2 Responses to Oral Comments

In this section, EPA provides further response to some of the formal oral comments received at the public meeting held on February 26, 2004. Formal oral comments and questions were received from numerous parties at the public meeting. Most of these comments were adequately addressed during the meeting. Responses are provided below to selected comments from twelve community members. The full transcript of the public meeting is attached to this Responsiveness Summary.

2.1 Responses to Comments from Mr. Jerry Grant, Community Member

Mr. Grant Comment No. 1, Transcript Page 34, Line 23. *The third part of it was the last monitoring of water from Clipper Creek and Lost Lake and down through Greenhorn.*

EPA's Response. The comment pertains to whether arsenic levels are being monitored on a routine basis in the mentioned surface water features, and if so, what the results show. EPA monitors selected surface water locations quarterly. The most recent monitoring event was conducted in March 2004. The arsenic results included 53 μg/L in Little Clipper Creek above Lost Lake, a maximum of 25 μg/L (in the higher of two samples) in Lost Lake, and 8.9 μg/L in Little Greenhorn Creek (which is located downstream of Lost Lake) at a location greater than a mile downstream from its confluence with Clipper Creek.

Mr. Grant Comment No. 2, Transcript Page 74, Line 4. *Just for the record and for everybody else, I would like to reiterate a little bit of what Will is talking about. I think that if you present the project as phase one of a total project, it feels better, at least for us and I think for a lot of residents who are involved down south of Greenhorn. Because this proposal makes everybody else feel like they're some lost children. So, I highly encourage this as a phase one of a total project and not just as a -- because this sounds like this is bing presented as a project and then you're going to close down.*

EPA's Response. The comment follows up on a comment made earlier in the meeting by Will Doleman (Transcript Page 71, Line 16) in which Mr. Doleman expresses a preference for conducting the entire cleanup of the Lava Cap Mine Superfund Site at once instead of in stages. EPA would like to reassure the public that the cleanup of the Mine Area Operable Unit is only the beginning of the process of cleaning up the entire Site. The main reason EPA is taking action at the Mine Area Operable Unit at this time is to take steps to secure the mine tailings located behind the failed log dam at the earliest practicable time. EPA has not yet completed its study of the cleanup options for other areas of the Site. Were we to wait until these furthest studies were completed, measures to address the tailings behind the log dam would be delayed for a period of one or more years. EPA believes it is very important that the source areas at the Mine Area Operable Unit be contained as soon as possible to ensure that further releases do not impact downstream areas. EPA continues to develop cleanup alternatives for the Groundwater Operable Unit and the Lost Lake Operable Unit and will propose cleanup plans for those components of the project at a later date.

2.2 Responses to Comments from Mr. Charlie Hatcher, Community Member

Mr. Hatcher Comment No. 1, Transcript Page 37, Line 12. *But my question is about health risks involving groundwater and then also involving the creek, I mean there are brown trout in the creek, obviously I probably shouldn't go fishing in it, but where does the levels in the wells in that area, you know, should I be drinking the well water?*

EPA's Response. There are elevated risks associated with recreational use of Little Clipper Creek and EPA does not recommend regular recreational use of the creek. With respect to groundwater, levels of arsenic vary more greatly from well to well, therefore the total potential risks that a resident may be exposed to can vary considerably. However, as EPA noted at the meeting, most residential wells in the lower end of the Little Clipper Creek drainage and around Lost Lake have very low or undetectable levels of arsenic. EPA plans to add Mr. Hatcher's well to its periodic monitoring program. More detailed information on estimated risks associated with recreational use of Little Clipper Creek, groundwater consumption, and consumption of fish from Lost Lake can be found in the Human Health Risk Assessment (Appendix E of the RI Report [EPA, 2001]). The risk assessment also evaluated the potential risks associated with regular consumption of fish from Lost Lake and concluded this is a meaningful contributor to the total risk estimated for a resident/recreational user of the lake. EPA does not recommend consumption of fish from Lost Lake or Little Clipper Creek.

2.3 Responses to Comments from Mr. Will Doleman, Community Member

Mr. Doleman Comment No. 1, Transcript Page 44, Line 1. *Lost Lake Dam, the material, the sediments that are down there in the channel. And I heard that they were high, but I never did get a number.*

EPA's Response. The comment refers to the fact that material close in appearance to the mine tailings can be visually detected at the base of Lost Lake Dam. EPA reports that the arsenic concentrations collected in two different sediment samples from the base of Lost Lake Dam were 2,060 mg/kg and 2,110 mg/kg, respectively.

Mr. Doleman Comment No. 2, Transcript Page 45, Line 22. *Now the other thing was, you know, if you do a partial cleanup now, it seems to me like it would probably hurt our ability later on possibly to get a full cleanup, basically because the agencies issuing the money can say, well, we did a bunch over there and there are other people who really need it. So, it would seem smarter to me to maybe wait one year and see if we couldn't get better funding.*

EPA's Response. EPA would like to reassure the public that the cleanup of the Mine Area Operable Unit is only the beginning of the process of cleaning up the entire Site. The main reason EPA is taking action at the Mine Area Operable Unit at this time is to take steps to secure the mine tailings located behind the failed log dam at the earliest practicable time. EPA has not yet completed its study of the cleanup options for other areas of the Site. The risks for other areas of the Site are comparable to those at the Mine Area Operable Unit, therefore, EPA's conclusion remains that these areas pose an unacceptable risk to human health and the environment and must be cleaned up. Although the EPA

Region 9 Office, which is in charge of the cleanup, must request cleanup funds from EPA Headquarters as part of its budgeting process, at this time we have no reason at this time to believe funding for the cleanup of any area of the Site will be denied.

Mr. Doleman Comment No. 3, Transcript Page 46, Line 12. -- *partial cleanup is okay, but included in that there needs to be a timetable with dates stating that this is part of the whole thing and that we're this whole cleanup, and we're doing this part here and then we're doing this part here and dates on each thing so the community is ensured that they don't come back and say, well, we've spent a bunch of money on you, these people over here need it more so the other part never gets cleaned up.*

EPA's Response. In terms of the overall cleanup schedule, EPA believes it is very important that the source areas at the Mine Area Operable Unit be contained as soon as possible to ensure that further releases do not impact downstream areas. Concurrent with the design of the mine area remedy selected in this ROD, EPA will continue to work on two other components of the overall site cleanup: the Lost Lake area; and groundwater contamination. EPA projects being able to present cleanup plans for these other portions of the site to the public in the near term.

Mr. Doleman Comment No. 4, Transcript Page 71, Line 6. *I think the plan is very well written up from what I can see, and I guess we would prefer 3-4 it seems like the better for very little difference in money.*

EPA's Response. EPA acknowledges Mr. Doleman's comment in support of Alternative 3-4.

2.4 Responses to Comments from Mr. Kyle Leach, Community Member

Mr. Leach Comment No. 1, Transcript Page 50, Line 21. *And I was going to ask, was there any solubility testing done on the material, the waste rock that's going to be capped and left in place, and if so, what methods were used?*

EPA's Response. Laboratory solubility testing was not performed specifically on the waste rock. However, solubility testing was conducted on the tailings, including RARA TCLP testing and the State of California Waste Extraction Test (WET) to determine if Soluble Threshold Limit Concentrations (STLC) were exceeded.

Mr. Leach Comment No. 2, Transcript Page 51, Line 7. *Did you do an acid test?*

EPA's Response. This is a follow-up to the previous question. The TCLP test uses acetic acid as the extractant and the WET test uses citric acid as the extractant.

Mr. Leach Comment No. 3, Transcript Page 51, Line 18. *But the lab tests that you did for solubility, was that with the water soaking or was it the standard lab test.*

EPA's Response. Both tests used the standard extraction procedures. As noted in the previous response, the standard procedures use acid for the extraction. The variation of the WET test in which demonize water is used was not conducted on the Lava Cap Mine tailings.

2.5 Responses to Comments from Mr. Mike Brenner, Community Member

Mr. Brenner Comment No. 1, Transcript Page 52, Line 21. *So what you've really identified for certain are mitigation options in this proposal, but that's only part of the picture. I think you really need to consider the impacts to the residents along Lava Cap Mine Road, the fact that it is the only access. The talk in the past for the preliminary investigation, the EPA used that road without identifying it and we found out after the fact there was damage to the thin pavement sections that cannot sustain heavy truck traffic. School children use the intersection of Lava Cap Mine and Idaho-Maryland and Lava Cap for the school bus. So I hope you consider these when you identify your access alternatives.*

EPA's Response. EPA appreciates the concerns of residents along Lava Cap Mine Road and the potential impacts of significant construction traffic. It should be noted that there are only two access points into the mine both with narrow roadways, so EPA's options are fairly limited. Both routes have some drawbacks related to impacts on residents, impacts to the road, ease of use for construction equipment, and potential impacts on construction staging and sequencing.

EPA will consider the access options further during the design phase and is committed to working with the community on these options and providing appropriate maintenance/repairs to ensure that any impacts to the roadways associated with remedy implementation are minimized.

2.6 Responses to Comments from Mr. Jim Dyer, Community Member

Mr. Dyer Comment No. 1, Transcript Page 55, Line 17. *We would prefer Option 3-4, it sounds good to my wife and I.*

EPA's Response. EPA acknowledges Mr. Dyer's comment in support of Alternative 3-4.

Mr. Dyer Comment No. 2, Transcript Page 56, Line 16. *You also mention in here airborne contamination, and I was wondering what range you were considering, as far as 150 feet from Little Clipper Creek on either side of it, 200 feet? What did you consider to be a hazard in terms of range?*

EPA's Response. There is not a specific distance away from the construction activities where potential hazards related to airborne contaminants are no longer a concern. There are many site-specific factors at the time of construction that affect the potential amount of airborne contamination, including the moisture level of the tailings being handled, the amount of wind, the excavation and transport equipment being used, and the specific location of the construction relative to surrounding features (e.g., the forest) that reduce airborne transport. EPA will require the contractor to implement strict dust control procedures during the tailings excavation and transport to mitigate potential airborne contamination concerns. In addition, EPA will coordinate with the local residents prior to construction to ensure they are aware of the construction schedule, planned activities, and potential hazards.

2.7 Responses to Comments from Mr. Volkert Bernbeck, Community Member

Mr. Bernbeck (listed as Mr. Fernley in the transcript) Comment No. 1, Transcript Page 58, Line 2. *I would just like to go on record that my wife and I also are in favor of 3-4.*

EPA's Response. EPA acknowledges Mr. Bernbeck's comment in support of Alternative 3-4.

2.8 Responses to Comments from Mr. Doug Haussler, Community Member

Mr. Haussler Comment No. 1, Transcript Page 58, Line 5. *Yes, my name is Doug Haussler and I live across the creek from Jim and Volkert here, and I also like the idea of excavating during the spring when the stuff's wet and to keep the dust particulates at a minimum. And you guys are going to haul that back to the mine and cap it with the rest of the stuff up there?.........I like that idea. And I think that the people that are directly impacted by it ought to be the ones with the final say in it. I mean, you know, you're going to be motoring through their property doing this stuff and right alongside of mine.*

EPA's Response. EPA acknowledges Mr. Haussler's support for Alternative 3-4 (excavation of the contaminated tailings and transport back to the mine for capping with the tailings pile). EPA will work closely with the property owners directly impacted by implementation of the remedy to try and minimize impacts and make sure their concerns are addressed.

2.9 Responses to Comments from Ms. Dixie Lee, Community Member

Ms. Lee's Comment No. 1- Transcript Page 58, Line 20. *My name is Dixie Lee, we live on the third residence on the mine property. I would just like to know what the difference in the level of arsenic is from down below the two other residences and mine?*

EPA's Response. The arsenic concentrations in three surface soil sampled collected from around the residence referred to in the comment, which is located further away from the mine tailings, range from 100 to 300 mg/kg. In comparison, arsenic concentrations in surface soil samples collected around the two lower residences, which are located in close proximity to the mine tailings, ranged from 100 to 1,750 mg/kg.

Ms. Lee's Comment No. 2- Transcript Page 60, Line 3. *I also have another question. When they are digging up all of this, how are they going to keep the dust down around the residences there? I mean are they going to keep it wet all the time?*

EPA's Response. EPA will require the contractor to implement strict dust control procedures, include watering things down, during the tailings excavation and transport to mitigate potential airborne contamination concerns. In addition, EPA will coordinate with the local residents prior to construction to ensure they are aware of the construction schedule, planned activities, and potential hazards. During construction activities immediately adjacent to homes, EPA may offer to temporarily relocate the residents offsite.

2.10 Responses to Comments from Mr. Craig Thurber, Community Member

Mr. Thurber's Comment No. 1- Transcript Page 63, Line 2. *Just one other question. The engineers considered possibly creating a slurry, a pipe system using the winter and finding old mine shafts and sort of putting it back in with a lot of added things to sort of bind up the arsenic, and so that would eliminate a lot of trucking and that sort of thing and it might take a few years. But it might be a cheaper remedy, because this community is a little bit like Paint Your Wagon, there's mine shafts under us, all of us, and most of us only own like 1 hundred feet down, the rest of it is still owned by mining companies and that sort of thing. Has that been considered or thought of.*

EPA's Response. The option of pumping the tailings into the underground mine workings was considered during the technology screening phase of the FS. The mining approach reported to have been used in the Lava Cap Mine was a method in which the mine openings were backfilled with waste after the ore had been extracted. Hence, the volume of void space remaining in the mine would be expected to be limited. EPA did not conduct an underground investigation to determine the void volume. This would have been a very expensive undertaking, and given the information available on the mining method used, did not seem warranted.

Mr. Thurber's Comment No. 2- Transcript Page 64, Line 5. *Add 25 percent concrete or something and bind it up.*

EPA's Response. The option of adding concrete to tailings pumped underground was not evaluated because it was unlikely that sufficient volume of storage would have been available underground for the disposal of the tailings.

2.11 Responses to Comments from Mr. Joe Boeckx, Community Member

Mr. Boeckx (listed as Mr. Books in the transcript) Comment No. 1, Transcript Page 68, Line 5. *My name is Joe Boeckx, 15800 Greenhorn, on the bottom of the material here. I own six acres right down where that creek runs through. I like 3-4.*

EPA's Response. EPA acknowledges Mr. Boeckx's comment in support of Alternative 3-4.

2.12 Responses to Comments from Mr. Tim Taylor, Community Member

Mr. Taylor Comment No. 1, Transcript Page 72, Line 6. *I would like Alternative 1-0, it's not really mentioned, but that's to do nothing.*

EPA's Response. EPA acknowledges Mr. Taylor's comment. However, it is EPA's determination that the "no action" alternative does not meet the minimum degree of protectiveness required by the National Contingency Plan. EPA has determined that the Mine Area Operable Unit represents presents an unacceptable threat to human health and the environment, and therefore must be cleaned up.

PART III - Responsiveness Summary

Written Comments Received

[redacted]

02/17/2004 10:27 PM

To: David Seter/R9/USEPA/US@EPA
cc: Don Hodge/R9/USEPA/US@EPA
Subject: Superfund

Dear Dave and Don,
I agree with your preferred Alternative, I just have a couple of concerns:

We have spend $ 150,000.- for an elaborate garden with valuable shrubs and an arboretum of about 80 rare trees, now protected by a 9 feet high fence and gates against deer damage. If the washed down tailings will be removed, that portion of the fence and one gate will probably have to be removed. Will you pay for a temporary fence west of little clipper creek, to keep the deer out while the tailings are beeing removed and for the erection of a new fence and gate at the present location? (Allen Foles did the fence; he did a solid job and was very reasonable).

