to cause harm to the person.
<b>Relative Bioavailability</b>	The amount of a compound that can be absorbed from a particular medium (such as soil) compared to the amount absorbed from a reference material (such as water). Expressed in percentage form.
<b>Route of Exposure</b>	The way a chemical can get into a person's body. There are three exposure routes: <ul style="list-style-type: none"><li>- breathing (also called inhalation),</li><li>- eating or drinking (also called ingestion), and</li><li>- getting something on the skin (also called dermal contact).</li></ul>
<b>Safety Factor</b>	Also called <b>Uncertainty Factor</b> . When scientists don't have enough information to decide if an exposure will cause harm to people, they use "safety factors" and formulas in place of the information that is not known. These factors and formulas can help determine the amount of a chemical that is <u>not</u> likely to cause harm to people.
<b>SARA</b>	The <b>Superfund Amendments and Reauthorization Act</b> in 1986 amended CERCLA (see <b>CERCLA</b> ) and expanded the health-related responsibilities of ATSDR. CERCLA and SARA direct ATSDR to look into the health effects resulting from chemical exposures at hazardous waste sites.
<b>Sample Size</b>	The number of people that are needed for a health study.
<b>Sample</b>	A small number of people chosen from a larger population (see <b>Population</b> ).
<b>Source (of Contamination)</b>	The place where a chemical comes from, such as a landfill, pond, creek, incinerator, tank, or drum. Contaminant source is the first part of an <b>Exposure Pathway</b> .

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<b>Special Populations</b>	People who may be more sensitive to chemical exposures because of certain factors such as age, a disease they already have, occupation, sex, or certain behaviors (like cigarette smoking). Children, pregnant women, and older people are often considered special populations.
<b>Statistics</b>	A branch of the math process of collecting, looking at, and summarizing data or information.
<b>Superfund Site</b>	See <b>NPL</b> .
<b>Survey</b>	A way to collect information or data from a group of people ( <b>population</b> ). Surveys can be done by phone, mail, or in person. ATSDR cannot do surveys of more than nine people without approval from the U.S. Department of Health and Human Services.
<b>Synergistic Effect</b>	A health effect from an exposure to more than one chemical, where one of the chemicals worsens the effect of another chemical. The combined effect of the chemicals acting together are greater than the effects of the chemicals acting by themselves.
<b>Toxic</b>	Harmful. Any substance or chemical can be toxic at a certain dose (amount). The dose is what determines the potential harm of a chemical and whether it would cause someone to get sick.
<b>Toxicology</b>	The study of the harmful effects of chemicals on humans or animals.
<b>Tumor</b>	Abnormal growth of tissue or cells that have formed a lump or mass.
<b>Uncertainty Factor</b>	See <b>Safety Factor</b> .
<b>Urgent Public Health Hazard</b>	This category is used in ATSDR's Public Health Assessment documents for sites that have certain physical features or evidence of short-term (less than 1 year), site-related chemical exposure that could result in adverse health effects and require quick intervention to stop people from being exposed.

## Appendix D. Public Comments Received

This public health assessment was available for public review and comment at the Village of Questa Buildings in Questa, New Mexico, from September 5, 2004 through October 22, 2004. The document was also available for viewing or downloading from the ATSDR web site.

The public comment period was announced to local media outlets. The public health assessment was also sent to federal, state, and local officials and some community members. ATSDR presented and discussed the findings of the public health assessment with community members at a public meeting and availability session on September 22 and 23, 2004, at Saint Anthony's Parish in Questa, New Mexico. Fact sheets summarizing the findings of the public health assessment were also provided to the community.

The written comments received from several organizations and private citizens are listed in their entirety below. ATSDR responses are inserted as italicized text.

### D1. Comments from Amigos Bravos:

RE: Public Health Assessment for Molycorp, Inc. Questa, Taos County, NM  
EPA Facility ID: NMD002899094

#### Introduction and General Comments:

As a statewide river conservation organization based in Taos County, New Mexico, Amigos Bravos, Friends of the Wild Rivers, has followed issues of contamination as related to the Molycorp site for over 16 years. We are pleased to see that substantial changes from the original health assessment have been incorporated into this new document. We have appreciated the effort - in the form of site visits, conference calls, and correspondence - that the ATSDR team has exerted over the past couple of years. However, we do have a number of concerns with the current health assessment.

#### Site is a Current Public Health Hazard:

On page 38 of the health assessment, health hazards are listed. The site is listed as a past public health hazard and a potential future public health hazard but not as a current public health hazard. Amigos Bravos contends that the site is a current public health hazard for a number of reasons. First of all, the unstable rock piles that loom above the town, the river, and highway pose a very serious current health hazard. A team of geotechnical engineers stated in a 6/4/03 report that the "substantial portions of the million or so cubic yards of material currently moving, along with adjacent materials that may lose their support, could accelerate and develop into a large-volume, high-velocity flowslide." As, to date, there has been no on-the-ground mitigation to address this issue, rock pile instability clearly represents a current public health hazard.

Amigos Bravos contends that, even without the glaring hazard of the unstable rock piles, there are many reasons to categorize the site as a current health hazard. The health

assessment determines that some private wells are contaminated to a level that if people drank from them they would cause adverse health effect but then assessment goes on to determine that since people have stopped drinking from these wells (presumably because of the contamination) that these wells do not pose a public health risk. The report also recommends on page 39 that “people in sensitive groups (people with asthma or other respiratory disease, the elderly and children) should limit outdoor activity on dry, windy days or if dust levels appear to be high.” To make these statements and then claim that there is no public health hazard makes little sense. It would be more accurate to state that there is a current public health hazard but as long as people modify their behavior, by not drinking from certain wells and staying inside when it is windy, they will not be exposed to this public health hazard. The report also contradicts itself by stating on page 38 that there is “no indication that anyone is currently drinking contaminated well water” yet on page nine the report states “it is possible that people could drink this water now or in the future.” The fact that the report states that people could drink this water now indicates that there is a public health hazard now.

***ATSDR Response:*** *ATSDR has modified its classification of the site to a “public health hazard,” without reference to time frame. Regardless of whether harmful exposures are actually occurring at present, action is recommended to ensure that public health is protected now and in the future.*

#### Compounded Effects of Multiple Pollutants

The report does not take into consideration the compounded effects of exposure to low levels of multiple pollutants. On page 28 the assessment states that exposure doses for a worse case scenario of contamination from the tailings surrounding the village’s water lines were calculated for each of the contaminants. Was a calculation of the compounded effects of ingesting elevated levels of these contaminants all at once done as well? Often pollutants interact with one another to produce an effect that is greater than the sum of each individual pollutant. A consideration of such compounded effects appears to be missing from the report.

***ATSDR Response:*** *In evaluating the municipal water system, ATSDR did not consider the effect of ingesting multiple contaminants at once. The calculation performed was purely hypothetical because there are no data indicating any substances are above drinking water standards in the water system. ATSDR recognizes that contaminants might interact with each other, but did not specifically address this issue (please see responses to comments on pages 66, 75, and 77 for further response).*

#### An Incomplete Report is Dangerous

Amigos Bravos questions the usefulness of health assessments that do not adequately survey a community and that do not incorporate collection of samples and generation of data to determine community exposure. Amigos Bravos is aware that ATSDR does not have access to adequate resources to conduct a comprehensive health assessment. Yet, a study without the above-mentioned components has limited use to an impacted community and, in fact,

could be dangerous, as it could create a false sense of safety or alarm depending on the results of the assessment. In this particular assessment, the preparers of the report depended upon community members voluntarily coming forward with health concerns. In a small community, where there is a history of intimidation from the polluting company, it is likely that many people will not feel comfortable volunteering such information, especially, if the forum for volunteering this information involves coming out to a meeting. A door-to-door survey would have been a possible tool for reaching a broader sample pool of individuals in the effected community. Ideally hair samples and other samples would have been collected and analyzed to determine community exposure to contaminants. At the very least, health care officials in the community should have been contacted and interviewed to determine if they have observed any alarming or noteworthy trends.

***ATSDR Response:*** *The first step in the public health assessment process is to determine potential exposures and to determine if those doses could be expected to result in adverse health effects. ATSDR relied on community members providing information about how people in the community might come into contact with site contaminants. In the absence of site-specific information, ATSDR used conservative assumptions about how people might be exposed. We did not identify any current exposures high enough to be expected to result in adverse health effects. Exposures that occurred in the past probably increased the risk of adverse health effects. However, those exposures were most likely limited to particular individuals who drank from specific contaminated wells in the case of drinking water, and any health effects experienced in the general population from dust exposure would have been temporary. Therefore, in the context of the public health assessment, further investigation of the health status of the general Questa population is not justified. We do not mean to imply that knowledge of a community's health status is not useful for public health authorities or health care providers; however, ATSDR is not the appropriate agency to gather this knowledge, for the reasons mentioned.*

#### Conclusions and Recommendations:

The report is incomplete in that it does not identify the site as a current health hazard. The report should be revised, for the reasons listed above, to include this health hazard category. The potential health impacts of compounded exposure to multiple contaminants should be addressed.

Other tools for gathering community health data should be incorporated. At the very least an acknowledgement of the serious limitations of the report, including the lack of comprehensive surveying of the community, lack of hair and other sampling, and lack of surveying of public health officials should be incorporated into the conclusions of the report.

We hope that ATSDR will consider these comments and recommendations when making drafting the final health assessment for the Questa area as well as before conducting assessments in other communities.

***ATSDR Response:*** *Please refer to specific responses above.*

**D2. Comments from Rio Colorado Reclamation Committee:**

RE: COMMENTS REGARDING SEPT 1, 2004, PUBLIC HEALTH ASSESSMENT FOR MOLYCORP, INC, QUESTA, TAOS COUNTY, NM, EPA FACILITY ID: NMD002899094

Thank you for the opportunity to comment on your agency's recent Public Health Assessment report. The report presents a clear representation of the ATSDR's method of evaluation of data available concerning the Questa site. The following comments/questions will be referenced to page and paragraph in the ATSDR document, where applicable:

Page 8, Evaluation Process, explains the process used of identifying the contaminants of concern based on comparison values, and estimates dosage comparisons to minimal risk levels or reference dose to determine whether or not an exposure should be considered a health risk. While it is understood that each chemical of concern must be evaluated as a "stand alone" risk, with its individual exposure path, dosage, and risk, the evaluation process does not consider the real world situation of the sum total of contaminant exposures. For instance, the document (page 10, Table 1) lists 29 substances that exceeded the agency's CV (comparison value) levels for ground water contaminants detected above a level where no human health effect should occur, yet the individual analysis of risk of health effects of individual contaminant levels only identifies levels of "arsenic, cadmium, fluoride, iron, magnesium, manganese, molybdenum, sulfate, and zinc to be great enough in some wells that regular drinking of water containing the highest levels could increase the risk of adverse health effects" (page 17, summary statement—Ingestion of Groundwater from Private Wells). Granted, the question posed here greatly complicates the evaluation process. Can an adequate evaluation of overall public risk be determined by individual component evaluation only? Are other evaluation procedures available that might incorporate, or adjust for factors such as the sum total of all contaminants of concern, or even a synergistic effect between two or three contaminants? The comment here is that we do not have a number of isolated risk factors to consider but a fairly large array of metals and related contaminants that may or may not work in concert to increase the potential for health impacts due to exposures at rates that may appear below literature benchmarks for individual contaminant exposure rates. Can human health risk estimates be presented as the result of the sum total of all, or even several factors, or is the process limited to individual estimates of exposure rates for each contaminant?

**ATSDR Response:** *This public health assessment is meant to give a general picture of the possible affect of contaminants on public health. It does not assess individual cases or attempt to predict diseases based on particular exposures. In evaluating groundwater from private wells, a number of contaminants of concern were present at levels high enough, individually, to have increased the risk of adverse health effects if people had drunk water containing them. This was enough to cause ATSDR to classify past exposures to this water as a public health hazard. Although multiple contaminants were present in some wells, and these could have interacted to result in additional risk of health effects in some people, the analysis of multiple contaminant exposures is complicated and would not have added to the classification of the site as a past public health hazard.*



Pages 9-17, Ingestion of Groundwater from Private Wells, discusses the individual metals of concern and the probable impact on human health risk based on estimates of exposure compared to health guidelines. A major point here is underscored by the statement made (and emphasized, last line page 10) regarding the great deal of uncertainty of estimation of past exposures. It is understood that these estimates are based on time averaged highest concentration detected in potential drinking water wells. However, the highest concentration of COC's as measured in groundwater are much greater, several on an order of magnitude (10 times), or more, for a number of factors including Aluminum, Chromium, Cadmium, Cobalt, Copper, Fluoride, Iron, Lead, Magnesium, Manganese, Nickel, Sulfate, and Zinc. Other metals including Arsenic, Cadmium, Iron, Manganese, Molybdenum, Zinc, and Fluoride, were specifically mentioned as present in high enough concentration to present increased risk to human health, depending on actual amounts present and how much water may have been ingested by people in the past. There seems a very large range of contaminants of concern that may be used for estimation purposes and while water wells used in the past may not have had the concentrations of contaminants as reflected in certain springs, private water wells may well have provided much higher concentrations to an unknowing public or private use than used in the time averaged column 2, Table I, page 10. In fact, the statement made on page 11, under Aluminum that "past exposure to the highest level of aluminum in well water would be unlikely to result in health effects" must be brought into question. As reported to Lisa Hayes after ATSDR's September 22, 2004 meeting in Questa, at least one past user of a contaminated well had medical tests indicating aluminum levels in her body to be from 10 to 12 times higher than the safest levels indicated by the testing laboratories. This individual has experienced spontaneous bone fracturing and bone disease. Her doctors concur, and even ATSDR's own reports agree, that such an occurrence can and should be attributed to the very high levels of aluminum ingested from this contaminated well. However, ATSDR, in this Public Health Assessment, chose to attribute this fracturing to Fluorosis.

***ATSDR Response:*** *In healthy individuals, the highest level of aluminum would not be expected to result in adverse health effects. However, people who have renal (kidney) failure may be unusually susceptible, as they have a reduced ability to excrete aluminum, they ingest aluminum compounds as part of their treatment, they may absorb aluminum present in the water used for dialysis, and they may absorb more aluminum gastrointestinally. The increased aluminum body burdens in these patients has been associated with skeletal toxicity (abnormal bone mineralization [osteomalacia], bone pain, pathological fractures, and diseases of adjoining muscles [proximal myopathy]). It has also been associated with dialysis encephalopathy (a brain disease) and hematopoietic (blood cell) toxicity [17]. It is possible that anyone with an increased body burden of aluminum could have similar bone problems. The highest level of aluminum measured in a potential drinking water well corresponds to child and adult dosages of 4 and 1.2 mg/kg/day, respectively. For comparison, recommended dosages of aluminum-containing medications can contribute 12–71 mg/kg/day aluminum from antacid/antiulcer products and 2–10 mg/kg/day from buffered analgesics. Although generally recognized as safe dosages, recent studies observed osteomalacia in healthy individuals following long-term use of aluminum-containing antacids [17].*

*We have added the preceding discussion to the evaluation of aluminum in drinking water, and we have added aluminum to Table 6 as a possible contributor to bone problems. The levels measured in drinking water wells are not expected to result in adverse health effects in healthy individuals. However, aluminum in drinking water may contribute to body burdens and health problems in people with compromised renal function or with high aluminum body burdens for other reasons. This does not change ATSDR's conclusion that exposure to contaminants in private drinking water wells in the past could have resulted in adverse health effects.*

It is not known at present how many private wells are used for drinking water. The report states that no contaminated private wells are knowingly in use at present, and, if they were, would probably present some increased risk, depending upon the levels of contamination and the amount consumed. The RCRC has confirmed that at least one private well of questionable quality is indeed being used. This is the well of [name removed by ATSDR for privacy], which is located [location removed by ATSDR for privacy]. This well has been tested numerous times with varying results. [Private citizen] confirms that [the home's occupants] have been so confused by the various test results that they continue to use this well for cooking, bathing, and some drinking water. Other wells are being used, at least for bathing, cooking and irrigation. Until all private wells in the Questa area are either tested or capped, it appears that a present human health risk (of some arguable, albeit notable, amount) does indeed exist. The writer is in full agreement with the ATSDR statement, last line of Summary---Ingestion of Groundwater from Private Wells, paragraph three, page 17.

***ATSDR Response:*** *ATSDR based its conclusions on well data that were provided to us. ATSDR was informed that the wells whose data we evaluated were not being used for drinking purposes. ATSDR did not evaluate data from the well mentioned above. Upon request, ATSDR is willing to provide advice to private homeowners on the basis of their individual well testing results. This would be considered outside of the process for producing the public health assessment document.*

Inhalation of Tailings Dust, pages 17-23, present the basic data and assumptions made to estimate the likelihood of past and present risks presented by tailings dust that may have or may be inhaled by people residing or attending school in the vicinity of the tailings facility. Comparison of Figures 3 and 4 on pages 22 and 23, air monitoring data sets for 24 Hour PM 10 Data vs. Hourly PM 10 Data, show significant exceedance of the 24 hour air standard during at least six periods of time when the PM-10 24 Hr air standard, app. 120 ug/m<sup>3</sup>, is projected onto the Hourly PM10 data set, Figure 4, page 23. While this type of projection may not be totally accurate, i.e.: may not reflect an accurate standard projection on the Hourly data set, it appears to reflect high level peaks, some three to four times the standard, and consistently cyclic wind disturbances in the general area that result in large amount of tailings materials in the atmosphere.

Moreover, the report states (page 22) "sensitive populations could experience adverse health effects from short-term peaks in dust, regardless of source." It should be noted that this tailings facility is located next to a middle school, housing children, a group of humans considered at risk to short term health impacts. Page 17, last paragraph, states that Molycorp changed operating practices in the 1990's, reducing uncovered areas and utilizing dust

control agents. Molycorp certainly changed operating practices of tailings handling which also included long periods of time of no tailings disposal (but continued tailings line operation for mine dewatering and contaminated water collected from springs disposal). Depending upon the timing of mill operations and subsequent tailings disposal operations, the tailings facility can see months, if not the better part of a year's time, without actual tailings deposition. If these time frames coincided with air quality monitoring periods, it would appear that relatively low levels of tailings materials might be found in the local atmosphere, given on-going efforts to reduce the aerial extent and overall friability of those materials on the surface to become air-borne due to blowing wind.

The main comment is that air quality monitoring must be a constant and on-going endeavor that can be compared to those times that tailings are actually being deposited, dried, and covered. The on-the-ground practices of dust control are not well understood by all Molycorp personnel, (at least, the key environmental field personnel are not able to describe in detail the handling, disposal, drying, interim dust control, and/or capping of the tailings.) Present air-borne tailings levels are uncertain at best and difficult to confirm given the data sets presented in the ATSDR report, which is most likely all that is available at the present time. Continued emphasis should be made on tailings area air quality and its impact on young school children playing right next to the tailing facility, an obvious high risk group for even moderate, short term impacts to air quality conditions. A statement should be made by the ATSDR as to a long-term evaluation of the likelihood of measurable human health impacts given the proximity of the tailings facility, its actual operating practices for disposal, drying, and interim dust control, and the middle school facility, private residents, and Village of Questa.

***ATSDR Response:*** *The comments are noted. ATSDR recommends dust control measures continue to be implemented to prevent tailings dust from leaving the facility. These measures should be included in the air operating permits negotiated between Molycorp and the state of New Mexico. If the procedures and permit requirements are followed, the effects on public health from tailings dust will be minimized.*

Physical Hazards, page 29, are mentioned only slightly in the document, and only to re-iterate the situation as reported to the Agency and public. However, the Physical Hazards of questionable rock slope stability are at the present time and in the past have been a considerable concern to a number of citizen groups, (Amigos Bravos, RCRC) state and local agencies, and the mining company. Molycorp's current, major on-going expenditures to evaluate, respond, and attempt to mitigate rock pile movements are obvious evidence in fact that hazards do exist to mine workers as well as the public. Why would Molycorp be spending millions of dollars at the present time if hard evidence of movement did not exist?