We don't have any plantings in the area of the tailings. The natural trees there however are very beautiful and we hope their bark will not be damaged.

Iam sure you will take measures to reduce the dust as much as possible (water spray trucks etc).

What you have not mentioned in your paper is the mosquito problem in the summer caused by pools and puddles in the creek due to the washed down tailings. Between 2000 and 2003 I have improved this condition somewhat by cutting ditches to drain them and filling them with gravel. Hopefully this condition will be improved and not worsened by your projected work.

In summary we are in full support of your " preferred Alternative".

Volkert and Debra Bernbeck
[redacted]
Grass Valley,CA 95945
[redacted]

Ps. We did not get the results of the last two water tests for our old and our new well.
could you bring them to the meeting on the 26 ?

Genevieve Field-Ridley
[redacted]
02/18/2004 12:33 PM

To: David Seter/R9/USEPA/US@EPA
cc:
Subject: Lava Cap Mine

Dear Mr. Seter,

I read with interest your latest Lava Cap Mine Newsletter and noticed that you will likely be considering a treatment plant for removal of As in surface water. Our firm, Walker & Associates, Inc in Sacramento has designed and constructed active and passive units for As removal in mine waters. I was the project coordinator for the testing and design of the system now being used at the Leviathan Mine. Obviously, we would like the opportunity to provide some information on our systems presently in yuse at several sites throughout the West, including 3 in California. Some of this in our website: www.walkergeochem.com. We would appreciate hearing from you at your convenience. You and I have had several conversations about other sites in the past and we beleive we could make a significant impact on this site.

Thanks for your consideration,
William J. Walker, Ph.D.
Senior Geochemist
Walker & Associates, Inc.
916-442-5304

Robert Shoemaker
[redacted]
>

02/27/2004 08:33 AM
Please respond to
Robert Shoemaker

To: David Seter/R9/USEPA/US@EPA
cc:
Subject:

Lava Cap Arsenic.doc

February 26, 2004

Mr. David Seter
Project Manager,
Lava Cap Mine Superfund Site

Dear Mr. Seter:

The following is my contribution of comments for the subject noted above.

I preface my remarks by stating I am qualified to speak on this matter as I have had experience in research, design, construction and operation of 80 heap leaching and 40 conventional milling operations for the recovery of gold and silver from their ores and many other plants for the treatment and recovery of both ferrous and non ferrous metals. I am also acquainted with the contractor on the Lava Cap project and take pride that I was successful in convincing Mr. James Poirot to become a civil engineer instead of a carpenter which led him to become Chairman and CEO of CH2M Hill which was an outgrowth of the engineering firm of Cornell, Howland, Hayes and Merrifield.

The EPA has studied the risks to both human and ecological health posed by the site and these efforts identified arsenic as the primary chemical of concern for human health at the site and arsenic and other metals as potentially harmful to plant and animal species. In special regard to animals the EPA gives a very long list of animals, birds and reptiles that live on the site and are apparently not affected by the arsenic. The mine is now over 140 years old and the EPA has not identified any human or animal that has been affected or become sick in any way by contact with the arsenic present. In addition the EPA has apparently not taken into consideration that the arsenic is present in both soluble and insoluble forms with the latter being arsenopyrite which is one of the most insoluble minerals existing and should not be considered hazardous. To use *Total Arsenic* only is deliberately misleading and highly unprofessional and does not permit a fair and unbiased assessment of the problems involved (if any). In addition, while the EPA recommends the installation of a treatment plant to lower the arsenic content of water issuing from the mine site, they do not state whether such a treatment plant is technically feasible and/or would be capable of lowering the contained arsenic to less than 10 parts per billion.

The EPA has stated that the Lava Cap mine operated at various times from 1861 to 1943. All U.S. gold mines (including the Lava Cap) were closed by November 1942 by War Production Board Order No. L-208. I have not yet determined if it was re-opened after World War II. The Lava Cap operated from its inception until the mid-1920's with gravity and amalgamation flowsheets and then converted to flotation concentration. The concentrate, which was sent to the Selby,CA smelter, was composed of gold and silver plus iron and arsenic sulfides and amounted to 20-22 tons per day. A cyanide plant was added to the Lava Cap flowsheet in October, 1940 and treated the flotation concentrate for gold and silver recovery. At that time the cyanide tailings which contained the arsenic and iron sulfides were sent to the tailings pond instead of the smelter. Any cyanide compounds left at the site after plant closure would have decomposed

within a short time of plant closure and therefore cyanide does not represent a hazard.
I would appreciate hearing from you as to why the EPA believes this site is hazardous since there never has been (and thus never will be) people or wildlife harmed by the arsenic on the site.

I would appreciate being retained on the mailing list for this project.

Very truly yours,

Robert S. Shoemaker

Jerry Grant/Corinne Gelfan
[redacted]

02/27/2004 09:15 AM

To: David Seter/R9/USEPA/US@EPA
cc:
Subject: Test info

Hi David,
We live on Lost Lake (800 feet of lakefront is our property line) so we are very interested in the toxic level in the lake. Please send the December surface water test results to me for lake and surrounding area. I know that 10 ppb of arsenic is the standard for drinking water. We are especially concerned for our dog who wades in and drinks out of the lake. Also do you not recommend that we put a boat in the water?
Thanks for your feedback.
Jerry Grant

[redacted]

02/29/2004 08:37 PM

To: Don Hodge/R9/USEPA/US@EPA
cc: David Seter/R9/USEPA/US@EPA
Subject: (no subject)

Dear Don,
after our meeting we both agree with you that an application only for preferred Alternatives 2-3 and 3-4 of the Lava Cap Mine, without mentioning the clean-up of Lost Lake at this time, would have a greater chance to be approved. We are in favor of that.

Volkert and Debra BERNBECK
[redacted]
Grass Valley, CA 95945

Jim and Joan
[redacted]
03/08/2004 07:17 PM

To: David Seter/R9/USEPA/US@EPA, Don Hodge/R9/USEPA/US@EPA
cc:
Subject: Lava Cap Mine project

Our comments are attached. Thank you. EPA Letter.doc

March 8, 2004

Mr. Dave Seter, Project Manager

Mr. Don Hodge, Community Involvement Coordinator

Gentlemen:

We are writing this letter in support of proceeding with the proposed cleanup of the Lava Cap Mine area operable unit. At the February 26th meeting, we, as well as all of the families living in the affected area, supported alternative 3-4. We hope to see this plan implemented, as discussed at the meeting.

A number of people living downstream of Geenhorn Road and at Lost Lake expressed a preference for delaying any action until an overall plan for the total clean can be made. They expressed a fear that the clean up would end after the first phase was completed. This is a concern that needs to be addressed in a timely manner. A road map that lays out the several phases of the clean up would be a good first step.

Clean up activities downstream of Greenhorn Road seem, to us, to represent a more challenging set of activities; they will require more community involvement. If this approach is chosen, with the road map, more support for proceeding could be generated.

Early in the study, the dam at Lost Lake was identified as requiring replacement. The reason sighted was the danger of collapse. Expressing the need to do this, as well as other specifics, would show a definite commitment to the project.

Again, we look forward to your proceeding with the first phase next spring.

Yours truly,

James and Joan Dyer
[redacted]
Grass Valley, CA 95945

9 March 2004

Dave Seter
U.S. Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, CA 94105

COMMENTS ON PROPOSED CLEANUP PLAN FOR MINE AREA OPERABLE UNIT, LAVA CAP MINE, NEVADA COUNTY

We have reviewed the U.S. Environmental Protection Agency's February 2004 *Proposed Cleanup Plan for the Mine Operable Unit (OU-1), Lava Cap Mine Site* in Nevada County. The cleanup plan describes the potential cleanup alternatives and the U.S. EPA's preferred alternative for implementation (Alternative 2-3). We have the following comments and questions:

1) Has EPA assessed the relative effectiveness of the potential remedies for OU-1 on reducing the flux of arsenic and other mine related constituents into underlying groundwater which will be addressed during implementation of the selected remedy for OU-2? Shallow groundwater beneath the waste rock / tailings pile has been impacted as described in the Remedial Investigation Report. The mine tailings and waste rock over the bedrock reportedly contain shallow saturated zones with elevated concentrations of arsenic. However, groundwater flow paths are not well known because of the fractured nature of the aquifer and the paucity of data currently available. Therefore, the relative efficacy of the potential remedies for OU-1 to reduce arsenic loading to underlying groundwater should be an essential criterion in the decision making process. Closing the waste rock and tailings as a waste pile as proposed in Alternative 2-3 may not prevent impacts to perched or shallow groundwater if the proposed surface water diversions do not effectively reduce groundwater recharge and significantly lower groundwater levels. In contrast, an onsite lined disposal cell will more likely effectively contain the arsenic and other mine related constituents and be more protective of shallow underlying groundwater. Long term cost savings might then be realized in the implementation of a remedy for OU-2.

2) We concur with EPA's proposal to implement the selected alternative in phases, as appropriate. For example, Alternative 2-3 would be conducted in phases to evaluate the effectiveness of surface water controls before designing and constructing a surface water treatment plant. Currently there is a significant level of uncertainty on the influence of an adjacent ephemeral stream on mine portal discharge rates. The mine portal is partially covered with waste rock and

colluvium which also receive runoff from the stream. This area should be well characterized prior to designing and constructing a surface water treatment plant. Furthermore, the effectiveness of the proposed surface water diversions to direct flow away from the mine inlets and from the consolidated waste pile should be directly evaluated and adjustments should be made in a phased approach as necessary.

3) The proposed preliminary remediation goal for surface water is set at the federal Maximum Contaminant Level (MCL) for arsenic of 10 micrograms per liter (μg/l). What are the technological and economic impacts of treating to background surface water arsenic concentrations which are reportedly less than 1 μg/l?

4) The design plans for the proposed buttress will need to address dynamic failure and the potential for liquifaction of the tailings behind the buttress.

Please call me at (916) 464-4736 if you have any questions regarding our comments.

Robert Busby

Robert Busby, C.E.G.
Associate Engineering Geologist

cc: Steve Ross, California Department of Toxics Substances Control, Sacramento

Comments on US EPA Lava Cap Mine Superfund Site Document, "US EPA Proposes Cleanup Plan for Mine Area Operable Unit," Dated February 2004

Comments Submitted by
G. Fred Lee, PhD, DEE
G. Fred Lee & Associates
27298 E. El Macero Drive, El Macero, CA 95618
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www.gfredlee.com

March 10, 2004

In October 2003 the US EPA issued a "Draft Mine Area Feasibility Study," which discussed various alternatives for remediation of the mine area of the Lava Cap Mine Superfund site. Detailed comments on this draft were submitted on November 14, 2003, to SYRCL by G. Fred Lee, TAG Advisor to the public on the Lava Cap Mine Superfund site. Recently the US EPA has responded to G. F. Lee's comments. Dr. Lee is providing SYRCL with comments on the adequacy of the US EPA's responses, in a separate discussion. Summary background information on the Lava Cap Mine Superfund site remediation has been provided by Lee and Jones-Lee (2003a).

Recently the US EPA released the Public Release Draft Mine Area Feasibility Study (FS) for the Lava Cap Mine Superfund site, Nevada County, California, dated February 2004. This document is the final version of the October 2003 draft FS for the mine area. In mid-February 2004 the US EPA scheduled a public hearing for February 26th, which was to be held in Grass Valley, California, in which the Agency staff briefly summarized the options for remediation of the mine area of the Lava Cap Mine Superfund site. Associated with this meeting, the US EPA released a 16-page summary of the alternatives for remediation of the mine area and, for the first time, made available the US EPA's "preferred" alternative. The US EPA has repeatedly made it clear that this is just the first phase of the remediation of the Lava Cap Mine Superfund site. Additional phases will be devoted to the deposition/Lost Lake area and the groundwaters. Provided below are comments on some of the issues covered in the 16-page document, "US EPA Proposes Cleanup Plan for Mine Area Operable Unit" that may be of concern to stakeholders in the Lava Cap Mine Superfund site remediation.

Overall, the US EPA's 16-page write-up, which was the focal point of discussions at the February 26th public hearing, presents a good overview discussion of the nature of the problems and the various alternatives that can be used to control them in the mine area operable unit. The US EPA's preferred alternative for the mine tailings and waste rock, tailings dam, mine buildings and surface water involves

- consolidating, regrading and capping the tailings at the site with an "impermeable membrane"
- covering tailings and waste rock with soil and revegetating
- replacing the log dam with a rock buttress
- diverting clean surface water flow around the mine tailings
- collecting and treating contaminated water draining from the mine shaft and from the tailings
- removing all of the former mine processing tanks, vats, sumps and contaminated soil from the mine buildings
- disposing of this material with the mine tailings or as hazardous waste where necessary.

For the residences in the mine area, the preferred alternative is to

- demolish the residence closest to the tailings pile
- remove soil around two other residences and replace it with clean soil
- move excavated material to the mine tailings pile for long-term management.

For Little Clipper Creek to Greenhorn Road, the preferred alternative is to excavate the tailings and contaminated sediment accumulations and haul excavated material to the mine tailings pile for long-term management.

Based on my professional experience and expertise, I find that the US EPA's proposed approach for remediation of the Mine Area Operable Unit is appropriate. With high-quality construction, the proposed remediation approach for the mine area will greatly reduce the near-term threat that the tailings and contaminated soils in the mine area and along Little Clipper Creek upstream of Greenhorn Road represents to public health and the environment. Basically, the US EPA has adopted an approach of an acceptable least-cost remediation of the immediate threat caused by the tailings and runoff waters, where the long-term costs associated with maintaining the capped tailings and contaminated soils and treatment of mine discharges and runoff waters will have to be paid by future generations.

Drs. Anne Jones-Lee and I have been involved in review of a number of Superfund sites, with respect to the adequacy of investigation and remediation relative to providing a high degree of public health and environmental protection for as long as the hazardous and non-hazardous/deleterious chemicals present at the site are a threat. We have found that Superfund/hazardous chemical site investigations do not necessarily obtain the technical information needed to adequately assess the hazards to public health and the environment. Further, there is pressure on the US EPA and state regulatory agencies to relax Superfund site investigation and remediation requirements, especially as they relate to initial remediation of the site. While long-term effectiveness is one of the primary criteria by which the remediation approach is to be evaluated, frequently on-site and some off-site remediation approaches that are used are only temporary containment of the hazardous chemicals left at the site after remediation. Lee and Jones (1991a,b), Lee and Jones-Lee (1994; 1996; 1997; 1998; 1999; 2000a,b; 2003b; 2004) and Lee (1997; 2003a,b) have discussed problems with approaches that are being used in Superfund and hazardous chemical site remediation and brownfield redevelopment of hazardous chemical sites.

Presented below is a discussion of some of the Lava Cap Mine area remediation issues that the public and regulatory agencies may wish to consider in supporting the US EPA's February 2004 proposed remediation of the mine area.

Cleanup Objectives

The US EPA has selected 10 μg/L as the arsenic cleanup objective for contaminated waters at the Lava Cap Mine Superfund site. This value is the same as the US EPA drinking water maximum contaminant level (MCL) for arsenic in domestic water supplies. The US EPA Lava Cap Mine Superfund site staff have characterized this cleanup objective as "protective" without discussing the degree of protection provided. In my previous discussion of the appropriateness of using this value as a cleanup objective, I have characterized this value as a politically based MCL. This value is not a risk-based value but was selected to reduce the cost of water treatment to remove arsenic from drinking water for small domestic water supplies.