The Stability Review Committee's efficacy has been considerably undermined by the demise of the Stability Review Board, an independent source of overview as to the state of rock pile stability and the best means to bring the site conditions to a point of reasonable public safety. The mining company's current efforts to stabilize the rock piles are on-going and some time will pass before conclusive results of these efforts can be confirmed (or not).

**ATSDR Response:** *The comments are noted. ATSDR recognizes that the waste rock piles pose a physical hazard.*

Health Hazard Category---page 38, lists the site as a Past Public Health Hazard, and Future Public Health Hazard, but sits the fence by not stating the obvious condition in place at the present time. This site most definitely is a Present Public Health Hazard, if for no other very good reason than unstable rock piles have been placed by the mining company in places and in configurations that are a menace to public health and commerce. Moreover, the tailing facility is located in proximity to private residents and a school housing young children, an at-risk group to short term, moderate to, at times, extreme levels of blowing tailings dust. (“extreme levels” referring to hourly averages repeatedly exceeding the 24 Hour average standard by a factor of four.) Private water sources throughout the vicinity have been contaminated due to impacts of mining and subsequent Red River water quality degradation. All of these issues reflect a Present Public Health Hazard, and are not negated by stating that no hazard exists as long as you do not drink the water or go outside when the wind is blowing.

**ATSDR Response:** *ATSDR has modified its classification of the site to a “public health hazard,” without reference to time frame. Regardless of whether harmful exposures are actually occurring at present, action is necessary to ensure that public health is protected now and in the future.*

Recommendations, page 39---items (1) and (2) are most definitely critical to minimizing health impacts to the community, but as mentioned above, should not minimize the evidence available that the site is indeed a present human health risk. Item (3) in support of a plan to replace the Village of Questa’s water delivery system due to past practices of bedding the water line with mine tailings is fully supported by the RCRC and many citizens of Questa.

Additional recommendations the ATSDR might consider include a re-thinking of water use from the Red River, to minimize mine related water consumption during and/or when milling operations are idle, to increase the overall water volume available in the Red River through the reach of the Red from the mill site to the Rio Grande, thus reducing the overall pollution levels in the Red and groundwater aquifers in the vicinity of Questa. Treatment of collected mine water and polluted springs effluent at the mill site, removal of metals and clean water return to the Red River would also increase the overall water volume in the Red and contribute to lowering overall pollution levels. Also, a serious consideration of termination of the tailings facility operation in favor of tailings disposal in the open pit along with a water recycling plan for all milling operations would result in dramatic water volume and quality improvements to the Red River and Questa community.

**ATSDR Response:** *These environmental contamination issues are the responsibility of the U.S. Environmental Protection Agency (EPA). If requested by EPA, ATSDR would be willing to comment on the public health protectiveness of any remedial alternatives under consideration for the Molycorp site.*

Public Health Action Plan—page 39, should include a concerted effort by the ATSDR to profile the community for health history and disease registry. This Health Assessment states in a number of places that “information (about use and possible contamination of private wells, levels of blowing dust, etc.) was limited.” Representatives of ATSDR admitted at the September 22, 2004 meeting that few people from the affected area actually provided health information. The RCRC questions the validity and usefulness of a Health Assessment which does not adequately represent health data from present and past members of the community and employees of the Molycorp Mine. It is understood that ATSDR lacks adequate resources to conduct a fully comprehensive health assessment, and is faced with seeking information from a community where many will not openly offer this information to a government agency. However, it is important that ATSDR make a prolonged effort to develop a profile of public health impacts that must include genuine engagement with community individuals over a lengthy period of time. Not only should the Agency go to the people to seek this information, but ATSDR should also contact local health care practitioners in Questa and Taos, as well as from Holy Cross Hospital in Taos and St. Vincent’s Hospital in Santa Fe, at minimum. The Agency’s outreach efforts must be increased and prolonged if a true picture of community health impacts and public health risk is to emerge, and if the community is to trust the results and recommendations of a Public Health Assessment.

***ATSDR Response:** ATSDR did not identify exposure pathways in the Questa area that would lead to community-wide adverse health effects today. Past exposure by drinking contaminated private well water may have increased the risk of adverse health effects in some people, but the health effects would be limited to specific individuals rather than the public as a whole. Exposure to tailings dust in the 1980s and earlier increased the risk of adverse health effects in the general population (at least to those who were exposed to the dust). Those health effects would have been temporary and are not likely today because dust control measures are in effect. Specific knowledge of the health status of Questa residents would be useful for public health authorities or health care providers; however, ATSDR is not the appropriate agency to gather this knowledge, for the reasons mentioned.*

### **D3. Comments from EPA:**

Comments on ATSDR’s  
Public Health Assessment, Molycorp, Inc.,  
Questa, Taos County, New Mexico  
Public Comment Release

#### General Comment

A number of screening levels, or comparison values used by ATSDR as indicators of potential health effects are different from the screening values that EPA is currently using at the site. Consensus on screening values may help avoid the appearance of inconsistency in evaluating potential health effects between EPA’s and ATSDR’s risk evaluations. EPA would like to meet to discuss this matter further.

**ATSDR Response:** *Because of fundamental differences in the purpose and procedures for ATSDR's public health assessment and EPA's human health risk assessment, it is not essential that screening values be identical. The comparison values ATSDR uses for screening are levels in media to which exposure would not be expected to result in adverse health effects. Exceeding a comparison value does not mean that adverse health effects will occur, just that more evaluation is needed. EPA takes additional risk management factors into consideration in setting screening values for assessment purposes.*

#### Specific Comments

Page 5, Section C, Demographics. The third sentence states that the population is 80 percent Hispanic. The fourth sentence elaborates the racial percentages of the population; however the percentages do not appear to add up with 52 percent White and 42 percent some other race alone. Instead, one would expect that something like 80 percent would be attributed to a single racial group. Additional clarification is warranted.

**ATSDR Response:** *The U.S. Census Bureau treats race and Hispanic origin as two separate and distinct concepts, that is, people who are Hispanic may be of any race, and people in each racial group may be either Hispanic or not Hispanic. Therefore, the percentage of people of Hispanic ethnic origin in a population will not directly correlate with a single racial category.*

Page 6, third complete paragraph. The fourth sentence lists local trout fishing waters identified by the New Mexico Department of Game and Fish. The discussion leaves out Upper Fawn Lake. Is this correct?

**ATSDR Response:** *The New Mexico Department of Game and Fish's Public Fishing Waters Map also lists Fawn Lakes as trout fishing waters, along with several other creeks and lakes in the area. The list in the text has been updated to include Fawn Lakes.*

Page 9, Section 1, Ingestion of Groundwater from Private Wells. In this section as well as throughout the document, it is not easy to distinguish between groundwater in and near the town of Questa and groundwater at and near the mine site. However, it is assumed that analytical data from both groundwater areas were used in the Agency for Toxic Substance and Disease Registry's (ATSDR's) assessment of possible groundwater related risks. If this is not the case, the document should be modified to state directly that only Questa groundwater quality was considered.

If both Questa and mine site analytical data were used, the discussions of potential public health impacts could be improved with notations of where maximum contaminant concentrations were observed (Questa or mine site) and this information used to support, as appropriate, conclusions reported for individual contaminants. For example, the highest measured concentration of aluminum may occur at the mine site, while the second highest occurred in or near Questa. If only the former (near the mine site) exceeded the intermediate minimal risk level (MRL), the conclusion that health impacts to Questa residents are minimal would be strengthened. This same comment holds generally true for discussions of soils later in the document. Additional clarification is suggested. In addition,

EPA's preliminary screening suggests that many fewer chemicals might be considered COCs for the tailings facility than for the mine site.

**ATSDR Response:** *While ATSDR used all available groundwater sampling data for screening of contaminants, only wells that were deemed potential drinking water wells, now or in the past, were evaluated further for estimation of potential past health effects. ATSDR consulted with EPA contractors about which groundwater wells should be considered potential past drinking water wells. Because information about past contaminant levels was limited, ATSDR did a rough estimation of "worst case" potential past exposures using more current data from these wells. ATSDR recognizes that contaminants in groundwater are not evenly distributed throughout the Questa area. However, documenting the locations of individual wells in an attempt to determine past effects associated with individual wells would be both overstating the applicability of the available data and beyond the scope of the public health assessment. ATSDR did not evaluate distinct areas of the site but only the site as a whole.*

Page 11, Discussion of Individual Chemicals. The discussions of potential health impacts from the chemicals listed on pages 11 through 16 could be confusing to readers. It is recommended that some introductory discussions be included. For example, readers could be confused by text that initially indicates an exceedance of some standard or criterion, followed by additional discussion and subsequent dismissal. An introductory paragraph could include definitions of MRL and other screening criteria, and further identify the need for additional evaluation if an exceedance of these criteria is observed. Then, in the text (for example aluminum), the discussions could include language such as "Since the screening value (MRL) is exceeded, potential health impacts were further assessed....." In addition, the introductory paragraph could also indicate that several of the substances evaluated are dietary essentials and that a certain amount is actually required for good health. This issue could then be again brought up under individual contaminants. These additions would likely make the text much more user friendly for readers without substantial technical background.

Further, the heavy use of acronyms could put many readers off. Perhaps the whole phrase (e.g., minimal risk level) or "lay" versions (e.g., no-effect-level) could be used instead of acronyms. This is simply a suggestion.