Adopting this value at the Lava Cap Mine Superfund site as the water arsenic cleanup objective is not in accord with the Central Valley Regional Water Quality Control Board approach for establishing water cleanup objectives for waste-derived pollutants. At other Superfund sites background or a true risk-based value is used as the cleanup objective for waste-derived pollutants. A review of the literature on the cancer risk in drinking water shows that the National Research Council (NRC, 2001) arsenic review estimated that a drinking water MCL for arsenic of 3 μg/L would produce a cancer risk of one additional cancer in 1,000 people. Normally the additional cancer risk established for drinking water is one additional cancer in a million people who consume 2 liters (about 2 quarts) of water per day over their lifetime. The NRC states that the 10 μg/L arsenic MCL is estimated to lead to 23 additional bladder cancers and 18 additional lung cancers in 10,000 people. In the spring of 2003 the California Office of Environmental Health Hazard Assessment (OEHHA, 2003) established a public heath drinking water goal for arsenic of 0.004 μg/L.

The US EPA (2002) established a water quality criterion for arsenic in water of 0.018 μg/L for drinking water and consumption of organisms that are taken from the water of concern. The drinking water component was the primary factor in establishing this water quality criterion. It is clear that the US EPA 10 μg/L drinking water MCL carries a much higher cancer risk than the US EPA normally accepts for drinking water. The reason the US EPA established an arsenic drinking water MCL of 10 μg/L was the projected costs to small domestic water supplies. The US EPA did not want to confront the political pressure of increasing the cost of water treatment for small domestic water supplies.

It has been found that arsenic naturally occurs in many surface and groundwaters at a few µg/L. This arsenic may be part of the cause of why 1 in 3 people will acquire cancer during their lifetime. About half of those who acquire cancer will die from it. At the Lava Cap Mine Superfund site the "background" arsenic in surface waters is about 2 µg/L.

Using the 10 µg/L as a cleanup objective at the Lava Cap Mine Superfund site will be protective since the arsenic derived from the mine and the tailings will be diluted by low-arsenic water before the runoff from the area will be consumed as drinking water on a regular basis. It will be important that no one establish an individual water supply based on surface waters of Little Clipper Creek, Clipper Creek, or Little Greenhorn Creek.

The 20 mg/kg for soil and the 25 mg/kg for sediments selected by the US EPA as cleanup objectives for tailings-contaminated soils and sediments is in accord with typical Superfund soil and sediment cleanup objectives. These values are protective of human health for those who have occasional contact with the soil or sediment. They are also expected to be protective of wildlife.

Remediation of the Tailings Pile

The primary remediation approach for the mine tailings area is to regrade the surface of the current tailings pile, add the contaminated soil and sediments from the mine area and along Little Clipper Creek, cover the upgraded tailings pile with a plastic sheeting liner, cover the plastic sheeting with a couple of feet of low-arsenic soil and vegetate the soil layer. Basically the US EPA is proposing to create an upgraded tailings pile. It will not be a regular landfill without a bottom liner and leachate collection system. It has been found that the moisture (water) in the existing tailings pile leaches high levels of arsenic that can pollute groundwaters. The US EPA's recommended approach relies on the ability of the plastic sheeting liner in the cover to prevent water from entering the tailings pile. A key issue that should be addressed is the ability of the plastic sheeting liner in the cover to keep moisture out of the tailings.

The US EPA, in its February 26, 2004, summary of the mine area remediation approaches, has a category called "Long-Term Effectiveness." However, no information is provided on what the US EPA staff who developed the evaluation of the effectiveness of the various approaches considered for the mine area remediation with the plastic sheeting cover liner meant by Long-Term Effectiveness. The only true term of reference for long-term effectiveness should be for as long as the wastes that are left at the site are a threat. This is the regulatory requirement for landfilling of wastes in California. The proposed approach of capping the tailings and contaminated soils with a plastic sheeting cover liner is known to be effective for a short term compared to the length of time that the waste tailings and polluted soils placed under the plastic sheeting will be a threat.

The US EPA has indicated that the plastic sheeting covered tailings pile will be "*Very Effective*" and "*Would provide long term treatment of mine discharges and tailing seeps and long term containment of mine tailings.*" The Feasibility Study (FS) document states on page 5-27, "*Based on the performance of existing landfill liner and cover materials, it is estimated that little or no deterioration of the HDPE membrane would occur for a period in excess of 200 years.*" No citation is given for this statement. At the February 26, 2004, pubic hearing, D. Seter, in response to a question from the audience, stated that he understood that the liner manufacturers claim that the liner will last 100 years. I pointed out that the liner manufacturers warrant an HDPE landfill liner for only 20 years. Further, this warranty is based on the landfill owner removing the wastes over the point in the liner where there is deterioration. Basically this warranty is of no value.

Based on my over 20 years of work on landfill liner performance, I know of no valid support for the hundreds of years period of time for the expected performance of the plastic sheeting liner in the tailings pile cover to keep water out of the tailings pile. There is considerable unreliable information on the projected performance of HDPE liners in landfills. They are based on unreliable application of the Arrhenius equation. The actual performance of the plastic sheeting layer in the tailings cover could readily be much shorter than that projected by the US EPA consultants (CH2M Hill, 2004).

One of the major deficiencies of the US EPA final document that discusses the various approaches for the remediation of the mine area is the failure to reliably discuss the consequences of the eventual failure of the plastic sheeting liner in the cover to prevent moisture from entering the landfill that would leach arsenic that can pollute groundwater under and down groundwater gradient from the capped tailings area.

Independent of how long the plastic sheeting layer in the cover is an effective barrier to water entering the tailings pile, there is no doubt that it will eventually fail to prevent large amounts of water from entering the tailings pile. The tailings in the tailings pile will be a threat to pollute groundwaters forever. A question that has not been addressed is how this failure will be detected. Since the plastic sheeting layer is buried under two feet of soil, it cannot be visually inspected for points of deterioration. Leak detectable covers are available that could indicate when the tailings pile plastic sheeting layer fails to prevent water from entering the tailings pile. However, this type of cover is typically not used because of the additional expense of operating and maintaining the system and the eventual cost of having to replace the cover when the leak detection system indicates that the low-permeability layer in the cover has failed to keep moisture out of the tailings pile.

Basically, the US EPA's recommended approach for remediation of the tailings and contaminated soils at the mine site is to temporarily contain the tailings in a plastic sheeting covered tailings pile and thereby pass the problems with true long-term maintenance of the tailings pile integrity to future generations.

50-Year Budget Period

The US EPA has used a 50-year period to estimate the costs of the various remediation approaches. While this approach is the "traditional" US EPA approach, it can greatly distort the relative costs of some remediation approaches. Of particular concern is the comparison of leaving the waste (tailings) at the site versus offsite disposal at a properly sited, designed, constructed, monitored and maintained disposal site. Fifty years is a very small part of the time that monitoring and maintenance funds will be needed to be devoted to the Lava Cap Mine tailings pile. If, in fact, the true cost of remediation were calculated, the onsite tailings pile would prove to be the most expensive. The difference is that the costs to the US EPA are less with the plastic sheeting covered tailings pile. The primary costs of this remediation will have to be borne by the state of California and the people within the sphere of influence of the Lava Cap Mine Superfund site.

Shift Responsibility for Monitoring and Stored Waste Containment System Maintenance to State of California

The US EPA's shifting of the near-term and especially the long-term monitoring and maintenance of the capped tailings and soils that will be left at the site after the proposed remediation has been carried out to the State is typical Superfund site procedure. As I understand the situation, the US EPA and the California Department of Toxic Substances Control (DTSC) must develop an agreement on the funding arrangement for near-term and long-term remediated site monitoring and maintenance. Because of the chronic problems of the state of California underfunding of its environmental agencies, there is concern that DTSC will be adequately funded to carry out the required monitoring and maintenance for as long the tailings and contaminated soils in the capped wastes are a threat – i.e., forever. DTSC should explicitly state its obligation for ad infinitum high-quality Lava Cap Mine Superfund site mine area monitoring and maintenance for as long as the wastes tailings and contaminated soils left at the site under a plastic sheeting liner and cover will be a threat. Specific information should be provided by DTSC on the resources that it will commit to this responsibility. Also, DTSC should indicate how it will keep the local stakeholders informed about the results of the monitoring and maintenance at the site.

Five-Year Review

The Superfund regulations provide for the US EPA to review "remediated" sites every five years. This review is to address any problems at the site as well as to review any new technology that has been developed for site remediation. In principal, this approach should be effective in addressing problems that develop at a remediated site. However, there have been problems in implementing the five-year review at some Superfund sites. The US Congress General Accounting Office (GAO) conducted an investigation of how well the US EPA has been carrying out its five-year review responsibility. The GAO reported that in some areas, the five-year review had not been carried out because of insufficient funds being available. While it appears that the US EPA Region 9, which is responsible for the Lava Cap Mine Superfund site, has thus far been conducting its five-year reviews, there are significant questions about whether this Region will be funded to carry out future five-year reviews for as long as the wastes in the covered tailings pile will be a threat.

New Treatment Technology Will Evolve

The US EPA staff have indicated that it may be possible that new treatment technology will evolve that will be used to treat the tailings pile tailings and soils and thereby reduce the long-term threat and costs of the remediation of the mine area tailings and contaminated soils. I have been involved in evaluating and reviewing new technologies for treatment of waste solids, contaminated soils and polluted waters for about 20 years. My work in this topic included teaching graduate level courses on remediation technology and serving as the director of a multi-university hazardous waste research center remediation division. While many tens of millions of dollars have been devoted to developing new hazardous waste treatment technology, and a number of new approaches for waste treatment have been developed, none of this technology can compete with the initially cheaper than real cost covered tailings pile approach. It is inappropriate to think that some yet undiscovered technology will likely evolve to significantly reduce the costs of tailings pile remediation.

Public Acceptance of Remediation Approach

One of the evaluation criteria that must be used in developing a Superfund site remediation approach is "community acceptance." At the February 26, 2004, public hearing on the proposed remediation approach for the mine area, I raised a question about how the US EPA proposes to gain the community's acceptance of the proposed plan for remediation of the mine area. I specifically asked if the public would have the opportunity to review the draft record of decision (ROD) for the mine area remediation approach that was proposed to the public on February 26, 2004. There are significant questions about the validity of the approach that the US EPA Community Involvement Coordinator (D. Hodge) indicated would be followed in adopting the ROD for the mine area, where the public would not be given the opportunity to review the draft ROD. US EPA will use some undefined approach involving review of the questions asked at the February 26, 2004, public hearing and the comments submitted within the one-month comment period. At this time the US EPA has only provided the public with a general outline of the US EPA "preferred alternative" approach for remediation of the mine area. The public should be given the opportunity to review the details of the ROD, caucus among stakeholders and then express their views on the acceptability of the remediation approach for the mine area.

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LAVA CAP MINE OU1 PROPOSED PLAN
PUBLIC COMMENT

Voice Mail Message received by David Seter, RPM
Message dated Friday March 19

Robert Parvin called to say although he could not attend the Feb 26 public meeting, he was subsequently given information from others who did attend, and that EPA's proposal seems as good as any. Other than that he had no particular comments but did inquire about the status of the investigation/cleanup south of Greenhorn Road. [redacted]

(Seter returned the call on March 25, and left a message acknowledging the comment and offering to discuss the status of investigation and cleanup of other parts of the site at Mr. Parvin's convenience.)

LAVA CAP MINE OU1 PROPOSED PLAN
PUBLIC COMMENT

Voice Mail Message received by David Seter, RPM
Message dated Thursday March 11

Mary Devincenzi called to say she lives on Hoppy Hollow Road and that the residents recently (Fall 2003) had Hoppy Hollow resurfaced at a cost of $2-3,000 per home. She expressed concern that when the Lost Lake portion of the cleanup begins, if Hoppy Hollow is used as an access road, the resurfacing work will be undone through the damage of truck traffic associated with the cleanup. She inquired who would be liable for any such damage. [redacted]

(Seter returned the call on March 25, confirmed the information in the comment, and informed the commenter that when EPA proposes the cleanup plan for Lost Lake, there will be another fact sheet and public meeting, and that the access routes will be described at that time. He informed the commenter that EPA will include road restoration costs in any cleanup proposal that impacts access roads.)

[redacted]
03/23/2004 12:19 PM

To: Don Hodge/R9/USEPA/US@EPA
cc: David Seter/R9/USEPA/US@EPA
Subject: lava cap mine

U.S. Environmental Protection Agency, Region 9 March 23, 2004
75 Hawthorne Street(SFD-3)
San Francisco, CA 94105-3901
Attn: Don Hodge

Lava Cap Mine
Superfund Site

Comments in response to Public meeting on February 26, 2004:

1. It was reported that water samples are taken quarterly in various locations at the site. Written data provided at the meeting failed to provide adequate facts to justify the existence of harmful effect from the levels of arsenic or other elements or conditions of the water. Staff reported no excessive levels in any wells or drinking water. Is there any evidence of damaged plants due to harmful arsenic or other natural minerals? Consultant failed to adequately explain the existence of, the relationship of, the testing protocol of or the significance of the different arsenic compounds (As3 and As5). An explanation is necessary to properly evaluate the level of harm both potential and proven.

2. The flow rates of Little Clipper Creek and Clipper Creek are presented unclearly. Standardize the use of "gpm" or "cfs" so comparisons and relevance can be readily compared. What is the evidence that increased levels of arsenic or other minerals from the discharge are denigrating the quality of life in the creeks?

3. Staff represented that the great storm of the winter 0f 1997-98 was a hundred year storm. Perhaps, but unlikely because the storms twenty miles north of the site experienced a 500 year rated storm. Which is true? Planning for a 100 year storm or a 500 year storm requires different scenarios for protecting the waterways. Explain the differences required for construction.

4. Concerns were raised about unhealthy conditions for people, pets and plants. What evidence do you have that planting eatable vegetables in this type of soil is harmful? Are there any studies or scientific proof that mineral dust including as or other trace minerals have caused death. Injury or sickness in conditions identical to those at the site?

5. What physical damages have occurred between 1979, when the log dam gave way and 1997 when tailings were spread downstream?

6. What plans or studies are there regarding the historical structures and artifacts at the site? Are the federal, state and county archeological laws, standards and rules being followed to protect the historic assets of the site?

7. Has an EIR or EIS been completed? Will the project qualify for a Negative Declaration instead? Who has prepared and evaluated the environmental potential harm from removing the minerals from the eco-system now living on the land? What evidence is there of environmental damage to plant or aquatic life since 1997?

8. Who has evaluated the economic benefit to the public at large from the estimated costs of the project?

9. Under Site Risks ion page 5, what scientific evidence supports the conclusion that "arsenic presents the primary risk to human and ecological health at the site?

10. Based on the site specific data available at this time,. none of the alternatives are in the public's best interest and do not meet the statutory requirements of CERCLA, par.121(b). A pure scientific approach to the mine site will more likely benefit the public than the current rhetoric about mineral rich water. Arsenic is an abundant naturally occurring mineral with proven benefits to the environment. Its removal from the waterways flowing through the site may cause environmental degradation downstream and this aspect of the issue has not been addressed. The study is incomplete.

11. What options are currently available to local people who may want to eliminate minerals from their drinking water? What are the benefits to the public if people with even the potential for mineral content in their drinking water treat the water at the faucet? Has this alternative received a study? If so, publish the results. If not, why?

12. Sent to Email: seter.david@epa.gov and hodge.don@epa.gov on March 23, 2004

Respectfully submitted

Michael M. Miller
[redacted]
Alleghany, CA 95910
[redacted]

To: Don Hodge March 23, 2004

U.S. Environmental Protection Agency, Region IX

From: Will Doleman

A.C.F.W.S. Research Group

Subject: Cleanup of the Lava Cap Mine Superfund Site, Nevada County California

At a meeting in Grass Valley, February 26, 2004 representatives from the Environmental Protection Agency (EPA) discussed their proposal to clean up the Lava Cap toxic waste area from the Lava Cap mine to Greenhorn Road. As I stated to (EPA's) Dave Seter, I feel that including an outline of the entire project with a proposed schedule showing the time-lines for the action segments and the approvals, would be an important addition to the proposal. for the following reasons:

If we do a partial cleanup, this could lower our clean-up priority. Since EPA has limited funds, projects in other areas could eat up their money, and they could not get back to us.

While only four homes occupy the mining property, 30 or 40 more surround Lost Lake where the majority of arsenic tailings washed down when the Mine's log dam broke in 1996. The Federal Geological Survey team reported that the tailings sediments are over 40 feet deep in the deepest part of Lost Lake near the dam. The proposal made at the meeting does not include any part of Lost Lake, or Clipper Creek and Little Greenhorn Creek which are a short distance downstream from the Lake.

The proposal also does not deal with ground water downgrade from the Mine, nor does it address the contaminated water table in the mine itself. (The EPA reported that the adit had the highest levels or arsenic found.) I believe that in this area the EPA proposal is deficient. The mine itself and its presence in very permeable lava geologic strata poses significant risks of contaminating wells downstream. Many well drilling reports confirm that lava water bearing strata is common to Nevada County. I think that an assumption is being made that underground streams flow in the same direction as Clipper Creek. However, because of the ancient lava geologic formations, the flows could take numerous different routes. A geological survey of the flow paths from the mine should be performed. or a tracer could be added to the mine water to indicate the direction of the flow.

To compound this problem, the proposed Idaho-Maryland mine, which is below, and southwest of the Lava Cap mine is dewatering its shafts. The negative pressure could draw flow from the Lava Cap mine. Yet neighborhood wells directly between the two mines are not being tested. Another portion of this proposed mine is near Brunswick and Idaho-Maryland roads, west of Lava Cap. These wells too, are not being tested. In springs downgrade from the Lava Cap mine we have found gelatinous material, similar to that at the base of Lost Lake. This gelatinous material contains high levels of arsenates.

As the neighborhood monitor and water researcher I invite Mr. Seter, Mr. Towell, the California Dept of Health, as well as the region IX hydrologist to join me on a tour of these areas.

If we can observe the larger picture we can do the most good with our Tax Dollars cleaning up the harmful contaminants .

Once again, we in the Greenhorn Road area appreciate your offer to clean up the mine area. It is just that we feel that what has been proposed is premature. Please join us on this tour so we can show you things about our neighborhood that might have a bearing on the cleanup of the Lava Cap mine.

Thank you very much,

For the Greenhorn road assn.

Will Doleman
A.C.F.W.S. Research Group

p.s. We have data showing arsenic in well water which was gathered previous to EPA's involvement. Also we have proof of manipulation of Lava Cap's waste materials in Little Clipper creek, and affecting Clipper and Little Greenhorn creeks.

cc: Tracy Barreau
California Department of Health Services

Downgradient of Lost Lake

The area downgradient of Lost Lake is also impacted by releases from Lava Cap Mine. The majority of suspended solids—including tailings, carried in the LCC/CC drainage below the mine—likely settle out in Lost Lake and the Deposition Area. However, in the 1997 flood event, the surface water flowing over the Lost Lake Dam reportedly was milky in appearance. This indicates suspended sediment associated with the 1997 event entered the drainages beyond the Lost Lake Dam. Surface soil sample results from the relatively large, flat area near the confluence of CC and LGC indicate that some deposition of tailings likely occurred in this area. Some tailings associated with the 1997 event most likely were carried further down the watershed. The sediment sample results support this possibility as arsenic concentrations in the furthest downgradient sediment sample from LGC are still above the PRG and reference levels. Although concentrations are much lower than those detected further upstream towards Lost Lake, the results indicate that Lava Cap Mine-related impacts likely extend some distance further downstream. Additional sampling downstream in LGC will be performed to better delineate the downstream extent of Lava Cap Mine impacts.

The arsenic concentration detected in the furthest downstream surface water sample (collected from LGC just down from the LGC/CC confluence) was the lowest of any non-reference area surface water sample collected during the May 2000 sampling event (15.9 µg/L). However, this data point and those at the base of the Lost Lake Dam confirm that there is continuous loading of arsenic from the Lava Cap Mine Site into the LGC drainage.

Arsenic concentrations from samples in the area downgradient of Lost Lake are summarized in Table 7-1.

7.1.2 Fate and Transport

Contaminant transport away from the source areas at the mine can occur via the following media: sediment, surface water, groundwater, and air. Migration of contaminants from the Lava Cap Mine occurs primarily via tailings transport in LCC southward and mine discharge directly into LCC. Historically, tailings transport away from the mine likely occurred extensively during active mining operations (primarily the 1934 through 1943 time period) via direct releases of tailings into LCC for transport down to Lost Lake, which served as a tailings impoundment. Since the end of mining operations, tailings releases have occurred through and over the log dam by leakage, flooding, or partial dam failure.

In 1934 there were onl a couple of Resid-ential Well in the Mine Area Not the case to-day.

The catastrophic flood event that caused the partial log dam failure during January 1997 caused an estimated 10,000 cy of tailings to be transported down the LCC/CC/Lost Lake/LGC drainage system. Evidence of tailings deposition is observed in all reaches of this system. Prior major storm events over the last 50 years would also have resulted in significant releases from the mine, although not likely as large as the 1997 event because of the dam failure. In addition, it is probable that small but steady releases of tailings past the log dam have been occurring routinely since mining operations ended in 1943.

Future movement of contaminated sediment and tailings will be in the form of:

- Continued transport through the dam
- Flood events that wash tailings over the dam

In addition to these samples, 61 screening-level surface soil samples were collected and analyzed for arsenic only. Twenty-one of these screening samples (including one duplicate sample) were collected in the Deposition Area at locations 13-1 through 13-20 (Figure 3-6). The remaining 40 samples were collected in 20 paired locations on the residential properties around the Lost Lake perimeter and are designated 11-1 through 11-40 (Figure 3-6). The paired screening sample locations included one soil sample near the estimated mean high water level and a second sample located approximately 2 vertical feet (approximately 5 to 10 lateral feet) above the first sample. The screening samples were collected prior to the full-suite samples mentioned previously to generate an approximate distribution of tailings-impacted areas around Lost Lake and the Deposition Area and to guide the choice of sampling locations. Many of the full-suite samples were used to sample further upslope around the Deposition Area and Lost Lake to better define the actual lateral extent of the impacted areas.

Arsenic was detected in 104 out of the 106 total samples (including the screening samples) in this area. The maximum arsenic concentrations detected are 913 mg/kg at location 13E in the Deposition Area and 811 mg/kg at location 11X around Lost Lake (Figure 3-6). Arsenic concentrations in the Deposition Area and Lost Lake Area range from 4.15 to 913 mg/kg, with an mean of 339 mg/kg. The distribution of arsenic in surface soil and sediment in the Deposition Area and Lost Lake vicinity is presented on Figure 4-8.

Overall, the Deposition Area surface soil samples have slightly higher concentrations than those detected around Lost Lake. The average arsenic concentration of the Deposition Area soils is 509 mg/kg for screening samples and 362 mg/kg for full-suite samples. The average arsenic concentration around Lost Lake is 315 mg/kg for the screening samples and 251 mg/kg for the full-suite samples.

Higher arsenic concentrations are detected in the screening samples compared to the full-suite samples for both groups, because more of the screening samples are focused on impacted areas. Many of the full-suite samples were taken from higher elevation locations outside the area flooded during the 1997 flood and release of tailings from the mine.

The average arsenic concentration among the full-suite samples collected in the Deposition Area (locations 13A though 13F, 13O, and 13P) is 594 mg/kg, while the average concentration among the higher elevation upslope samples (locations 13I through 13N) is 15.1 mg/kg. These higher elevation concentrations are similar to those observed in the reference areas.

Around Lost Lake, screening samples show relatively high arsenic concentrations (average 315 mg/kg). As previously mentioned, these samples are divided into two groups: those near the mean annual high-water line and those located approximately 2 feet higher in elevation. Arsenic concentrations from the water line samples average 353 mg/kg. The arsenic concentrations in the samples collected approximately 2 feet (vertically) above the water line average 273 mg/kg. These results indicate that both sets of samples are generally within the area impacted by tailings released during the 1997 flood event. The higher elevation sample group is more variable and shows a slightly lower average arsenic concentration.

The full-suite soil samples taken around Lost Lake were used to better characterize near-lake conditions and delimit the vertical extent of tailings impacted soils. The step-out surface soil samples used to delimit the extent of the tailings-impacted area include locations 11A through 11G, 11Q, 11S, and 11T. The arsenic concentrations among the definitive samples along the lake range from 6.5 to 811 mg/kg (at location 11X), with an average of 459 mg/kg. The arsenic concentrations among the step-out samples range from 6.6 to 38.4 mg/kg (at location 11B), with an average of 12.8 mg/kg. These higher elevation arsenic concentrations are similar to reference area concentrations.

In the Deposition Area and around Lost Lake, the extent of contamination from the Lava Cap Mine is based on a review of arsenic concentrations in step-out sample locations collected along the slopes above the Deposition Area and upgradient from Lost Lake. For these upslope sample locations, arsenic is consistently very low (generally less than 25 mg/kg) in all samples collected above elevation 2,468 feet above msl (see the detailed elevation contours shown on Figure 4-8). Thus, it is assumed that the peak water elevation during the 1997 flood event in this area was just below 2,468 feet above msl. Using this elevation (and actual sample results at specific locations) to represent the extent of mine-related impacts, the size of the impacted area is delineated on Figure 4-8.

Besides arsenic, the other constituents where maximum concentrations exceed PRGs and reference area values are aluminum, cadmium, and manganese (Table 4-29). All other constituents are detected, typically in all 45 samples, but at concentrations below PRGs.

Table 4-30 shows summary statistics for the subsurface soil samples (18) collected from soil borings (hand-augered and drilled) in the Deposition Area. The locations of borings where subsurface samples were collected include 13A through 13F (hand auger locations) and 13Q and 13R (drilled locations). All soil boring locations are shown on Figure 3-6. The hand auger samples range from 3 to 10 feet bgs. Boring 13Q was sampled down to 25.5 feet bgs, and boring 13R was sampled down to 15 feet bgs.

Subsurface soil sample arsenic concentrations range from 719 to 2,480 mg/kg, with an average concentration of 1,434 mg/kg. Arsenic concentrations do not appear to attenuate with depth below the ground surface and are similar between the hand auger and drilled boring sample groups. The deepest subsurface soil sample (25 to 25.5 feet bgs at location 13Q) has an arsenic concentration of 875 mg/kg. The deepest sample at location 13R (10 to 15 feet bgs) has an arsenic concentration of 912 mg/kg. These results indicate that tailings-impacts are likely present in essentially all the soil/sediment present in the Deposition Area and Lost Lake. The subsurface soil sample results also confirm that, in addition to the 1997 flood event, there have been significant releases over an extended period of time.

The only constituent besides arsenic to exceed PRGs in the Deposition Area subsurface soil samples is cyanide. Seventeen of the 20 constituents are present in all 18 subsurface samples.

4.6.2 Sediment

since the area is also comprised of sulfur-sulfides, Iron and Nitrogen much of this cyanide may have compounded into theocyanide a substance we know little about!

Table 4-31 provides the summary statistics for all constituents analyzed in sediment in the Deposition Area and Lost Lake Area. As is shown in Table 4-31, 24 sediment samples were collected in this area. All sample locations are shown on Figure 3-6.

Downgradient of Lost Lake

The area downgradient of Lost Lake is also impacted by releases from Lava Cap Mine. The majority of suspended solids present in Little Clipper/Clipper Creeks below the mine likely settle out in Lost Lake and the Deposition Area. However, in the 1997 flood event, the surface water flowing over the Lost Lake Dam reportedly was milky in appearance indicating that tailings entered the drainages beyond Lost Lake Dam. Surface soil sample results from the relatively large, flat area near the confluence of Clipper Creek and Little Greenhorn Creek indicate that deposition of tailings occurred in this area. Additional tailings associated with the 1997 event most likely were carried further down the watershed. Although downstream concentrations are much lower than those detected further upstream towards Lost Lake, the data indicate that Lava Cap Mine-related impacts likely extend some distance downstream into Little Greenhorn Creek. Additional sampling downstream in Little Greenhorn Creek will be performed to better delineate the downstream extent of Lava Cap Mine impacts. These samples will be taken in spring of as the EPA test area has already been expanded to incorporate areas near Little Gren-ho road an

The arsenic concentration detected in the furthest downstream surface water sample (collected from Little Greenhorn Creek just down from the Clipper Creek) was the lowest of any non-reference area surface water sample collected during the May 2000 sampling event (15.9 µg/L). However, this data point and those at the base of the Lost Lake Dam confirm that there is continuous loading of arsenic from the Lava Cap Mine Site into the Little Greenhorn Creek drainage.

Risk Assessments

The baseline human health and ecological risk assessments indicate that many areas at and downgradient of the mine, impacted by mine-related contamination, contain levels of inorganic constituents, particularly arsenic, that pose a significant potential risk to human and ecological receptors.

Human Heath Risk Assessment

The Human Health Risk Assessment concludes that arsenic is the primary risk driver in impacted areas and is the only constituent that contributes significantly to the estimated risks to human receptors. The Human Health Risk Assessment evaluates potential risks to mine workers, mine resident, residents/recreational users along Little Clipper Creek below the mine, residents/recreational users around Lost Lake, recreational users of the Deposition Area, and recreational users of Clipper Creek below Lost Lake. Six exposure units at the mine and in downgradient areas were identified for estimating potential risks.

Results of the baseline risk assessment for the six exposure units indicate that potential cancer risks for both current receptors and future hypothetical receptors exceed EPA's risk management range of 10^{-6} to 10^{-4}. The estimated potential cancer risks in all exposure units range from 10^{-5} to 10^{-3} with most of the scenarios having risk estimates that are greater than the corresponding background cancer risks. Noncancer HI estimates for all exposure units exceed one and most exceed their respective background noncancer HI, indicating the potential for noncancer health impacts. The risk driver for all exposure units and media is arsenic. The estimated risks for residents around Lost Lake and along Little Clipper Creek do not exceed background as long as the residents do not participate in recreational activities around the lake or creek and do not have elevated arsenic in their residential well.

than those detected at the mine (Table ES-2). Elevated levels of arsenic have also been detected in groundwater samples from one residential well located along the Little Clipper Creek drainage below the mine.

one of these

Deposition Area and Lost Lake

In the Deposition Area and around Lost Lake, the data indicate that throughout this area, all samples below an elevation of 2,468 feet above msl have been impacted by releases from the mine.