**ATSDR Response:** *The evaluation process is described in the section beginning on page 8, immediately preceding the discussion of exposure pathways and contaminants of concern. The text has been rewritten to minimize the use of acronyms.*

Page 13, Lead section. The issue of children's blood lead is usually assessed by looking at the percentage of a population with blood lead concentrations above a cutoff -- usually 10 µg/dL. Does the text sufficiently address this by reporting only predicted increases in average blood lead concentrations? Please clarify.

Also, in EPA's draft the "mu" in µg/dL actually printed as a "theta". This may have resulted from printer font conversion, but this should be checked before release to the public.

**ATSDR Response:** *ATSDR typically uses conservative factors to predict blood lead level increases from exposure to lead in drinking water or soil for screening purposes. The evaluation*

*in question was for past exposure to lead in drinking water. Any current measurement of blood lead levels in area children would not add further to our limited knowledge of past exposures. ATSDR copies of the public health assessment correctly show the “mu” symbol in the units for microgram per deciliter.*

Page 14, Molybdenum section. The report seems to dismiss the potential for hair color changes in humans caused by molybdenum (Mo) interference with copper (Cu) metabolism, and suggests that "a number of hypotheses could explain anecdotal reports" of hair color changes. This conclusion would be much better supported with a brief description of the strength of the former evidence, and a listing of one or two reasonable alternative hypotheses. For example, the statement that "no reports of hair color changes ..." could, in theory, mean "no one has looked closely at this issue". The public is aware and concerned about Mo and may demand more information. Additional clarification is suggested.

***ATSDR Response:*** *Molybdenum is known to interfere with copper metabolism in ruminant animals (grazing animals that “chew their cud,” such as sheep or cows) producing symptoms such as whitening of hair or wool [34,29]. This is a problem with ruminant animals in particular, because high dietary molybdenum reacts with moderate to high dietary sulfur in the rumen (the first stomach) to form thiomolybdates. These compounds greatly reduce copper absorption, and certain thiomolybdate species can be absorbed and interfere systemically with copper metabolism [35]. This interaction between thiomolybdates and copper does not occur to a significant degree in humans [36,37]. ATSDR staff found no reference to hair color changes in humans from molybdenum exposure in case reports, toxicological studies, and epidemiologic studies reviewed for this report. The anecdotal reports ATSDR received stated that children’s hair turned white starting at the tips. A metabolic cause, if any, would cause hair to turn white starting at the roots. An apparent whitening of hair tips could be an optical effect if the ends of hairs were frayed or otherwise damaged [38]. However, due to the limited nature of the information available on effects and exposure events that took place years ago, it is impossible for ATSDR to speculate about the cause of the described hair color effects.*

*The above information has been added to the Molybdenum section in the body of the text.*

Page 16, Fluoride section. The last sentence questions whether fluoride (F) is naturally occurring or a byproduct of mine operations. The first part of the question can be answered in the affirmative, F is naturally occurring. The real question is likely to be "have or do mining operations increase F contamination of groundwater in Questa and/or at the mine site". This question is a part of EPA’s remedial investigation (RI) and has not been answered. The text should be revised.

***ATSDR Response:*** *The text has been revised to state, “Fluoride is a naturally occurring mineral at the site, and it is not yet known whether fluoride levels are elevated as a result of mine operations.”*

Page 16, Sulfate section. The screening level (i.e., 500,000 µg/L) used by ATSDR to assess sulfate effects is reported as an EPA health-based value (Table 1). However, it is different from the screening value that EPA is currently using for sulfate at the site (i.e., 1,500,000



µg/L). Consensus on this and other screening values may help avoid the appearance of inconsistency in evaluating potential health effects between EPA's and ATSDR's risk evaluations. EPA would like to meet to discuss this matter further.

**ATSDR Response:** *Because the purpose and procedures of EPA and ATSDR assessments differ, it is not essential that screening values be identical. EPA takes additional risk management factors into consideration in setting screening values for assessment purposes. EPA has, on occasion, recommended the level of 500,000 micrograms per liter (µg/L) of water as a health-based advisory for acute effects (absence of laxative effects) [44].*

Page 16, Summary section. The evaluation of individual contaminants in groundwater does not address the issue of potential additive or synergistic effects of exposure to multiple chemicals. Although this issue does not appear to be a public concern, it warrants discussion in the PHA. EPA recognizes the issue is difficult to address from a toxicological viewpoint, but some discussion using available groundwater data could be useful. For example, if the highest concentrations of contaminants come from wells in different locations (i.e., co-exposure to high concentrations is not possible), or if the highest concentrations of several contaminants occur in a relatively remote location (i.e., exposure unlikely), the issue can be addressed to some extent empirically. Additional clarification is suggested.

**ATSDR Response:** *ATSDR did not evaluate exposure to multiple contaminants because exposure to individual contaminants at certain wells was found to be high enough to pose a hazard.*

Page 17, Implications of Past Inhalation of Dust, Second paragraph. The fourth sentence suggests that the 24-hr standard is intended to protect the majority of individuals. The next sentence, "however, exceeding the standard may be unhealthy for sensitive groups" seems illogical. It is assumed that exceeding the standard would be unhealthy even for non-sensitive individuals. Do the authors mean to suggest that some sensitive individuals could be affected at TSP concentrations less than the standard? Please clarify.

Further, an indication of past tailings dust releases might be obtained by examining the soil transect data available from RI sampling. These data show no gradation of concentrations of tailings-related contaminants with distance from the tailings facility in any of several directions. In theory, these data could be used to make worst case estimates of average dust loading from the tailings.

**ATSDR Response:** *The level of risk and recommendations made to various population groups varies, depending on the air quality index (to which particulate matter contributes). According to EPA's "Air Quality Index: A Guide to Air Quality and Your Health," the 24-hour standard for particulate matter corresponds to a level that is safe for sensitive groups (people with heart or lung disease, older adults, and children) [71]. "Unusually sensitive people" (not defined) are advised to consider limiting outdoor activity at particulate levels as low as one half the 24-hour standard. Particulate levels up to 50% above the standard are considered "unhealthy for sensitive groups." These groups are advised to avoid prolonged or heavy exertion during such conditions. Levels 50-100% higher than the 24-hour standard are considered "unhealthy" and all people are advised to avoid prolonged or heavy exertion. Further recommendations are made*

*for higher levels. The text has been modified to state “24-hour standards are set to protect the majority of individuals from adverse health effects. Exceeding the standard, even slightly, increases the risk of adverse health effects for sensitive groups, such as people with asthma or other respiratory disease, the elderly, and children (greater exceedances eventually increase the risk of health effects in the general population).” We hope this clarifies our meaning.*

*The TSP and PM10 data, while limited, were sufficient to show the potential for past health effects from past exposure to dust. Attempting to determine actual tailings contribution to the dust by analyzing soil transect data was beyond the scope of the document.*

Page 20, Incidental Ingestion of Soil or Tailings. The above-mentioned transect data could be useful in evaluating potential exposures in the community as opposed to at the tailings facility or mine site. Additional clarification is suggested.

***ATSDR Response:*** *ATSDR lumped and evaluated all data labeled as tailings or surface soil in the Molycorp database. The highest contaminant concentrations are expected to be close to mine or tailings facilities, so lumping all the soil data together gave a “worst case” estimate for evaluation. Because soil exposure using this data was not expected to result in adverse health effects, further evaluation of soil data from specific areas was not performed.*

Page 24, Aroclors section. The final sentence concludes "exposure to Aroclors is not expected to result in any adverse health effects". A caveat should be added to this conclusion that this applies to people that might trespass on the site. A separate analysis would be required (and has been performed by Molycorp) for workers at the mine site.

***ATSDR Response:*** *This clarification has been added to the text.*

Appendix A. Calculations referred to in Appendix A could not be checked without back-up data. EPA assumes that sufficient quality control (QC) of calculations has been performed by others. Please clarify.

***ATSDR Response:*** *ATSDR has a thorough quality control and review process for its public health assessments. It is possible to reproduce the calculations referred to in Appendix A by using the appropriate values for contaminant levels from tables in the body of the text, along with the factors as listed in Appendix A. The result could then be checked against the calculated dose, which appears in the body of the text in the evaluation of particular contaminants.*

#### **D4. Comments from Private Citizens:**

RE: COMMENTS REGARDING September 1, 2004 PUBLIC HEALTH ASSESSMENT FOR MOLYCORP, INC., QUESTA, TAOS, N.M., EPA FACILITY ID NMD002899094

Thank you for the opportunity to comment on your Agency's recent Public Health Assessment regarding the past, present and future health impacts on the area surrounding the Community of Questa. While we are pleased to see that ATSDR acknowledges that the operations at the Molycorp Questa Mine have polluted groundwater and certain private

wells in the area as well as the surface waters of the Red River, we take issue with some of the statements made in the Assessment and some of the methods used or not used in compiling this report.

The report gives a list of 29 substances which exceeded the agency's Comparison Value Levels for ground water contaminants detected above a level where no human health effects should occur. However the individual analysis of risk of health effects of individual contaminant levels only lists levels of "arsenic, cadmium, fluoride, iron, magnesium, manganese, molybdenum, sulfate and zinc to be great enough in some wells that regular drinking of water containing the highest levels could increase the risk of adverse health effects." We take issue with this statement for two reasons.

Until recently, we were the owners of the property containing a heavily contaminated well, known as the "[name removed by ATSDR for privacy] Well". Both of us have developed numerous health problems, reported to ATSDR, which our doctors have associated with the various contaminants in that well. One such problem is spontaneous bone fracturing and bone disease. (*Citizen 1*) Testing done via Hair Sampling, Blood and Urine tests have show that [*Citizen 1*] had levels of Aluminum at 10 to 12 times the highest levels considered safe by the individual testing laboratories and by her doctors. It is a puzzle to us that aluminum is not on the list on Page 17, summary statement. We also question the conclusion made on page 11 under "Aluminum", which states "past exposure to the highest level of aluminum in well water would be unlikely to result in health effects", and feel that this statement should be re-evaluated.