The remedial investigation results indicate that the materials present from the ground surface all the way down to the bedrock beneath the Deposition Area are comprised primarily of tailings. The total thickness of tailings-impacted soil ranges from 22 to 28 feet in the upper end of the Deposition Area. Based on site history (Lost Lake was created as a tailings impoundment) and data from Deposition Area borings, it is presumed that all sediment filling Lost Lake is also tailings-impacted. Using the approximate shape of the original stream canyon and the current ground surface elevation, the estimated volume of tailings-impacted sediments deposited in the Deposition Area and Lost Lake is approximately 500,000 cubic yards.

Surface water samples collected from the permanent pond near the Little Clipper Creek/Clipper Creek confluence have elevated arsenic concentrations ranging from 599 to 1,160 μg/L. Groundwater samples collected from shallow monitoring wells completed in the tailings-impacted soils of the Deposition Area also contain elevated arsenic concentrations, ranging from 235 to 2,430 μg/L. However, none of the residential wells sampled around Lost Lake and Deposition Area contain arsenic above 1 μg/L.

Arsenic was not detected in air samples collected from the two Deposition Area locations sampled. However, conditions at the time of sampling were not ideal for detecting air particulate transport (i.e., there was little wind and conditions were not particularly dry).

Surface soil samples collected from lower elevations (generally within 25 feet of the lake shoreline) on residential properties around Lost Lake generally have elevated arsenic concentrations, ranging up to 848 mg/kg. Most of these samples were collected below the elevation of 2,468 feet above msl, which delineates impacted from non-impacted surface soil. Arsenic concentrations in the samples collected upslope from the lake (above elevation 2,468 feet) and towards the residences around Lost Lake and the Deposition Area range from 6.6 to 38.4 mg/kg. This concentration range is similar to reference area concentrations.

All sediment samples collected from Lost Lake, shallow and deep samples from both the northern and southern lobes, contain elevated arsenic concentrations ranging from 304 to 1,140 mg/kg.

Surface water samples collected from Lost Lake have arsenic concentrations ranging from 5.8 to 70.6 μg/L. Arsenic concentrations generally are higher in the southern lobe of the lake than in the northern lobe. Arsenic concentrations in surface water samples from Clipper Creek through the Deposition Area and in Lost Lake were highest during the October 1999 sample event, when flow rates and lake levels were the lowest.

chemicals which hid the Arsenic are being used to move the arsenic to the waters surface so that they can not be Detected on to a semi-solid Grey or orange sludge to the water ways substraight.

Site Setting

Lava Cap Mine is on the southern slope of Banner Ridge at approximately 2,800 feet above mean sea level (msl). The Little Clipper Creek drainage below the log dam is relatively steep, dropping to approximately 2,468 feet above msl at the confluence of Little Clipper Creek and Clipper Creek located 1 mile downstream.

Nevada County generally has warm, dry summers and mild, wet winters. Most of the precipitation comes during the 6 month period from November through April. Annual precipitation is approximately 53 inches in Nevada City, California.

Surface Water

The Lava Cap Mine property is located entirely within the Little Clipper Creek drainage basin. The upper reaches of Little Clipper Creek above the mine are seasonally dry and become perennial (year-round flow) below the mine where Little Clipper Creek is fed by mine discharge. Little Clipper Creek flows downstream from the Lava Cap Mine log dam for approximately 1 mile to the confluence with Clipper Creek in the Deposition Area above Lost Lake. Clipper Creek continues downstream through the Deposition Area and into Lost Lake, which is contained by the Lost Lake Dam. There is constant seepage beneath the Lost Lake Dam into the Clipper Creek channel below the dam. In addition, during most of the year, there is at least some flow over the spillway on the dam. Clipper Creek continues for less than a quarter of a mile below Lost Lake before it enters Little Greenhorn Creek.

Water discharges continuously from the caved-in adit, located in the waste rock pile area at the mine. Under normal, non-storm conditions, the flow rate from the adit was estimated to range from a low of around 50 gpm (approximately 0.1 cfs) to a high of about 200 gpm (or around 0.5 cfs). Normal flows in Little Clipper Creek and Clipper Creek are fairly low (typically no more than between 5 and 15 cfs for much of the year), but these creeks can experience significant increases in flow during winter storm events. Estimated peak flows in the winter of 2000 exceeded 300 cfs in both Little Clipper Creek and Clipper Creek.

Geology

The Lava Cap Mine Site is located in the Sierra Nevada physiographic province, which is characterized by intrusive and volcanic igneous rocks as well as metamorphosed sedimentary rocks that are faulted and fractured. In general, these rocks are highly weathered at the surface.

The key rock types in the Lava Cap Mine area, include: mine deposits, including waste rock and tailings; tertiary volcanic breccias commonly referred to as lava; zones of Tertiary conglomerates or gravels; and Paleozoic to Upper Jurassic metasedimentary rocks, including argillites, slates, conglomerates, thin-bedded cherts and other metasediments (Cole/Mills Associates, 1985).

In the vicinity of the historic mining activities at the Lava Cap Mine, the surface is covered by waste rock, underlain by tailings at the southern end of the mining area. The waste rock is a gravel and rock mixture, comprised primarily of metasedimentary unit rocks. The tailings range from fine sand to (more commonly) clay that is dark gray when wet and unoxidized. The metasedimentary rocks encountered beneath the waste rock/tailings pile were observed to be a greenish-gray argillite with evidence of quartz, feldspar, and sulfide minerals present in small amounts.

iron + sulfur + Nitrogen + cyanide = Theocyanid

The mine workings are located entirely within the metasedimentary unit. Gold-bearing quartz veins averaging 5 feet in width occur along inactive reverse faults that are oriented north-northwest and dip about 51 degrees to the east (Cole/Mills Associates, 1985). The ore material contains abundant carbonate material cut by igneous dikes of varying origin. The silver- and gold-rich ore also contains relatively high concentrations of sulfides rich in iron and arsenic.

Is this being tested for

are wells in the above orientation from the mine Lost Lake Deposition area and Lost Lake being tested?

Hydrogeology

Groundwater flow is primarily to the south-southeast between the mine and the Lost Lake area (Cole/Mills Associates, 1985), based on data from a regional domestic well survey (Hydrosearch, 1984). Shallower domestic wells, less than 200 feet deep, have an average yield of 18 gpm. Deeper domestic wells generally penetrate 300 to 570 feet, producing from 0.25 to 140 gpm (Cole/Mills Associates, 1985).

Potable groundwater throughout the Lava Cap Mine Site is contained in secondary openings (fractures and joints) of the metasedimentary bedrock unit. This fractured rock aquifer is the source of domestic water supply throughout the Site vicinity.

Water levels measured in monitoring wells completed through the waste rock/tailings pile and into the upper portions of the metasedimentary unit suggest there is a downward hydraulic gradient in the shallow bedrock aquifer. The downward gradient indicates the potential for impacted water in the shallowest portions of the aquifer beneath the tailings pile to migrate downward and deeper into the bedrock aquifer.

Groundwater also occurs in the fractured volcanic breccia (the "lava cap" on the ridge), that overlies the metasedimentary rocks north of the mine. Several springs are identified at the surface contact between the volcanic and metasedimentary units. The springs suggest that groundwater may be perched in the lava unit, with limited flux into the underlying metasedimentary unit. However, there are no direct measurements to verify this.

At the mine, shallow saturated zones are present within the waste rock/tailings pile and discharging from the mine adit. Shallow saturated zones are also present in the upper portions of the metasedimentary unit, immediately beneath the waste rock/tailings pile. This shallow water was sampled at several locations during the RI field effort, including the mine discharge from the adit, seeps from the tailings pile, and shallow monitoring wells completed beneath the waste rock/tailings pile. Elevated concentrations of arsenic are found in all of these locations suggesting that the two systems (the saturated mine wastes/workings and the underlying shallow metasedimentary unit) may be interconnected.

ck. your well report from your title company or get a copy from the county which might Indicate Like many Locale wells here that your water origanates from Lava rock geological formation. some well drillers were lax and did not list well water source

Remedial Investigation Activities

The remedial investigation at the Lava Cap Mine Site included geologic, hydrogeologic, air, and ecological investigations that involved collection of soil, sediment, surface water, groundwater, air, and biota samples. Samples were collected in the following general areas:

Terry Tamminen
Agency Secretary
Cal/EPA

Department of Toxic Substances Control

Edwin F. Lowry, Director
8800 Cal Center Drive
Sacramento, California 95826-3200

Arnold Schwarzenegger
Governor

March 24, 2004

Mr. David Seter, P.E.
Project Manager
Environmental Protection Agency, Region IX
Superfund Division
75 Hawthorne Street, (SFD-7-2)
San Francisco, California 94105

COMMENTS ON THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY PREFERRED ALTERNATIVE FOR THE PROPOSED CLEANUP PLAN FOR MINE OPERABLE UNIT, LAVA CAP MINE SITE, NEVADA COUNTY, CALIFORNIA

Dear Mr. Seter:

Thank you for the opportunity to review the proposed cleanup plan for the Mine Operable Unit (OU) of the Lava Cap Mine federal superfund site in Nevada County, California. This OU includes on-site residences, mine buildings, mine tailings, waste rock, and a portion of Little Clipper Creek (LCC) immediately below the tailings pile flowing downstream to an area just north of Greenhorn Road. The Department of Toxic Substances Control (DTSC) has completed review and is providing comments on the proposed cleanup plan and the Public Release Draft Mine Area Feasibility Study as Attachment A. The Regional Water Quality Control Board (RWQCB) has also provided comments which are enclosed as Attachment B.

DTSC accepts Environmental Protection Agency's (EPA's) proposed cleanup plan. However, DTSC finds certain disadvantages for implementing Alternative 2-3 over Alternative 2-5 for the reasons given in Attachment A.

If you have any questions, please contact me at (916) 255-3694.

Sincerely,

Steven Ross

Steven Ross
Hazardous Substance Engineer

Enclosures

cc: Mr. David Towell
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Central Valley Region
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Attachment A

I. Proposed Plan

1. DTSC agrees with EPA's view that water treatment options be evaluated after the effectiveness of any surface water controls and containment option is examined. Before proposing a water treatment system for the State to cost share, EPA should examine in greater detail the design, operation and maintenance costs for the system. Possibly a pilot system treatment study can be installed and operated to determine the necessary parameters for operating a full scale system. Operation of a full scale high capacity volume coagulation/microfiltration water treatment system may be costly and likely to produce a large volume of sludge requiring its handling. Any sludge produced may fail the STLC test increasing the disposal costs from a Class II to a Class I disposal facility.

2. DTSC accepts Alternative 1-4, excavation around residences. In addition, the northern residence may require remediation although cost estimates in the feasibility study do not account for this. One soil sample collected approximately 100 feet from the residence measured 59 mg/kg corresponds to risk and hazard above levels of human health concern.

3. DTSC accepts Alternative 3-4, excavation of contaminated sediments in Little Clipper Creek and consolidation for disposal.

4. Alternative 2-3 is acceptable to DTSC. However, EPA should attempt to mitigate disadvantages and shortcomings of this alternative when compared to Alternative 2-5. If Alternative 2-3 is selected, DTSC's position is that a 10 year cost share is appropriate. Disadvantages in selecting Alternative 2-3 in lieu of Alternative 2-5 follow:

   i. The capping component of Alternative 2-3 will not have a liner underneath the tailings which may continue to leach arsenic tainted water through fractures and joints in the bedrock. This appears possible given the saturated nature of the tailings.

   ii. Upon completing the groundwater investigation in a separate Operable Unit, optimum locations for placing groundwater extraction wells may be on top of the engineered cap.

   iii. The buttress is an additional design structure which would require future maintenance yet this engineered structure is not necessary in Alternative 2-5.

iv. The cap will likely require long-term treatment of seeps as long as the tailings remain in place resulting in additional operation and maintenance costs placed on the State compared to the disposal cell option in Alternative 2-5. Alternative 2-5 ensures tailings will be excavated, dried, consolidated and encapsulated between upper and lower liners guaranteeing its isolation. Alternative 2-5 removes the tailings to a location up gradient of source areas and away from the saturated subsurface materials. Over time, leachate from the disposal cell may diminish lowering the State's operation and maintenance costs.

v. EPA's assessment of short-term risk posed by potential exposure to arsenic identified as a limitation in implementing Alternative 2-5 is not supported. Worker safety will follow OSHA standards and residents have been removed from source areas. EPA does not detail the short-term exposure from saturated arsenic tailings anticipated by workers and whether extraordinary safety measures are necessary in implementing Alternative 2-5 over Alternative 2-3.

vi. EPA indicates Alternative 2-5 has increased short term risk and engineering challenges compared to Alternative 2-3 as a result of extensive handling and drying of saturated tailings. However, the operation and maintenance requirements would be reduced, comply with water quality objectives, and may prove more effective and permanent than the capping component of Alternative 2-3.

5. DTSC agrees that arsenic is the major risk driver. However, several other metals (aluminum, antimony, chromium (as Cr+6), iron, lead, manganese, and nickel) are present at the Lava Cap Mine Site in concentrations corresponding to estimated potential risks greater than 1 x 10-6 or hazards greater than 1.0 based on calculations employing DTSC recommended assumptions. These metals were in concentrations predicted to yield potentially significant risks to humans. The concentrations of aluminum, manganese, and nickel are only predicted to have potential to adversely affect short term workers (construction workers). Lead was present in mine source areas at concentrations up to 2320 mg/kg soil. An agreeable approach would include analysis of all these constituents during confirmation sampling with comparison to established cleanup goals in the Record of Decision and/or remedial action plans.

6. In EPA's October 5, 2001 Responses to Dr. Lee, a data gap was acknowledged at the mine area with respect to potential contamination by organic chemicals. Describe how this data gap will be addressed during remediation and confirmation sampling and/or discuss how this data gap was resolved.

7. DTSC recommends using an estimate of the central tendency such as the arithmetic mean or the 95^{th} percent upper confidence limit (UCL) on the arithmetic mean (95^{th} UCL), not the 95^{th} percentile, for background data sets of samples.

Consequently, DTSC advises employing the 95th UCL on the arithmetic mean as background concentrations of metals in surface soil (n=18), and the mean concentrations of metals in sediments (n=13). DTSC recommended background concentrations for soil, sediment, and surface water for arsenic are provided in the "DTSC Summary Table".

8. As the human health risk assessment contains several divergences from DTSC guidance, with some of the most notable being the lack of inclusion of inhalation and dermal pathways and use of exposure assumptions and toxicity criteria that underestimate risk as compared to DTSC recommended assumptions, DTSC would like EPA to consider using the values in the attached tables for establishing cleanup goals in the Record of Decision.

9. The proposed plan indicates natural background concentrations of arsenic at about 20 mg/kg for soil, 25 mg/kg from sediment, and 1.8 ug/l surface water. Using the methodology for determining background as discussed in an earlier comment, DTSC calculates the arsenic background values as 14 mg/kg (95% UCL, n=18) for soil and 20 mg/kg (mean, n=13) for sediment. DTSC agrees with the 1.8 ug/l value as representative of background in surface water.

10. As per the EPA Region 9 PRGs Table, the acceptable risk range of 10-4 to 10-6 for arsenic is represented by 39 to 0.39 ppm arsenic in residential soil. However, because 22 ppm represents a non-cancer hazard index of 1.0, DTSC recommends that any acceptable soil concentration be below 22 ppm. How much below can be determined by local background conditions. At the Lava Cap Mine Superfund Site, DTSC recommended background arsenic concentrations are 14 mg/kg soil and 20 mg/kg sediment.

11. DTSC has completed review of the equations and assumptions applied in the cleanup goal (CUG) spreadsheets transmitted by CH2M Hill and placed into tables in Appendix G of the Feasibility Study. Based on this review, DTSC has developed and attached spreadsheets applying DTSC recommended assumptions and generated proposed CUGs for soil, sediment and surface water for the mine OU consistent with DTSC guidance. DTSC would like EPA to consider these recommended assumptions and CUGs. These assumptions and/or development of CUGs are as follows:

    i. Lead human health risk-based cleanup goals are derived by employing DTSC's Blood Lead spreadsheet Version 7.0 using the 99th percentile blood lead concentration of 10 ug/l as the point of departure for protection of human health.

    ii. DTSC has developed and attached assumptions and generated recommended CUGs for soil/sediments for the following scenarios:

a. Outdoor Worker
b. Short-term (Construction) Worker
c. Resident
d. Recreationalist I (includes infants through adults)
e. Recreationalist II (includes school age children through adults)

iii. DTSC has developed and attached recommended human health risk-based CUGs for surface water exposures by recreational users applying the Recreationalist I and II scenarios. DTSC assumed no swimming in or fish ingestion from Little Clipper Creek.

iv. DTSC recommended toxicity criteria used in development of the CUGs include inhalation RfD for arsenic, cadmium, cyanide and nickel, as well as oral RfD for cadmium.

v. In the absence of route-specific non-carcinogenic toxicity criteria, DTSC recommends using surrogate toxicity criteria obtained by route to route extrapolation. If heavy metals with published inhalation and oral toxicity criteria are examined, the data show significant more toxicity via the inhalation route. This suggests that assuming inhalation toxicity is equivalent to oral toxicity yields an underestimation of the hazard, and generates a less conservative cleanup goal. However, this process is preferred to the alternative of not including inhalation exposures in the development of cleanup goals which effectively assumes an inhalation RfD of 0.

vi. Inclusion of air pathway for each COC.

vii. PEF of 1x106 m3/kg was employed for construction workers. This incorporates the recommended concentration of respirable dust in air of 1.0 mg/m3 based on assuming nuisance particulates are present at the ACGIH TWA TVL concentration of 10 mg/m3 and 10 percent of the mass of particles are in the respirable PM 10 range.

viii. Cyanide air intake rate (IRair) was changed from 0.42 m3/day to 20 m3/day for Outdoor Workers and construction workers as Short Term Workers.

ix. Dermal absorption for each COC and inclusion of dermal pathway for each COC.

x. Adults in Recreationalist I and II scenarios were assumed to have a sediment dermal adherence factor (DAF) of 3.0 mg/kg.

xi. Recreationalist II child is assumed to be 6 to 12 years of age, therefore beyond the age of pica ingestion. Thus the soil ingestion was changed from 200 mg/day to 100 mg/day.

12. Surface water from the mine area was not evaluated in the human health risk assessment and human health risk-based cleanup goals were not developed in the feasibility study for surface water in this area. DTSC calculates the background arsenic concentration in surface water (unfiltered) at 1.8 ug/l (95th percentile). DTSC supports EPA's preliminary remediation goal of the federal Maximum Contaminant Level (MCL) for arsenic (10 ug/l) provided the technical and economical considerations for treating surface water to background and/or risk-based cleanup goal is evaluated more thoroughly in the Record of Decision and remedial action plans.

13. Nonresidential cleanup goals selected will require institutional controls.

II. Supporting Feasibility Study

14. FS, Page 1-18. DTSC does not agree that the Human Health Risk Assessment identified arsenic as the only significant risk driver. Although DTSC agrees that arsenic is the major risk driver, several other metals (aluminum, antimony, chromium (as Cr+6), iron, lead, manganese, and nickel) were present at the Lava Cap Mine Site in concentrations representing predicted significant risks to humans; that is in concentrations corresponding to potential risks greater than 1 x 10-6 or hazards greater than 1.0. Lead was present in mine source areas at concentrations up to 2320 mg/kg.

15. FS, Page 1-19. Background arsenic concentrations are reported as 20 mg/kg soil, 25 mg/kg sediment. DTSC does not agree with the use of these values as discussed in comments 7 and 9 above.

16. FS, Page 1-25. Surface water sources at the mine area are reported to have concentrations of arsenic up to 14,300ug/l. Four surface water sources were discussed, ponded water from sumps in historical buildings, the collapsed adit discharge, the waste rock/tailings pile seep, and the tailings pile underflow that discharges from the base of the log dam. Surface water from the mine area was not evaluated in the human health risk assessment and human health risk-based cleanup goals were not developed for surface water or sediment in this area.

17. FS, Pages 1-31, 1-32. DTSC recommends all references to "mine worker" that actually refer to an outdoor worker be amended accordingly on pages 1-31 & 1-32.

18. FS, Pages 1-33, 1-34, and Appendix F. The results from the human health risk assessment presented and discussed on pages 1-33 and 1-34 are not consistent with those presented in the HHRA (Appendix E of Draft RI, November 2001). The site related risks and hazards appear to be from the revised summary tables included in the Responses to Comments (EPA, August 22, 2002), however the background risks and hazards are not. The background risks and hazards appear to be from the segregated background data sets for Reference Areas 1, 2, and 3, each containing few data points. Appendix F of the FS, however, contains the

comprehensive background data set obtained by combining data from Reference Areas 1, 2, and 3 as previously agreed to create a more robust background data set. DTSC recommends correcting this inconsistency within the FS and include the source of all the risk estimates discussed in the text and the means by which they were derived, using an appendix if necessary to achieve transparency in their derivation.

19. FS, Page 1-34. The human health risk assessment results for Exposure Unit 4 only addresses the recreational user. DTSC recommends indicating if residents live along Little Clipper Creek.

20. FS, Pages 1-34, 2-5 to 2-9. Based on DTSC's evaluation of the risks, consistent with DTSC guidance, not only are arsenic, iron, and lead present in soil or sediments at levels of human health concern, but also aluminum, antimony, chromium (as Cr^{+6}), manganese, and nickel. DTSC recommends including this information in the FS.

21. FS, Page 1-36. Based on DTSC's evaluation wherein unfiltered surface water concentrations were compared to U.S. EPA Region IX Preliminary Remediation Goals (PRGs) for tap water, not only arsenic but also mercury as methyl mercury may be present in surface water in LCC at levels of human health concern. Consequently, HERD developed human health risk-based clean up goals for recreational users exposed via wading in LCC.

22. FS, Table 2-1. DTSC recommends including all constituents detected in surface water in the Water Quality Control Plan (Basin Plan) and the corresponding CTR/MCL criteria instead of listing only those which exceed the criteria.

23. FS, Page 2-6, Section 2.3.2. Although the residential scenario is the most conservative scenario for carcinogenic effects, the short-term soil invasive construction worker is the most conservative scenario for many non-carcinogenic effects.

24. FS, Table 2-2. Arsenic is not the only carcinogen; cadmium, nickel, and chromium in the hexavalent form are also carcinogens. In addition, DTSC does not agree with the background values presented as discussed in an earlier comment and supported by calculations in the attached tables.

25. FS, Page 2-8. DTSC recommends confirmation sampling consist of all constituents present in any medium at levels of human health concern. Comparison of confirmation soil and sediment samples with the reference data set (background) envisions the use of the t-test (parametric) or Wilcoxan Rank Sum test (nonparametric). In addition to those tests, DTSC would like EPA to consider the use of the Quantile test which is used to detect when a removal has failed in only a few areas within a cleanup unit and a hot measurement analysis which is

used in conjunction with other tests to determine if any contaminant has exceeded its respective upper limit concentration value and, if so, further evaluate if additional local remedial action may be required.

26. FS, Page 2-9 & 4-35. Both locations state that small isolated areas of tailings along LCC are not proposed for remediation. DTSC recommends remediation of all areas where contaminants are in excess of cleanup goals.

27. FS, Appendix F. Recommend revisions to Appendix F to allow for a comprehensive, consistent, stand alone development of background concentrations so that any independent reviewer can reach the same conclusions regarding Lava Cap Mine background concentrations as follows:

    a. Including the complete background data set. Include results from statistical population distribution analyses for each chemical in each medium.

    b. Specify the sample locations, depths and analytical results that were deemed unrepresentative of background concentrations and the statistical support or reason for exclusion. There appears to be some confusion on the data excluded.

        i. The text states that two surface soil samples were excluded from the background data set; Table F-1 contains data from 18 surface soil samples; and Table F-2 contains data from 10 subsurface soil samples; Table F-3 contains data from 13 sediment locations. Thus the background data account for 43 soil/sediment locations. In contrast, Tables 3-1 and 3-6 of the Draft RI report contain soil/sediment data for 31 samples, 19 and 12 samples, respectively, for soil/sediment in Reference Areas 1 and 2.

        ii. Similarly, the text states that one groundwater sample was excluded from the background data set and Table F-5b contains unfiltered groundwater data from 3 to 11 locations, depending on the analyte. Table 3-4 of the Draft FI report contains groundwater data from only one sample.

        iii. Likewise, unfiltered background surface water data are presented in Table F-4b for 17 to 27 samples, depending on the analyte, whereas Tables 3-3 and 3-5 of the Draft RI report contain background surface water data from 2 to 15 samples, depending on the analyte, 1 to 6 and 1 to 9 samples, respectively from Reference areas 1 and 2.

        iv. The concentration of arsenic in "background" groundwater (Table F-5b) is greater than the MCL of 10 ug/l, creating suspicion with respect to the adequacy of the background sample locations.

c. Refer or include the map(s) identifying the locations for each background sample.

28. FS, Appendix G. Recommend revision of Appendix G to provide a more comprehensive, stand-alone development of human health risk-based cleanup goals to allow any independent reviewer to reproduce the calculations. Transparency in the development of risk-based cleanup goals for the public record necessitate inclusion of the following: standard equations employed, spreadsheet outputs from DTSC's Blood Lead version 7.0, as well as citing sources used for each exposure factor and toxicity criterion. Included with these comments are attached spreadsheets applying DTSC recommended assumptions and generated proposed CUGs for soil, sediment and surface water for the mine OU consistent with DTSC guidance.

California Regional Water Quality Control Board

Central Valley Region

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Secretary for Environmental Protection

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9 March 2004

Dave Seter
U.S. Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, CA 94105

COMMENTS ON PROPOSED CLEANUP PLAN FOR MINE AREA OPERABLE UNIT, LAVA CAP MINE, NEVADA COUNTY

We have reviewed the U.S. Environmental Protection Agency's February 2004 *Proposed Cleanup Plan for the Mine Operable Unit (OU-1), Lava Cap Mine Site* in Nevada County. The cleanup plan describes the potential cleanup alternatives and the U.S. EPA's preferred alternative for implementation (Alternative 2-3). We have the following comments and questions:

1) Has EPA assessed the relative effectiveness of the potential remedies for OU-1 on reducing the flux of arsenic and other mine related constituents into underlying groundwater which will be addressed during implementation of the selected remedy for OU-2? Shallow groundwater beneath the waste rock / tailings pile has been impacted as described in the Remedial Investigation Report. The mine tailings and waste rock over the bedrock reportedly contain shallow saturated zones with elevated concentrations of arsenic. However, groundwater flow paths are not well known because of the fractured nature of the aquifer and the paucity of data currently available. Therefore, the relative efficacy of the potential remedies for OU-1 to reduce arsenic loading to underlying groundwater should be an essential criterion in the decision making process. Closing the waste rock and tailings as a waste pile as proposed in Alternative 2-3 may not prevent impacts to perched or shallow groundwater if the proposed surface water diversions do not effectively reduce groundwater recharge and significantly lower groundwater levels. In contrast, an onsite lined disposal cell will more likely effectively contain the arsenic and other mine related constituents and be more protective of shallow underlying groundwater. Long term cost savings might then be realized in the implementation of a remedy for OU-2.

2) We concur with EPA's proposal to implement the selected alternative in phases, as appropriate. For example, Alternative 2-3 would be conducted in phases to evaluate the effectiveness of surface water controls before designing and constructing a surface water treatment plant. Currently there is a significant level of uncertainty on the influence of an adjacent ephemeral stream on mine portal discharge rates. The mine portal is partially covered with waste rock and

colluvium which also receive runoff from the stream. This area should be well characterized prior to designing and constructing a surface water treatment plant. Furthermore, the effectiveness of the proposed surface water diversions to direct flow away from the mine inlets and from the consolidated waste pile should be directly evaluated and adjustments should be made in a phased approach as necessary.

3) The proposed preliminary remediation goal for surface water is set at the federal Maximum Contaminant Level (MCL) for arsenic of 10 micrograms per liter (μg/l). What are the technological and economic impacts of treating to background surface water arsenic concentrations which are reportedly less than 1 μg/l?

4) The design plans for the proposed buttress will need to address dynamic failure and the potential for liquifaction of the tailings behind the buttress.

Please call me at (916) 464-4736 if you have any questions regarding our comments.

Robert Busby, C.E.G.
Associate Engineering Geologist

cc: Steve Ross, California Department of Toxics Substances Control, Sacramento

DTSC Summary Table
Recommended Soil/Sediment and Surface Water Human Health Risk-Based Cleanup Goals
Lava Cap Mine Site - OU1

Exposure Scenario	Aluminum	Antimony	Arsenic[1]	Arsenic[2]	Cadmium[1]	Cadmium[2]	Chromium+6	Cyanide	Iron	Lead[4]	Manganese	Nickel[1]	Nickel[2]
Soil/Sediment Cleanup Goal (mg/kg)													
Outdoor Worker (soil)	8.7E+05	3.8E+02	1.6E+00	2.5E+02		7.9E+02		1.2E+04	2.9E+05	1700	1.8E+04		1.6E+04
Short-term Worker (soil)	6.9E+03	7.5E+01	5.9E+00	2.3E+01		2.5E+01		1.5E+03	5.6E+04	600	7.0E+01		7.0E+01
Residential (soil)	7.4E+04	3.0E+01	3.9E-01	2.2E+01	5.8E+02	7.0E+01	1.7E+01	1.2E+03	2.3E+04	94 (150)	1.7E+03	9.6E+03	1.4E+03
Recreation I (soil & sediment)	1.8E+05	7.4E+01	4.2E-01	3.5E+01		2.5E+02		1.0E+03	5.6E+04	190 (240)	4.3E+03		3.6E+03
Recreation II (soil & sediment)	4.9E+05	2.0E+02	5.5E-01	7.1E+01		1.0E+03		1.7E+03	1.5E+05	240	1.1E+04		9.6E+03
EPA Region 9 Residential PRGs			3.9E-01	2.2E+01						400			
EPA Region 9 Industrial PRGs			1.6E+00	2.6E+02						750			
Cal Modified PRG										150			
Background Surface Soil (mg/kg)	***6.2E+04***	***6.5E-01***	***1.4E+01***	***1.4E+01***	***2.9E-01***	***2.9E-01***		***3.9E-01***	***4.6E+04***	***2.8E+01***	***1.3E+03***	***3.1E+01***	***3.1E+01***
Background Sediment (mg/kg)	***4.0E+04***	***7.0E-01***	***2.0E+01***	***2.0E+01***	***2.3E-01***	***2.3E-01***		***1.3E-01***	***4.7E+04***	***1.4E+01***	***8.5E+02***	***2.4E+01***	***2.4E+01***

Exposure Scenario	Arsenic[1]	Arsenic[2]	Mercury[3]
Surface Water Goal (ug/l)			
Recreation I - Wading only	6.3E+01	5.1E+03	1.7E+03
Recreation II - Wading only	7.5E+01	7.8E+03	2.6E+03
Background Surface Water (ug/l)	***1.8E+00***	***1.8E+00***	***4.0E-03***
MCL (ug/l)	***1.0E+01***	***1.0E+01***	***3.6E+00***

[1]Based on cancer endpoint.
[2]Based on noncancer endpoint.
[3]Assuming mercury present as methyl mercury.
[4]Parenthetical value is for non-pica child.