**ATSDR Response:** *Please see the response to a similar comment on page 67. We have added a discussion of the possible contribution of aluminum to bone problems in unusually susceptible groups to the evaluation of aluminum in drinking water beginning on page 11. We also added aluminum to Table 6 as a possible contributor to bone problems. The levels of aluminum measured in area drinking water wells are not expected to result in adverse health effects in healthy individuals. However, aluminum in drinking water may contribute to body burdens and health problems in people with compromised renal function or with high aluminum body burdens for other reasons. This does not change ATSDR's conclusion that exposure to contaminants in private drinking water wells in the past could have resulted in adverse health effects. ATSDR does not evaluate contaminants on an individual exposure basis, and some people might be especially susceptible to toxic effects due to their personal medical status.*

While we understand the need for evaluating the "stand alone" risk for each COC, we also question whether an adequate evaluation of overall public risk can be determined by considering each contaminant individually. Our doctors are puzzled by the appearance and the degree of some of our symptoms and illnesses, and have expressed the concern that a synergistic effect of several of the COC's, if not the sum total of all the COC's we have ingested over the years may possibly explain some of our health problems. We see this failure to look at the combination of COC's and their possible health risk as a real problem with the Public Health Assessment.

**ATSDR Response:** *The purpose of the public health assessment is to determine if potential exposures to site contaminants could be expected to result in adverse health effects, not to predict individual outcomes based on specific exposures. Estimated past exposures to levels of individual contaminants in private drinking water wells were high enough to result in an increased risk of adverse health effects and a past public health hazard. Further evaluation of potential synergistic interactions between coexisting site contaminants was not performed since this evaluation was unlikely to change the hazard category. ATSDR recognizes that synergistic effects due to multiple contaminant exposures may have been possible; however the prediction, evaluation, or diagnosis of individual health outcomes from limited past data is beyond the scope of the public health assessment.*

We next take issue with the conclusion that the site posed a Past Public Health Hazard and a Future Public Health Hazard, but sees no present Public Health Hazard as long as people cease drinking from contaminated wells and stay indoors during levels of extreme winds to avoid inhaling tailings dust, yet does not commit to naming the site a Present Public Health Hazard.

There are still private wells in use in the Questa area, though the total number and the quality of the water is unknown. It has been brought to our attention that the former [name removed by ATSDR for privacy] property, and possibly it's well, both now owned by Molycorp, is being used to occasionally house out-of-town Molycorp contractors. And it is almost impossible for people, especially those most at risk physically, stay inside during periods of exceptionally high winds. This is especially true since the local Middle School is so close to the tailings ponds. Until ALL contaminated wells are found and decommissioned, and the tailings dust issue is resolved (if ever), this site most certainly presents a Present Public Health Hazard. Another reason for such a designation is barely touched upon in the Assessment: the Instability of the rock piles. This situation is so dangerous that Governor Richardson has mandated that Emergency Evacuation Plans be put in place and that Molycorp spend millions of dollars to remedy the situation. While a plan is being developed and implemented, it will be some time before it is know if it is even an effective one. So the unstable rock piles also make this site a Present Public Health Hazard to the Community and to Molycorp workers alike.

**ATSDR Response:** *ATSDR has modified its classification of the site to a "public health hazard," without reference to time frame. Regardless of whether harmful exposures are actually occurring at present, action is necessary to ensure that public health is protected now and in the future.*

Another matter which has come to our attention, and which makes us wonder about the validity of the health data collected thus far, is the fact that various members of the ATSDR site team who have been speaking to community members about their health concerns have been at odds in the information they are telling individuals to report. Several members of the team have adamantly stated that health records should not be provided to ATSDR, but rather only a list of a person's symptoms and diagnoses. Other team members have told individuals that they must send in their health records. We both were told by one team member after the September 22, 2004 Questa meeting that medical records were necessary, and she was

disappointed that she had not received them from key individuals in the community. Even we, with a heavily documented contaminated well, were given conflicting information. [Citizen 1] was told to send just a list of her symptoms and diagnoses, which she did, while [Citizen 2] was simply told “We’ll hook your doctors up with our doctors”. His medical information still has not been taken by the ATSDR team member who interviewed him. If we, who have been so involved in this process, have been given such conflicting information, no wonder the people of Questa are confused as to what they should do—aside from community members who are too intimidated by Molycorp to give their information to a government agency.

**ATSDR Response:** *ATSDR regrets any conflicting information community members were given. Part of the public health assessment process is to evaluate health concerns presented to ATSDR by the community. This evaluation is a general one in which the exposure pathways identified through the investigation are evaluated to determine the likelihood of exposures being linked to health concerns voiced by the community or other adverse health effects. It is not within the scope of ATSDR’s public health assessment process to document, evaluate, or diagnose any individual’s medical records or specific medical conditions.*

*Although ATSDR does not provide individual diagnoses, we do have physicians with expertise in occupational and environmental medicine on staff. They are willing to consult with an individual’s private physician about the individual’s medical conditions on a confidential basis. Because of the private nature of personal medical histories and records, this must be initiated by the individual and his or her personal physician. Any private medical information that ATSDR learns through such consultation will not be included in the public health assessment.*

Another important, problem with the Assessment is that certain health concerns are referred to in the body of the report (such as the whitening of hair in children), or were listed in the October 2003 Health Needs Assessment, but are not listed in Table 6: “Public Health Assessment—Public Comment Release”. This may seem unimportant, but for many people it is easier to read the more simplified Tables rather than the whole report. Nowhere in Table 6 is it stated that this is not a complete list of Public Health Comments received by the Agency. Only the people who attended the September 22, 2004 meeting learned this fact. All symptoms and diseases reported should be included in this Table.

**ATSDR Response:** *Table 6 has been updated to include all health concerns received. In some cases, concerns were combined into one table entry if they were very similar.*

Finally, as stated in the Assessment in several places, “information was limited”. This is especially true when it comes to a more complete profile of the health history of past and present members of the surrounding area and Molycorp workers. We are aware that ATSDR is working with limited resources and in a community where the atmosphere is suspicious and divisive. However, the Agency must make a concerted effort to reach out to individual community members for health information, as well as speaking with health care practitioners in the Questa and Taos areas, especially the clinics and hospitals from Taos to Santa Fe. An incomplete Public Health Assessment is of little use to anyone. In fact, such an

Assessment might do more harm than good, either by alienating the community over the long haul or giving people incompletely researched and therefore possibly false information.

**ATSDR Response:** *Health outcome data (death and disease rates in a community) can be used to give a more thorough evaluation of the public health implications of a given exposure. To evaluate health outcome data in a community, an official database containing disease rates for the local population is necessary. On the basis of research conducted by ATSDR staff and limited contact with local and state health officials, no such database is available. The scope of the public health assessment is to determine public health actions that can be taken to reduce and prevent harmful exposures to site contaminants. ATSDR considers the recommendations contained in the public health assessment to be sufficiently protective of public health.*

#### **D5. Comments from Molycorp:**

Comments on ATSDR Draft Public Health Assessment for Molycorp, Questa, New Mexico

Thank you for the opportunity to submit comments on ATSDR's Draft Public Health Assessment for Molycorp's Questa, New Mexico Mine. It is clear that a great deal of research and deliberation went into this report. It is generally professionally done, objective and of high quality. There is, however, a consistent flaw in the report that should be addressed before the report is finalized. That flaw is a lack of sufficient nexus between many of the most important conclusions in the report and the data on which those conclusions are based. As we describe below, in several instances the conclusions are not supported by the references cited to support them or the conclusions themselves are internally contradictory. In other instances the references are not sufficiently specific to validate the conclusions. ATSDR relies upon a data base that is robust and should be more than adequate to assess the risk of harm to human health from the Site, but additional effort is needed to ensure the credibility of that assessment.

Summary Section

Page 1, Paragraph 1

The comment is made that. "Waste rock and tailings have contributed heavy metals to surface water in the Red River and groundwater downgradient from the mine facilities". To our knowledge, the RI/FS that is currently underway has not come to any conclusions about this issue. Based on the data we are aware of, the source of heavy metal contamination of the Red River and downgradient groundwater (at the Mine site) is currently an open question. The USGS is in the process of measuring and evaluating the contribution from naturally occurring metals from the regional watershed in order to estimate the contribution, if any, of the mine site. The relative contribution of mine-related sources, other anthropogenic sources and natural phenomenon to ground water contamination has yet to be determined and the report should clearly state that fact.

**ATSDR Response:** *The referenced statement was taken from EPA's Hazard Ranking System documentation record, which scored contaminants at the Molycorp site for placement on the National Priorities List. ATSDR provided the statement as a generally accepted introduction as*

*to why the site was proposed for the NPL. The determination of legal responsibility for site contamination is beyond ATSDR's mandate and is not implied by this general statement.*

Page 1, Paragraph 3

The comment is made that “Some of the wells potentially used for private consumption in the past have levels of arsenic, cadmium, iron, magnesium, manganese, molybdenum, zinc, fluoride, or sulfate high enough to have increased the risk of adverse health effects, to varying degrees, if people drank water from the affected well regularly”. There are two issues that require clarification:

1) The wells to which this conclusion applies are not identified. Thus, the relationship of the wells to mining activities, the past use of the water from the wells (as drinking water, for livestock, crop irrigation, etc.) and the length of time the wells have been in use, cannot be determined. Accordingly, it is difficult to evaluate either the cause or even the existence of “increased...risk of adverse health effects” based upon exposure. 2) The findings in the summary are inconsistent with the chemical-by-chemical evaluation (Ingestion of Groundwater from Private Wells, pages 11-17) which concludes that, for some of the chemicals in the list above, it is “unlikely that health effects could have occurred from exposure.” Based on the summaries, the following chemicals were found to potentially result in an increased risk: arsenic, cadmium, fluoride, manganese, and zinc. Molybdenum, magnesium, iron, and sulfate were not found to increase the risk of adverse health effects at concentrations found in what were described as potential drinking water wells.