Shaded value is lowest risk-based cleanup goal for each chemical.

No clean up goals were exceeded in OU1 (based on REM concentrations for Exposure Units 1, 3, and 4 in the 2001 Public Release Draft RI) for the following metals: Cadmium and Cyanide.

The short term worker (construction worker) clean up goals were the only clean up goals exceeded in OU1 (based on REM concentrations for Exposure Units 1, 3, and 4 in the 2001 Public Release Draft RI) for the following metals: Aluminum, Manganese, and Nickel.

Toxicity Criteria Comparison Table

	Cancer Slope Factors (mg/kg-day)$^{-1}$				Reference Doses (mg/kg-day)			
	Inhalation		Oral		Inhalation		Oral	
Chemical	**RI Used**	**DTSC (source)**	**RI Used**	**DTSC (source)**	**RI Used**	**DTSC (Source)**	**RI Used**	**DTSC (Source)**
Aluminum					1.4E-03	1.4E-03 (NCEA)	1.0E+00	1.0E+00 (NCEA)
Antimony						4.0E-04 (Oral)	4.0E-04	4.0E-04 (IRIS)
Arsenic	1.5E+01	1.5E+01 (IRIS)	1.5E+00	1.5E+00 (IRIS)		8.6E-06 (OEHHA)[a]	3.0E-04	3.0E-04 (IRIS)
Barium					1.4E-04	7.0E-02 (Oral)	7.0E-02	7.0E-02 (IRIS)
Beryllium	8.4E+00	8.4E+00 (OEHHA)			5.7E-06	2.0E-06 (OEHHA)[a]	2.0E-03	2.0E-03 (IRIS)
Cadmium	6.3E+00	1.5E+01 (OEHHA)				5.7E-06 (OEHHA)[a]	5.0E-04	1.0E-03 (IRIS)[b]
Chromium, +3						1.5E+00 (Oral)	1.5E+00	1.5E+00 (IRIS)
Chromium, +6		5.1E+02 (OEHHA)				5.7E-05 (OEHHA)[a]		3.0E-03 (IRIS)
Cobalt						5.7E-06 (NCEA)	6.0E-02	2.0E-02 (NCEA)
Copper						4.0E-02 (Oral)	3.7E-02	4.0E-02 (HEAST)
Cyanide						8.6E-04 (IRIS) HCN	2.0E-02	2.0E-02 (IRIS)
Iron						3.0E-01 (Oral)	3.0E-01	3.0E-01 (NCEA)
Lead	4.2E-02	4.2E-02 (OEHHA)	8.5E-03	8.5E-03 (OEHHA)				
Magnesium								
Manganese					1.4E-05	5.7E-05 (OEHHA)[a]	2.4E-02	2.4E-02 (IRIS)[c]
Mercury, Hg^{++} Hg^{o}						2.6E-05 (OEHHA)[a] 8.6E-05 (IRIS)	3.0E-04	3.0E-04 (IRIS) $HgCl_2$
Nickel		9.1E-01 (OEHHA)				1.4E-05 (OEHHA)[a]	2.0E-02	2.0E-02 (IRIS)
Selenium						5.7E-03 (OEHHA)[a]	5.0E-03	5.0E-03 (IRIS)
Silver						5.0E-03 (Oral)	5.0E-03	5.0E-03 (IRIS)
Thallium						7.0E-05 (Oral)	7.0E-05	7.0E-05 (IRIS)
Vanadium						7.0E-03 (Oral)	7.0E-03	7.0E-03 (HEAST)
Zinc						3.0E-01 (Oral)	3.0E-01	3.0E-01 (IRIS)

RI Used = Value applied in the Remedial Investigation (RI) report human health risk assessment, and in the FS for development of risk-based cleanup goals
IRIS = Integrated Risk Information System
OEHHA = Office of Environmental Health Hazard Assessment
NCEA = National Center for Environmental Assessment
HEAST = Health Effects Assessment Summary Tables
Oral = Oral toxicity criteria used as surrogate for inhalation toxicity criteria due to lack of inhalation data

[a]Values reported as $\mu g/m^3$ and converted to mg/kg-day using the equation $(\mu g/m^3 \times 20\ m^3/day \times 10^{-3}\ mg/\mu g) / 70\ kg$.
[b]Value shown is for cadmium administered in food. Cadmium in water oral reference dose is 5.0E-04 mg/kg-day (IRIS).
[c]The reference dose for total manganese oral intake is 1.4E-01mg/kg-day, the contribution allowable from soil and water is 2.4E-02 mg/kg-day (IRIS).

DTSC Recommended Soil Cleanup Goals
Lava Cap Mine Site - OU1
Outdoor Worker Exposure Factors and Soil Cleanup Goals

	COPC									
Exposure/Toxicity Factors	Aluminum	Antimony	Arsenic	Arsenic	Cadmium	Cyanide	Iron	Lead	Manganese	Nickel
Toxicity Factors										
CSF_{oral} $(mg/kg\text{-}day)^{-1}$			1.5E+00							
CSF_{inh} $(mg/kg\text{-}day)^{-1}$			1.5E+01							
RfD_{oral} (mg/kg-day)	1.00E+00	4.00E-04		3.0E-04	1.0E-03	2.0E-02	3.0E-01		2.4E-02	2.0E-02
RfD_{dermal} (mg/kg-day)					2.5E-05					
RfD_{inhal} (mg/kg-day)	1.40E-03	4.00E-04		8.6E-06	5.7E-06	8.6E-04	3.0E-01		1.4E-05	1.4E-05
General Factors										
EF (days/year)	2.5E+02	2.5E+02	2.5E+02	2.5E+02	2.5E+02	2.5E+02	2.5E+02	2.5E+02	2.5E+02	2.5E+02
ED (years)	2.5E+01	2.5E+01	2.5E+01	2.5E+01	2.5E+01	2.5E+01	2.5E+01	2.5E+01	2.5E+01	2.5E+01
BW (kg)	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01
ATncarc (days)	9.1E+03	9.1E+03		9.1E+03	9.1E+03	9.1E+03	9.1E+03	9.1E+03	9.1E+03	9.1E+03
ATcarc (days)			2.6E+04							
Soil Ingestion Pathway										
IRsoil (mg/day)	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02
FIsoil (fraction ingested)	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00
Soil Dermal Contact Pathway										
ABS (unitless)	1.0E-02	1.0E-02	3.0E-02	3.0E-02	1.0E-03	1.0E-01	1.0E-02	0.0E+00	1.0E-02	1.0E-02
SA (cm^2/day)	3.3E+03	3.3E+03	3.3E+03	3.3E+03	3.3E+03	3.3E+03	3.3E+03	3.3E+03	3.3E+03	3.3E+03
AF (kg/cm^2)	2.0E-01	2.0E-01	2.0E-01	2.0E-01	2.0E-01	2.0E-01	2.0E-01	2.0E-01	2.0E-01	2.0E-01
Soil Particulate Inhalation Pathway										
PEF (m^3/kg)	1.3E+09	1.3E+09	1.3E+09	1.3E+09	1.3E+09	1.3E+09	1.3E+09	1.3E+09	1.3E+09	1.3E+09
Irair (m^3/day)	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01

	Cleanup Goal (mg/Kg)									
Target Hazard Quotient/Risk	1	1	1.00E-06	1	1	1	1		1	1
	Aluminum[4]	Antimony	Arsenic[2]	Arsenic[3]	Cadmium	Cyanide	Iron[4]	Lead[1]	Manganese	Nickel
Cleanup Goal (mg/kg)	8.7E+05	3.8E+02	1.6E+00	2.5E+02	7.9E+02	1.2E+04	2.9E+05	1.7E+03	1.8E+04	1.6E+04

[1]Lead cleanup goal based on DTSC's LEADSPREAD MODEL v.7 (DTSC 2002).
[2]Cleanup goal based on cancer endpoint.
[3]Cleanup goal based on noncancer endpoint.
[4]Risk-based clean up goal exceeds soil saturation limit of 1×10^5 mg/kg.

DTSC Recommended Soil Cleanup Goals
Lava Cap Mine Site - OU1
Short Term Worker Exposure Factors and Soil Cleanup Goals

Exposure/Toxicity Factors	COPC									
	Aluminum	Antimony	Arsenic	Arsenic	Cadmium	Cyanide	Iron	Lead	Manganese	Nickel
Toxicity Factors										
CSF_{oral} $(mg/kg\text{-}day)^{-1}$			1.5E+00							
CSF_{inh} $(mg/kg\text{-}day)^{-1}$			1.5E+01							
RfD_{oral} (mg/kg-day)	1.00E+00	4.00E-04		3.0E-04	1.0E-03	2.0E-02	3.0E-01		2.4E-02	2.0E-02
RfD_{dermal} (mg/kg-day)					2.5E-05					
RfD_{inhal} (mg/kg-day)	1.40E-03	4.00E-04		8.6E-06	5.7E-06	8.6E-04	3.0E-01		1.4E-05	1.4E-05
General Factors										
EF (days/year)	2.5E+02	2.5E+02	2.5E+02	2.5E+02	2.5E+02	2.5E+02	2.5E+02	2.5E+02	2.5E+02	2.5E+02
ED (years)	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00
BW (kg)	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01
ATncarc (days)	3.7E+02	3.7E+02		3.7E+02	3.7E+02	3.7E+02	3.7E+02	3.7E+02	3.7E+02	3.7E+02
ATcarc (days)			2.6E+04							
Soil Ingestion Pathway										
IRsoil (mg/day)	4.8E+02	4.8E+02	4.8E+02	4.8E+02	4.8E+02	4.8E+02	4.8E+02	4.8E+02	4.8E+02	4.8E+02
FIsoil (fraction ingested)	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00
Soil Dermal Contact Pathway										
ABS (unitless)	1.0E-02	1.0E-02	3.0E-02	3.0E-02	1.0E-03	1.0E-01	1.0E-02	0.0E+00	1.0E-02	1.0E-02
SA (cm^2/day)	5.7E+03	5.7E+03	5.7E+03	5.7E+03	5.7E+03	5.7E+03	5.7E+03	5.7E+03	5.7E+03	5.7E+03
AF (kg/cm^2)	8.0E-01	8.0E-01	8.0E-01	8.0E-01	8.0E-01	8.0E-01	8.0E-01	8.0E-01	8.0E-01	8.0E-01
Soil Particulate Inhalation Pathway										
PEF (m^3/kg)	1.0E+06	1.0E+06	1.0E+06	1.0E+06	1.0E+06	1.0E+06	1.0E+06	1.0E+06	1.0E+06	1.0E+06
Irair (m^3/day)	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01

	Cleanup Goal (mg/Kg)									
Target Hazard Quotient/Risk	**1**	**1**	**1.00E-06**	**1**	**1**	**1**	**1**		**1**	**1**
	Aluminum	Antimony	Arsenic[2]	Arsenic[3]	Cadmium	Cyanide	Iron	Lead[1]	Manganese	Nickel
Cleanup Goal (mg/kg)	**6.9E+03**	**7.5E+01**	**5.9E+00**	**2.3E+01**	**2.5E+01**	**1.5E+03**	**5.6E+04**	**6.0E+02**	**7.0E+01**	**7.0E+01**

[1]Lead cleanup goal based on DTSC's LEADSPREAD MODEL v.7 (DTSC 2002).
[2]Cleanup goal based on cancer endpoint.
[3]Cleanup goal based on noncancer endpoint.

DTSC Recommended Soil Cleanup Goals
Lava Cap Mine Site
Residential Exposure Factors and Soil Cleanup Goals

	COPC												
Exposure/Toxicity Factors	Aluminum	Antimony	Arsenic	Arsenic	Cadmium	Cadmium	Chromium+6	Cyanide	Iron	Lead	Manganese	Nickel	Nickel
Toxicity Factors													
CSF_{oral} $(mg/kg\text{-}day)^{-1}$			1.5E+00										
CSF_{inh} $(mg/kg\text{-}day)^{-1}$			1.5E+01		1.5E+01		510					9.1E-01	
RfD_{oral} (mg/kg-day)	1.00E+00	4.00E-04		3.0E-04		1.0E-03		2.0E-02	3.0E-01		2.4E-02		2.0E-02
RfD_{dermal} (mg/kg-day)						2.5E-05							
RfD_{inhal} (mg/kg-day)	1.40E-03	4.00E-04		8.6E-06		5.7E-06		8.6E-04	3.0E-01		1.4E-05		1.4E-05
General Factors													
EF (days/year)	3.5E+02	3.5E+02	3.5E+02	3.5E+02	3.5E+02	3.5E+02	3.5E+02	3.5E+02	3.5E+02	3.5E+02	3.5E+02	3.5E+02	3.5E+02
ED Adult (years)	2.4E+01	2.4E+01	2.4E+01	2.4E+01	2.4E+01	2.4E+01	2.4E+01	2.4E+01	2.4E+01	2.4E+01	2.4E+01	2.4E+01	2.4E+01
ED Child (years)	6.0E+00	6.0E+00	6.0E+00	6.0E+00	6.0E+00	6.0E+00	6.0E+00	6.0E+00	6.0E+00	6.0E+00	6.0E+00	6.0E+00	6.0E+00
BW Adult (kg)	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01
BW Child (kg)	1.5E+01	1.5E+01	1.5E+01	1.5E+01	1.5E+01	1.5E+01	1.5E+01	1.5E+01	1.5E+01	1.5E+01	1.5E+01	1.5E+01	1.5E+01
ATncarc (days)	2.2E+03	2.2E+03	2.2E+03	2.2E+03	2.2E+03	2.2E+03	2.2E+03	2.2E+03	2.2E+03	2.2E+03	2.2E+03	2.2E+03	2.2E+03
ATcarc (days)	2.6E+04	2.6E+04	2.6E+04	2.6E+04	2.6E+04	2.6E+04	2.6E+04	2.6E+04	2.6E+04	2.6E+04	2.6E+04	2.6E+04	2.6E+04
Soil Ingestion Pathway													
IR Adult (mg/day)	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02
IR Child (mg/day)	2.0E+02	2.0E+02	2.0E+02	2.0E+02	2.0E+02	2.0E+02	2.0E+02	2.0E+02	2.0E+02	2.0E+02	2.0E+02	2.0E+02	2.0E+02
FIsoil (fraction ingested)	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00
IFSadj (mg-yr/kg-day)	1.14E+02	1.14E+02	1.14E+02	1.14E+02	1.14E+02	1.14E+02	1.14E+02	1.14E+02	1.14E+02	1.14E+02	1.14E+02	1.14E+02	1.14E+02
Soil Dermal Contact Pathway													
ABS (unitless)	1.0E-02	1.0E-02	3.0E-02	3.0E-02	1.0E-03	1.0E-03	0.0E+00	1.0E-01	1.0E-02	0.0E+00	1.0E-02	1.0E-02	1.0E-02
SA Adult (cm^2/day)	5.7E+03	5.7E+03	5.7E+03	5.7E+03	5.7E+03	5.7E+03	5.7E+03	5.7E+03	5.7E+03	5.7E+03	5.7E+03	5.7E+03	5.7E+03
SA Child (cm^2/day)	2.8E+03	2.8E+03	2.8E+03	2.8E+03	2.8E+03	2.8E+03	2.8E+03	2.8E+03	2.8E+03	2.8E+03	2.8E+03	2.8E+03	2.8E+03
AF Adult (kg/cm^2)	7.0E-02	7.0E-02	7.0E-02	7.0E-02	7.0E-02	7.0E-02	7.0E-02	7.0E-02	7.0E-02	7.0E-02	7.0E-02	7.0E-02	7.0E-02
AF Child (kg/cm^2)	2.0E-01	2.0E-01	2.0E-01	2.0E-01	2.0E-01	2.0E-01	2.0E-01	2.0E-01	2.0E-01	2.0E-01	2.0E-01	2.0E-01	2.0E-01
SFSadj (mg-yr/kg-day)	3.61E+02	3.61E+02	3.61E+02	3.61E+02	3.61E+02	3.61E+02	3.61E+02	3.61E+02	3.61E+02	3.61E+02	3.61E+02	3.61E+02	3.61E+02
Soil Particulate Inhalation Pathway													
PEF (m^3/kg)	1.3E+09	1.3E+09	1.3E+09	1.3E+09	1.3E+09	1.3E+09	1.3E+09	1.3E+09	1.3E+09	1.3E+09	1.3E+09	1.3E+09	1.3E+09
Inh Adult (m^3/day)	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01
Inh Child (m^3/day)	1.0E+01	1.0E+01	1.0E+01	1.0E+01	1.0E+01	1.0E+01	1.0E+01	1.0E+01	1.0E+01	1.0E+01	1.0E+01	1.0E+01	1.0E+01
InhFadj (m^3-yr/kg-day)	1.1E+01	1.1E+01	1.1E+01	1.1E+01	1.1E+01	1.1E+01	1.1E+01	1.1E+01	1.1E+01	1.1E+01	1.1E+01	1.1E+01	1.1E+01