***ATSDR Response:*** *In response to 1), ATSDR's role is to determine the overall possibility for public health effects resulting from elevated contaminant levels at hazardous waste sites, not to evaluate individual cases. For this reason, potential drinking water wells were evaluated as a whole. The large degree of uncertainty involved in estimating past exposures was discussed in the report and would make any attempt at evaluating individual wells of limited use. In response to 2), the highest levels of molybdenum, magnesium, iron, and sulfate (in addition to the other contaminants listed) were found to be high enough to cause adverse health effects if people drank water with these concentrations regularly, and therefore these chemicals are included in the summary of contaminants that could have increased the risk of adverse health effects.*

Page 1, Paragraph 5

The comment is made that “Contaminants in Questa municipal water meet applicable water quality standards...”. We would recommend that the term contaminants not be used in connection with a drinking water supply that meets all drinking water standards, but rather constituent be used. Globally, ATSDR should review the use of the word contaminants and substitute constituents when appropriate. Constituent is often the preferred term when discussing naturally occurring chemicals, such as metals. The source of these potential constituents is not clarified. The reader may infer incorrectly that they are from Molycorp's mining operations. Two wells located west of the Sangre de Cristo mountain range supply Questa's municipal water. There is no evidence that this area has been impacted by Molycorp operations.

***ATSDR Response:*** *ATSDR has reworded the referenced conclusion to indicate that potential contaminants would be associated with the tailings, not the municipal water itself.*

## Background Section

## Page 5, Paragraph 1

The description of the operational history is incomplete. The water from the tailings pond, if it reached a certain elevation, was routed to the water treatment plant and then the treated water was placed in Pope Lake prior to being discharged to the Red River. This operation has not been used or needed for several years.

**ATSDR Response:** *This information has been added to the site operational history section.*

## Page 5, Paragraph 2

Beginning in 1993 (during a mine-shutdown) large areas of unused tailings were covered with an alluvial soil and seeded to minimize the potential windblown tailings. With the re-starting of operations in 1996 and continuing today, operations covers unused areas of tailings with surfactant, water or a soil cover to minimize the potential for windblown tailings off-site.

**ATSDR Response:** *This information has been added to the site operational history section.*

## Page 6, Paragraph 4

The last sentence states that, “The native fishery has reportedly declined significantly since the 1970s”. This statement is inaccurate and implies that the surface mine is responsible. Actually, the native trout is the Rio Grande Cutthroat, which been largely displaced from the Red River since the mid 1940’s. Exotic Brown Trout and Brook Trout were introduced into the Red River around the turn of the century (1900), and Rainbow Trout have been heavily stocked annually in the Red River since the 1920’s. The native Rio Grande Cutthroat now only occurs in the uppermost tributaries in the entire Rio Grande drainage basin, both in Colorado and New Mexico. Fish population studies have shown little change in the fish communities since the late 1950’s, either in the Red River upstream of the mine or downstream of the mine. In fact, studies as early as 1960 have shown substantial decline in fish communities beginning at the town of Red River and continuing downstream to the Village of Questa. This pattern continues to be evident today.

**ATSDR Response:** *The last two sentences of this comment appear to be contradictory. We have left the original statement as is, but added an acknowledgement that the cause of the decline has not been definitively determined.*

## Discussion Section

## Page 7

Data Used – Data sources are only very briefly described. It is therefore difficult, if not impossible, to determine exactly which data were used, particularly for the private well sampling results. The data must be described with sufficient specificity that it can easily be identified. More importantly, there should be a statement that all data relied upon for preparation of the report is available to the public at the Site Document Repository.



**ATSDR Response:** *ATSDR evaluates environmental data as to its overall implications for public health. Its public health assessment documents are intended for the general public. Detailed descriptions of data from individual wells or sampling events are not included as ATSDR does not intend to evaluate individual cases. The database prepared by Molycorp for EPA was the major source of data for this report and should be available to the public at the site repository; however, ATSDR also used data and information provided by private citizens, which are not subject to public release.*

Page 9, Ingestion of Groundwater from Private Wells

The general statement describing “several private wells located near the mine and tailings facilities have been affected by site contaminants” is not supported by the data presented in this document. The term “site contaminants” does not specify which elements are site related. In fact, metals and inorganics such as sulfate are chemicals naturally found throughout the mineralized Questa area. The EPA RI/FS is evaluating the potential for metals and inorganics, such as sulfate, in surface water and groundwater to be mining related. Since the RI/FS is not complete, the text should reflect that the source/pathway/receptor relationship has not been firmly established.

**ATSDR Response:** *ATSDR has changed the statement to refer to “potential site contaminants.” Any contaminant levels which could potentially affect public health are evaluated in this document, whether they are proven to result from site operations or not.*

Page 10, Table 1: Groundwater Contaminants

More information should be provided on the rationale for selecting data from various wells, the location of these wells, the date samples were taken, etc. The second column in Table 1 that is described as the highest concentration detected in any groundwater sample, should be removed from the Table. The maximum concentration detected in groundwater does not relate to the potential exposure of the public. The groundwater measurements do not necessarily reflect a drinking water source. Similarly, groundwater in reference locations such as Straight Creek, above the mine site has very high concentrations of these same constituents and should not be compared to drinking water concentrations. There must be a direct relationship between current or past exposure in drinking water for the concentrations to be presented in this table. This table implies incorrectly that there is the potential for the public to be exposed to the extreme concentrations in the second column.

**ATSDR Response:** *ATSDR evaluates environmental data as to its overall implications for public health. Detailed descriptions of data from individual wells and their locations are not included. The maximum concentration detected in groundwater (Column 2 in Table 1) was used for screening, as it represents a potential future exposure pathway if nothing is done to address groundwater contamination. The document indicates that these values do not represent known actual past or present exposures. Current and past exposures were estimated using only those wells that are or were potentially used for drinking water.*

Page 12, Chromium

There are sufficient site data available, as well as literature data, to demonstrate that the majority of chromium measured in well water would have been in the trivalent form. Based

on the Remedial Investigation/Feasibility Study directed by EPA, over 1247 groundwater samples were analyzed for dissolved chromium with fewer than 10 percent of the samples having detectable chromium. All the sample results were at least an order of magnitude less than the EPA Region 6 risk based screening level for trivalent chromium of 55 mg/L. In addition, a subset of the groundwater samples was analyzed for hexavalent chromium. The maximum detected value for hexavalent chromium was significantly less, by a factor of 5, than the EPA Region 6 risk based concentration level for hexavalent chromium of 0.11 mg/L. The chromium levels in the groundwater analyzed do not pose an unacceptable risk.

**ATSDR Response:** *Even assuming chromium was present in the more toxic hexavalent form (chromium [VI]), ATSDR found that no adverse health effects were expected from exposure to chromium in drinking water.*

#### Pages 17-23; Inhalation of Tailings Dust

Molycorp is entirely in agreement with the analysis of this exposure pathway's conclusions that "(I)t is impossible to accurately estimate past exposures" of the community to entrained tailing. Two points that directly support this conclusion, however, are not clearly stated. First, the empirical evidence suggests that the relative importance of mineral tailings as a source of wind borne particulates is secondary. Second, studies analyzing the adverse health effects of inhaling particulate matter are difficult to apply to the context of Molycorp's mineral tailings. These studies are based on urban particulates that tend to have a greater fraction of smaller, i.e., more inhalable particulates, and urban particulates tend to be of greater toxicity than would be expected from Molycorp's tailings because they typically contain a high percentage of combustion products including nitrous and sulfur oxides.

**ATSDR Response:** *The comments are noted.*

#### Page 17, Paragraph 2, Summary

The comment, "The levels of arsenic, cadmium, fluoride, iron, magnesium, manganese, molybdenum, sulfate, and zinc...could increase the risk of adverse health effects, to varying degrees" is not completely correct. Similar to our comments above on this statement (Pg 1, Par 3) the individual chemical-by-chemical health assessments on Pages 11-17 of the report indicate that only arsenic, cadmium, fluoride, manganese, and zinc, can be described as possibly increasing the risk of adverse health effects. It is unclear at this time if these constituents, occurring in drinking water wells can be attributable to the Molycorp mining operations.

**ATSDR Response:** *The highest levels of molybdenum, magnesium, iron, and sulfate (in addition to the other contaminants listed) were found to be high enough to cause adverse health effects if people drank water with these concentrations regularly, and therefore these chemicals are included in the summary of contaminants that could have increased the risk of adverse health effects.*

#### Page 17, Paragraph 4, Inhalation of Tailings Dust

The last sentence, "However, dust is still occasionally reported, especially on windy days" is vague and should be qualified. After more than a year of the most extensive ambient air dust

monitoring to date, Dr. Eric Winegar (Applied Measurement Science) has concluded that “the data suggest that the primary contribution to the air quality on the site is farming and vehicular activity in the area of the tailings”. This conclusion was also supported by a silicon/iron ratio analysis, showing that most of the PM<sub>10</sub> measured by Dr. Winegar was from regional sources-- not the tailings area.

**ATSDR Response:** *The comments are noted. However, ATSDR did also receive anecdotal reports of recent citizen complaints about dust.*

Page 18, Paragraph 2

The sentence, “Scientific studies conducted in other places and published in the 1980s and 1990s showed that a 1%-5% increase in total deaths, and a 10%-50% increase in respiratory or chronic obstructive pulmonary disease hospital emissions in the elderly, resulted for every 100 ug/m<sup>3</sup> increase in TSP”, needs to be qualified. Most of these studies were conducted in either urban or suburban environments that were impacted by PM<sub>10</sub> (particulate matter 10 um or less) from combustion sources including nitrous and sulfur oxides. As such, these studies have little relevance to the TSP measured near the Tailings Facility. Extensive monitoring has shown that the bulk of the PM<sub>10</sub> (the particulates most likely to cause the health effects) measured at, or near, the tailings operation is from regional sources.

**ATSDR Response:** *Combustion sources typically produce more PM<sub>2.5</sub> particles (particles less than 2.5 microns in diameter). These fine particles are more likely associated with premature mortality and hospital admissions. PM<sub>10</sub> includes coarse fraction particles resulting from windblown dust and from vehicles traveling on unpaved roads. PM<sub>10</sub> particles are more likely to accumulate in the respiratory system and aggravate health problems such as asthma. ATSDR agrees that TSP measured near the tailings facility was more likely to result in health problems associated with PM<sub>10</sub> than with fine PM<sub>2.5</sub> particles. Clarifying language to indicate these points has been added to the document text.*

Page 21, Paragraph 3, Implications of Past Inhalation of Dust (1990s) This paragraph contains the statement, “As indicated by intermittent peaks in Figure 3 and as reported by people in the Questa community, on some days PM<sub>10</sub> levels were appreciably elevated due to wind blowing dust from the Molycorp tailings facility. The short-term (hourly) PM<sub>10</sub> increases might have increased the risk of adverse health effects, especially for sensitive populations.” Based on our knowledge of management practices, we believe the air monitoring data collected in 2003 and 2004 reflect typical conditions associated with the tailings operation for the last decade. The tailings facility was one source of the PM<sub>10</sub> measured at the high school in the 1990’s. However, the data collected recently, indicate that most of the PM<sub>10</sub> is from regional sources not the tailings facility. It should be noted again that the type of PM<sub>10</sub> most often associated with the health effects described in the scientific literature is from combustion sources and is fundamentally different from tailings dust.

**ATSDR Response:** *Combustion sources typically produce more PM<sub>2.5</sub> (particles less than 2.5 microns in diameter). Both PM<sub>10</sub> and PM<sub>2.5</sub>, when above applicable standards, can result in*

*adverse health effects, regardless of the source. Molycorp provided only a summary of recent air monitoring results, so ATSDR used the NMED air monitoring data before 1999 to evaluate the air pathway.*

Page 24, Table 3: Tailings or Surface Soil Contaminants

It is not clear from the paragraph preceding Table 3 (Pg 23) or the paragraph following Table 3 (Pg 24) if Table 3 applies only to the Tailings area or to both the Mine and Tailings areas. This should be clarified in the introductory paragraph on Pg 23, Incidental Ingestion of Soil or Tailings. If the table data are only for the Tailings area, there were no Aroclors or PAHs found in this area. These compounds were detected on the mine property in locations distant from any offsite receptors. USEPA Region 9 PRGs are used as comparison values. It is more appropriate to use Human Health Medium-Specific Screening Levels developed by Region 6 (the Region in which the mine is located).

***ATSDR Response:*** *The introductory paragraph has been clarified to indicate that the data include all soil and tailings samples collected from the mine site, tailings area, and other locations.*

Page 25, 1st Paragraph, Aroclors

In this paragraph, the Aroclors are correctly described as being present on the Mine site in an area of limited access. It should be noted that when these data were first made available to Molycorp, a risk assessment was initiated to determine if employees, who are in the area on a daily basis, could be impacted by the presence of these PCBs. Molycorp worked with the USEPA to make sure that all assumptions in this risk assessment were conservative and health protective. USEPA agreed that Molycorp employees were the receptors of most concern. USEPA also selected PCBs as the only organic chemicals to carry through the RI/FS risk assessment as COPCs for onsite present and future mine employees. Molycorp's PCB risk assessment (Human Health Risk Assessment For Occupational Exposure to PCBs In Soil at the Questa Mine and Mill Site, Questa, New Mexico, February 2004 completed by McDaniel Lambert Inc.) was reviewed by USEPA and comments and suggestions were incorporated into the final document. Presentations were made to employees on the results. Below is a brief synopsis of the findings:

*PCBs were found above detection limits at five soil sampling areas on the Questa mine and mill site. Most (>95%) of the elevated detections were in the mill site alone. Based on discussions with the Mine Site Operations Manager, employees are more likely to be exposed to soil and therefore PCBs at the mill site. Therefore, the mill site was selected as the focus of identified, the limited soil contact worker and the invasive soil contact worker. The "limited scenario" is for a worker who passes through or performs light work in the area on a daily basis for 25 years. The "invasive scenario" is for a worker who performs trench digging or other heavy soil moving activities for 30 days/year for 25 years. This PCB health risk assessment evaluated the potential cancer risk and noncancer hazard to a worker population at the mill site area. The exposures and associated risks detailed in this assessment were developed using the reasonable maximum exposure approach promulgated by EPA. Risks were estimated assuming continued mining land use. These assumptions were made in accordance with regulatory guidance (EPA 1989a), the current zoning for the property, previous site assessments, site-specific information, and best professional judgment. Exposure pathways included incidental ingestion of soil, dermal contact with soil, and inhalation of particulates from soil. The table below summarizes the potential health risks to workers, at the Questa Mill Site area in terms of the noncancer hazard index and incremental lifetime cancer risk.*

***SUMMARY OF PCB HEALTH RISK***

Receptor	Cancer Risk	Noncancer Hazard Index
Worker Limited Soil Contact	$1.1 \times 10^{-6}$	0.01
Worker Invasive Soil Contact	$2.1 \times 10^{-6}$	0.02

\* $1.14 \times 10^{-6} = 0.00000114 = 1.14$  excess cancers per million people exposed

As shown in the table above, the estimated noncancer hazards (represented by the hazard index) are well below the preliminary risk management goal of 1.0 for all residential receptors. The cancer risks are within the  $10^{-4}$  (1 in 10,000) to  $10^{-6}$  (1 in 10,000,000) risk management range stipulated by the USEPA (1990b) for the general public and well below the range typically used for occupational risk management purposes (1 in 1,000 to 1 in 10,000).

**ATSDR Response:** The comments are noted. The findings of this public health assessment regarding PCBs are consistent with the information provided.

#### Page 26, Table 4: Surface Water or Seep Contaminants

Table 4 presents data on contaminants in surface water, but does not describe the location, date, or method of sampling. It is therefore almost impossible to come to any conclusions as to the source of the contamination or to determine if the contaminated surface water is located where a person could be exposed via wading or swimming. It is important for the reader to understand where and how the sampling was conducted.

**ATSDR Response:** ATSDR evaluates environmental data as to its overall implications for public health. Detailed descriptions of sample locations are not included. Because the “worst case” showed no adverse health effects expected from exposure to surface water or seeps, further evaluation of where actual exposures might occur was not performed.

#### Page 27, Table 5: Sediment Contaminants

Table 5 presents data on contaminants in sediment, but does not describe the location, date, or method of sediment sampling. While this information would not likely alter the conclusion that sediments are, “.not expected to result in health effects”, it is nevertheless important to include in the report. It is important to clarify the location and potential source(s) of elevated levels of contaminants reported in the table.

**ATSDR Response:** ATSDR evaluates environmental data as to its overall implications for public health. Detailed descriptions of sample locations are not included. Because the “worst case” showed no adverse health effects expected from exposure to sediment, further evaluation of where actual exposures might occur was not performed.

#### Page 29, Par 2, Ingestion of Garden Samples

In this paragraph it is stated that, “Sampling of washed and unwashed vegetation in the area indicated that some contaminants might be present in soil or dust on the surfaces of vegetation”. We agree that it is always a good idea to wash vegetables to remove dust and dirt prior to consumption. However, we would request that EPA’s conclusions regarding garden sampling should be included: Analysis of vegetables grown in gardens immediately south, east and north of the tailings (predominant wind and water flow directions) show that garden vegetables are safe to eat. It should also be noted in the report that there is no information to suggest that the tailings facility or other Molycorp activities are the source of contaminated dust or soil on vegetables.

***ATSDR Response:*** *The comments are noted. ATSDR used vegetable data collected by EPA to evaluate the garden vegetable pathway. On the basis of conversations with EPA representatives, EPA and ATSDR are in agreement that local produce is safe to eat.*

Page 33, Table 6: Health Concerns Expressed by Community Members

Tooth Discoloration/Bone Problems – No conclusions have been reached regarding the source of fluoride in local drinking water wells. ATSDR has previously observed this could be a regional background issue.

***ATSDR Response:*** *The comments are noted.*

Page 34, Table 6: Health Concerns Expressed by Community Members

Kidney Problems – No conclusions have been reached about the source of cadmium in local wells. The wells in question are not described anywhere in the report in terms of location, date of sampling, etc.

Gastrointestinal Problems – No conclusions have been reached in the RI/FS about the source of sulfate in local drinking water wells. The wells in question are not described anywhere in the report in terms of location, date of sampling, etc.

***ATSDR Response:*** *The comments are noted. ATSDR evaluates any contaminant that could potentially affect public health, whether proven to result from site operations or not. Our evaluation is not intended to determine risk of health effects from any individual well, but overall implications for public health.*

Page 35, Table 6: Health Concerns Expressed by Community Members

Chronic Respiratory Problems – “No metals were high enough in increase the risk of disease”. Change “in” to “to”. It might aid the reader to have some kind of overall conclusion at the end of this section about the relationship between community health concerns and the mine and tailing facility operations.

***ATSDR Response:*** *The suggested change was made.*

Health Hazard Category Section

Page 38, Paragraph 2

The following is stated in this paragraph: “Estimated past exposures to arsenic, cadmium, iron, magnesium, molybdenum, zinc, fluoride, or sulfate in water from some private wells or to particulate matter blowing off of tailings piles were potentially high enough to results in adverse health effects. Therefore ATSDR categorizes the site as a past public health hazard.” (ATSDR’s emphasis) Our comments on this paragraph are similar to previous comments (see Pg 1, Par 3). Namely, the individual chemical-by-chemical health assessments on Pages 11-17 indicate that only arsenic, cadmium, fluoride, manganese, and zinc, can be described as possibly increasing the risk of adverse health effects. It is unclear at this time if these constituents, occurring in drinking water wells can be attributable to a release related to the Molycorp mining operations. We agree that in the 70s and 80s there may have been some contribution to area TSP from the tailings facility, but that this would

have been intermittent not continuous. Any health effects were likely limited to acute symptoms such as eye, nose, throat, and upper respiratory tract irritation.

**ATSDR Response:** *Both the summary and the individual chemical evaluations indicate that the highest levels of molybdenum, magnesium, iron, and sulfate (in addition to the other contaminants listed) measured in private wells were high enough to cause adverse health effects if people drank the water regularly.*

Page 38, Paragraph 4

The following is stated in this paragraph: “Without actions and regulations to protect the public from contaminants and physical hazards at the site, the potential for adverse health effects remains. Discontinuing dust control measures, resuming drinking of contaminated well water, or failing to address rock pile stability issues could all adversely affect public health. Therefore, ATSDR categorizes the site as a potential future public health hazard.” (ATSDR’s emphasis) This paragraph ignores the fact that there are numerous regulatory and operating permit controls in place at the Mine. There are many regulatory agencies that oversee the Mine operations. Molycorp must comply with the regulations and permits from these agencies in order to operate. For example, Molycorp is regulated by several bureaus within the New Mexico Environmental Department, the Mining and Minerals Division of the Energy, Minerals and Natural Resources Department, the USEPA as well as others. The comment about rockpile stability does not seem to be within ATSDR’s mandate to “prevent harmful exposures and diseases related to toxic substances”.

**ATSDR Response:** *ATSDR recognizes that the mine currently operates under oversight of various governmental agencies. Our statements are intended to emphasize the importance of proper setting and enforcement of current regulations, because adverse health effects could result if this does not occur. Affected private wells may not be under Molycorp’s control, so it is important for the public to be aware that consumption of water from those private wells could increase the risk of adverse health effects. Finally, ATSDR does evaluate and make recommendations on the basis of physical hazards at hazardous waste sites.*

Conclusions Section

Conclusion 1 – See our comments above (Pg 38, Par 2).

Conclusion 2 – See our comments above (Pg 38, Par 2 and Pg 21, Par 3).

**ATSDR Response:** *See responses above.*

Recommendations Section

Recommendation 1 – As we have commented throughout the document, the location of wells and potential contamination sources are unclear to the reader.

**ATSDR Response:** *ATSDR’s role is to determine the overall possibility for public health effects resulting from elevated contaminant levels at hazardous waste sites, not to evaluate individual cases. For this reason, potential drinking water wells were evaluated as a whole. The large degree of uncertainty involved in estimating past exposures was discussed in the report and*

would make any attempt at evaluating individual wells of limited use. ATSDR evaluates any contaminant that could potentially affect public health, whether proven to result from site operations or not.

Recommendation 2 – Molycorp has an ongoing extensive dust mitigation effort at the tailings facility as required by its operating permits. Comprehensive dust monitoring of the tailings facility is ongoing. We also agree that sensitive individuals should limit outdoor activities on windy and dusty days, regardless of the source of the dust. Again, it should be noted that dust monitoring indicates that regional sources predominate in the current analysis of PM10 on or near the tailings facility.

**ATSDR Response:** *The comments are noted. The tailings facility is a potentially significant source of dust in the area and dust control measures should be followed.*

#### **D6. Comments from a Private Citizen:**

Re: Public Health Assessment, EPA Facility: NMD002899094

I want to thank the ATSDR team for having a second go at a Public Health Assessment for Questa and the Molycorp Superfund site. It can't have been an easy task. We're always told that the Molycorp mine presents special difficulties because of the extreme steepness of the mountains; I think you'll agree the village of Questa presents its own set of difficulties—the hesitancy of the residents to come forward, the years gone by since the early, generally undetermined exposures, lack of medical data bases, to name a few.

When I looked at the sources listed at the end of the PHA, specifically those for molybdenum, I realized you had another difficulty to contend with—a paucity of definitive studies. The European Commission's Scientific Committee of Food in its 2000 *Opinion on Tolerable Intake Level of Molybdenum*, states flat out, "There are no well-designed chronic studies in man which can be used for risk assessment." The U.S. NRC has categorized the involvement of molybdenum in the oft-cited 1961 study of Armenian men, as speculative. The Food and Nutrition Board of the Institute of Medicine refers to limited toxicity data for molybdenum in humans.

I examined the sources on molybdenum toxicity cited in the PHA because I thought it possible that the molybdenum/copper antagonism that caused depigmentation in the cattle owned by a Questa man also caused the whitening of that man's children's hair. (p.15) On molybdenum/copper interaction (p.15) the PHA says, "The effect of molybdenum intake on copper status in humans remains to be clearly established..." but in the following paragraph the PHA implies that the effects *have been* established—"Recent studies have reported that molybdenum does not interfere with copper processing in humans..." In the most recent study cited—Turnlund and Keyes, 2000, *Dietary molybdenum: effect on copper absorption, excretion, and status in young men*—"doses of up to 1.5 mg a day showed no adverse effects on copper utilization." (Dietary Reference Intakes for ...Molybdenum, FNB, IOM) However, drinking water from private wells in Questa show a much greater concentration—2.27 mg of molybdenum per liter, and amount which could be even higher if more than one



liter a day were consumed. (Table 1, page 10) In short, the Turnlund study may not apply in Questa. The PHA should make it clear that no current studies assessing copper processing in humans address the high level of molybdenum found in Questa wells.

**ATSDR Response:** *Molybdenum is known to interfere with copper metabolism in ruminant animals (grazing animals that “chew their cud,” such as sheep or cows). The resulting copper deficiency is reported to cause the animal’s hair/wool to turn white [23,29,34]. This is a problem with ruminant animals in particular, because high dietary molybdenum reacts with moderate to high dietary sulfur in the rumen (the first stomach) to form thiomolybdates. These compounds greatly reduce copper absorption, and certain thiomolybdate species can be absorbed and interfere systemically with copper metabolism [35]. This interaction between thiomolybdates and copper does not occur to a significant degree in humans [36,37]. Although the exact effect of molybdenum intake on copper status in humans remains to be clearly established, individuals who don’t take in enough dietary copper or can’t process it correctly could be at increased risk of molybdenum toxicity [23]. ATSDR staff found no reference to hair color changes in humans from molybdenum exposure in case reports, toxicological studies, and epidemiologic studies reviewed for this report. It is impossible to explain local residents’ reports of children in Questa whose hair turned white after drinking molybdenum-contaminated water. The anecdotal reports ATSDR received stated that children’s hair turned white starting at the tips. A metabolic cause, if any, would cause hair to turn white starting at the roots. An apparent whitening of hair tips could be an optical effect if the ends of hairs were frayed or otherwise damaged [38]. However, due to the limited nature of the information available on effects and exposure events that took place years ago, it is impossible for ATSDR to speculate about the cause of the described hair color effects. Molybdenum is not stored at high levels in the body, and exposure of the children to contaminated well water was reportedly stopped relatively quickly [39]. For these reasons, it is unlikely that these children would suffer long-term adverse health effects from this exposure to molybdenum.*

*Only 4 out of 46 potential former drinking water wells tested had molybdenum levels that would result in exposure higher than the tolerable upper intake level. Any adverse effects due to this exposure would have been limited to the few people drinking water regularly from these wells.*

Under Health Outcome Data, the PHA says that a health database would mean nothing in Questa because “contaminant levels...were not and are not high enough to result in an increased risk of adverse health effects.” But research must prove this conclusively—there must be a sufficient number of studies, the studies must be well designed, and all studies must apply. I’m not convinced this is so with the current studies on molybdenum toxicity in humans.

**ATSDR Response:** *The PHA states “contaminant levels for pathways that would have affected the general population (soil, surface water, sediment) were not and are not high enough to result in an increased risk of adverse health effects.” For individual past exposure to molybdenum in drinking water, few details are known about individuals’ specific activities and the exact levels of molybdenum they might have been exposed to, so it is impossible to directly and definitely link*

*their potential past exposure with past or current health statistics. The people who regularly drank private well water with the highest concentrations of molybdenum could have experienced adverse health effects.*

I was also interested in the methodological approach in the PHA; studies of contaminant levels and exposure pathways take primacy, actual health situations are hardly considered. It's not as if medical science never works in the other direction, taking stock of human health problems and then assessing or reassessing risk levels of contaminants. Consider radiation and cancer risk. As individuals, from the time of the earliest researchers like Marie Curie, have developed cancer from levels of radiation believed safe, medicine has adapted, steadily lowering approved x-ray dosages, for instance.

***ATSDR Response:*** *The first step in ATSDR's public health assessment process is to determine potential exposures and to determine if those doses could be expected to result in adverse health effects. ATSDR relied on community members providing information about how people in the community might come into contact with site contaminants. In the absence of site-specific information, ATSDR used conservative assumptions about how people might be exposed. We did not identify any current exposures high enough to be expected to result in adverse health effects. Exposures that occurred in the past probably increased the risk of adverse health effects. However, those exposures were most likely limited to particular individuals who drank from specific contaminated wells in the case of drinking water. Any health effects experienced in the general population from dust exposure would have been temporary. Therefore, in the context of the public health assessment, further investigation of the health status of the general Questa population is not justified. We do not mean to imply that knowledge of a community's health status is not useful for public health authorities or health care providers; however, ATSDR is not the appropriate agency to gather this knowledge, for the reasons stated.*

As the PHA mentions, no health studies have been done in Questa to see if Questa residents show illness that might be caused by contaminants at the site. But ATSDR must consider this information relevant since ATSDR interviews health professionals, and can authorize epidemiology studies, disease registries, or research on specific hazardous substances. I hope all these can be done in Questa in an expanded site public health action plan, and that we haven't seen the last of the ATSDR team.

***ATSDR Response:*** *ATSDR did not identify current or past exposures great enough to justify further investigation of the health status of the general Questa population. We do not mean to imply that such studies would not be useful for public health authorities or health care providers, but that ATSDR is not the appropriate agency to gather this knowledge. Although this public health assessment is in its final version, ATSDR is still willing to provide public health-related consultation to the community, EPA, or other organizations, upon request.*