	Cleanup Goal (mg/Kg)												
Target Hazard Quotient/Risk	**1**	**1**	**1.00E-06**	**1**	**1.00E-06**	**1**	**1.00E-06**	**1**	**1**		**1**	**1.00E-06**	**1**
	Aluminum	Antimony	Arsenic[1]	Arsenic[2]	Cadmium	Cadmium	Chromium+6	Cyanide	Iron	Lead[3]	Manganese	Nickel[1]	Nickel[2]
Cleanup Goal (mg/kg)	**7.4E+04**	**3.0E+01**	**3.9E-01**	**2.2E+01**	**5.8E+02**	**7.0E+01**	**1.7E+01**	**1.2E+03**	**2.3E+04**	**94 (150)**	**1.7E+03**	**9.6E+03**	**1.4E+03**

[1]Cleanup goal based on cancer endpoint.
[2]Cleanup goal based on noncancer endpoint.
[3]Lead cleanup goal based on DTSC's LEADSPREAD MODEL v.7 (DTSC 2002) for pica child, value in parentheses is for non-pica child.

DTSC Recommended Soil/Sediment Cleanup Goals
Lava Cap Mine Site - OU1
Recreationalist I Exposure Factors and Soil/Sediment Cleanup Goals

	COPC									
Exposure/Toxicity Factors	Aluminum	Antimony	Arsenic	Arsenic	Cadmium	Cyanide	Iron	Lead	Manganese	Nickel
Toxicity Factors										
CSF_{oral} (mg/kg-day)$^{-1}$			1.5E+00							
CSF_{inh} (mg/kg-day)$^{-1}$			1.5E+01							
RfD_{oral} (mg/kg-day)	1.00E+00	4.00E-04		3.0E-04	1.0E-03	2.0E-02	3.0E-01		2.4E-02	2.0E-02
RfD_{dermal} (mg/kg-day)					2.5E-05					
RfD_{inhal} (mg/kg-day)	1.40E-03	4.00E-04		8.6E-06	5.7E-06	8.6E-04	3.0E-01		1.4E-05	1.4E-05
General Factors										
EF (days/year)	1.04E+02	1.04E+02	1.04E+02	1.04E+02	1.04E+02	1.04E+02	1.04E+02	1.04E+02	1.04E+02	1.04E+02
ED Adult (years)	2.4E+01	2.4E+01	2.4E+01	2.4E+01	2.4E+01	2.4E+01	2.4E+01	2.4E+01	2.4E+01	2.4E+01
ED Child (years)	6.0E+00	6.0E+00	6.0E+00	6.0E+00	6.0E+00	6.0E+00	6.0E+00	6.0E+00	6.0E+00	6.0E+00
BW Adult (kg)	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01
BW Child (kg)	1.5E+01	1.5E+01	1.5E+01	1.5E+01	1.5E+01	1.5E+01	1.5E+01	1.5E+01	1.5E+01	1.5E+01
ATncarc (days)	2.2E+03	2.2E+03	2.2E+03	2.2E+03	2.2E+03	2.2E+03	2.2E+03	2.2E+03	2.2E+03	2.2E+03
ATcarc (days)	2.6E+04	2.6E+04	2.6E+04	2.6E+04	2.6E+04	2.6E+04	2.6E+04	2.6E+04	2.6E+04	2.6E+04
Soil/Sediment Ingestion Pathway										
IR Adult (mg/day)	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02
IR Child (mg/day)	2.0E+02	2.0E+02	2.0E+02	2.0E+02	2.0E+02	2.0E+02	2.0E+02	2.0E+02	2.0E+02	2.0E+02
FIsoil (fraction ingested)	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00
IFSadj (mg-yr/kg-day)	1.14E+02	1.14E+02	1.14E+02	1.14E+02	1.14E+02	1.14E+02	1.14E+02	1.14E+02	1.14E+02	1.14E+02
Soil/Sediment Dermal Contact Pathway										
ABS (unitless)	1.0E-02	1.0E-02	3.0E-02	3.0E-02	1.0E-03	1.0E-01	1.0E-02	0.0E+00	1.0E-02	1.0E-02
SA Adult (cm^2/day)	5.7E+03	5.7E+03	5.7E+03	5.7E+03	5.7E+03	5.7E+03	5.7E+03	5.7E+03	5.7E+03	5.7E+03
SA Child (cm^2/day)	2.8E+03	2.8E+03	2.8E+03	2.8E+03	2.8E+03	2.8E+03	2.8E+03	2.8E+03	2.8E+03	2.8E+03
AF Adult (kg/cm^2)	3.0E+00	3.0E+00	3.0E+00	3.0E+00	3.0E+00	3.0E+00	3.0E+00	3.0E+00	3.0E+00	3.0E+00
AF Child (kg/cm^2)	3.0E+00	3.0E+00	3.0E+00	3.0E+00	3.0E+00	3.0E+00	3.0E+00	3.0E+00	3.0E+00	3.0E+00
SFSadj (mg-yr/kg-day)	9.2E+03	9.2E+03	9.2E+03	9.2E+03	9.2E+03	9.2E+03	9.2E+03	9.2E+03	9.2E+03	9.2E+03
Soil/Sediment Particulate Inhalation Pathway										
PEF (m^3/kg)	1.3E+09	1.3E+09	1.3E+09	1.3E+09	1.3E+09	1.3E+09	1.3E+09	1.3E+09	1.3E+09	1.3E+09
Inh Adult (m^3/day)	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01
Inh Child (m^3/day)	1.0E+01	1.0E+01	1.0E+01	1.0E+01	1.0E+01	1.0E+01	1.0E+01	1.0E+01	1.0E+01	1.0E+01
InhFadj (m^3-yr/kg-day)	1.1E+01	1.1E+01	1.1E+01	1.1E+01	1.1E+01	1.1E+01	1.1E+01	1.1E+01	1.1E+01	1.1E+01

	Cleanup Goal (mg/kg)									
Target Hazard Quotient/Risk	**1**	**1**	**1.00E-06**	**1**	**1**	**1**	**1**		**1**	**1**
	Aluminum[4]	Antimony	Arsenic[1]	Arsenic[2]	Cadmium	Cyanide	Iron	Lead[3]	Manganese	Nickel
Cleanup Goal (mg/kg)	**1.8E+05**	**7.4E+01**	**4.2E-01**	**3.5E+01**	**2.5E+02**	**1.0E+03**	**5.6E+04**	**190 (240)**	**4.3E+03**	**3.6E+03**

[1]Cleanup goal based on cancer endpoint.

[2]Cleanup goal based on noncancer endpoint.

[3]Lead cleanup goal based on DTSC's LEADSPREAD MODEL v.7 (DTSC 2002).

[4]Risk-based clean up goal exceeds soil saturation limit of 1 x 10^5 mg/kg.

DTSC Recommended Soil/Sediment Cleanup Goals
Lava Cap Mine Site - OU1
Recreationalist II Exposure Factors and Soil/Sediment Cleanup Goals

	COPCs									
Exposure/Toxicity Factors	Aluminum	Antimony	Arsenic	Arsenic	Cadmium	Cyanide	Iron	Lead	Manganese	Nickel
Toxicity Factors										
CSF_{oral} $(mg/kg\text{-}day)^{-1}$			1.5E+00							
CSF_{inh} $(mg/kg\text{-}day)^{-1}$			1.5E+01							
RfD_{oral} (mg/kg-day)	1.00E+00	4.00E-04		3.0E-04	1.0E-03	2.0E-02	3.0E-01		2.4E-02	2.0E-02
RfD_{dermal} (mg/kg-day)					2.5E-05					
RfD_{inhal} (mg/kg-day)	1.40E-03	4.00E-04		8.6E-06	5.7E-06	8.6E-04	3.0E-01		1.4E-05	1.4E-05
General Factors										
EF (days/year)	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02
ED Adult (years)	2.4E+01	2.4E+01	2.4E+01	2.4E+01	2.4E+01	2.4E+01	2.4E+01	2.4E+01	2.4E+01	2.4E+01
ED Child (years)	6.0E+00	6.0E+00	6.0E+00	6.0E+00	6.0E+00	6.0E+00	6.0E+00	6.0E+00	6.0E+00	6.0E+00
BW Adult (kg)	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01	7.0E+01
BW Child (kg)	3.3E+01	3.3E+01	3.3E+01	3.3E+01	3.3E+01	3.3E+01	3.3E+01	3.3E+01	3.3E+01	3.3E+01
ATncarc (days)	2.2E+03	2.2E+03	2.2E+03	2.2E+03	2.2E+03	2.2E+03	2.2E+03	2.2E+03	2.2E+03	2.2E+03
ATcarc (days)	2.6E+04	2.6E+04	2.6E+04	2.6E+04	2.6E+04	2.6E+04	2.6E+04	2.6E+04	2.6E+04	2.6E+04
Soil/Sediment Ingestion Pathway										
IR Adult (mg/day)	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02
IR Child (mg/day)	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02	1.0E+02
FIsoil (fraction ingested)	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00
IFSadj (mg-yr/kg-day)	5.25E+01	5.25E+01	5.25E+01	5.25E+01	5.25E+01	5.25E+01	5.25E+01	5.25E+01	5.25E+01	5.25E+01
Soil/Sediment Dermal Contact Pathway										
ABS (unitless)	1.0E-02	1.0E-02	3.0E-02	3.0E-02	1.0E-03	1.0E-01	1.0E-02	0.0E+00	1.0E-02	1.0E-02
SA Adult (cm^2/day)	5.7E+03	5.7E+03	5.7E+03	5.7E+03	5.7E+03	5.7E+03	5.7E+03	5.7E+03	5.7E+03	5.7E+03
SA Child (cm^2/day)	4.3E+03	4.3E+03	4.3E+03	4.3E+03	4.3E+03	4.3E+03	4.3E+03	4.3E+03	4.3E+03	4.3E+03
AF Adult (kg/cm^2)	3.0E+00	3.0E+00	3.0E+00	3.0E+00	3.0E+00	3.0E+00	3.0E+00	3.0E+00	3.0E+00	3.0E+00
AF Child (kg/cm^2)	3.0E+00	3.0E+00	3.0E+00	3.0E+00	3.0E+00	3.0E+00	3.0E+00	3.0E+00	3.0E+00	3.0E+00
SFSadj (mg-yr/kg-day)	8.2E+03	8.2E+03	8.2E+03	8.2E+03	8.2E+03	8.2E+03	8.2E+03	8.2E+03	8.2E+03	8.2E+03
Soil/Sediment Particulate Inhalation Pathway										
PEF (m^3/kg)	1.3E+09	1.3E+09	1.3E+09	1.3E+09	1.3E+09	1.3E+09	1.3E+09	1.3E+09	1.3E+09	1.3E+09
Inh Adult (m^3/day)	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01
Inh Child (m^3/day)	1.0E+01	1.0E+01	1.0E+01	1.0E+01	1.0E+01	1.0E+01	1.0E+01	1.0E+01	1.0E+01	1.0E+01
InhFadj (m^3-yr/kg-day)	8.7E+00	8.7E+00	8.7E+00	8.7E+00	8.7E+00	8.7E+00	8.7E+00	8.7E+00	8.7E+00	8.7E+00

	Cleanup Goal (mg/Kg)									
Target Hazard Quotient/Risk	**1**	**1**	**1.00E-06**	**1**	**1**	**1**	**1**		**1**	**1**
	Aluminum[4]	Antimony	Arsenic[2]	Arsenic[3]	Cadmium	Cyanide	Iron[4]	Lead[1]	Manganese	Nickel
Cleanup Goal (mg/kg)	**4.9E+05**	**2.0E+02**	**5.5E-01**	**7.1E+01**	**1.0E+03**	**1.7E+03**	**1.5E+05**	**2.4E+02**	**1.1E+04**	**9.6E+03**

[1]Lead cleanup goal based on DTSC's LEADSPREAD MODEL v.7 (DTSC 2002).
[2]Cleanup goal based on cancer endpoint.
[3]Cleanup goal based on noncancer endpoint.
[4]Risk-based clean up goal exceeds soil saturation limit of 1×10^5 mg/kg.

DTSC Recommended Surface Water Cleanup Goals
Lava Cap Mine Site - OU1
Recreationalist I Exposure Factors and Surface Water Cleanup Goals

	COPC		
Exposure/Toxicity Factors	Arsenic[1]	Arsenic[2]	Mercury[3]
Toxicity Factors			
CSF_{oral} $(mg/kg\text{-}day)^{-1}$	1.5E+00		
RfD_{oral} (mg/kg-day) [IRIS]		3.0E-04	1.0E-04
RfD_{dermal} (mg/kg-day)			
General Factors			
ET (hrs/day)	1.0	1.0	1.0
EF (days/year)	1.04E+02	1.04E+02	1.04E+02
ED Adult (years)	2.4E+01	2.4E+01	2.4E+01
ED Child (years)	6.0E+00	6.0E+00	6.0E+00
BW Adult (kg)	7.0E+01	7.0E+01	7.0E+01
BW Child (kg)	1.5E+01	1.5E+01	1.5E+01
ATncarc (days)	2.2E+03	2.2E+03	2.2E+03
ATcarc (days)	2.6E+04	2.6E+04	2.6E+04
Surface Water Ingestion Pathway			
IR Adult (mg/day)	0	0	0
IR Child (mg/day)	0	0	0
IFSadj (mg-yr/kg-day)	0.00E+00	0.00E+00	0.00E+00
Surface Water Dermal Pathway			
SA Adult (cm^2/day) [USEPA EFH, 1999]	3980	3980	3980
SA Child (cm^2/day) [USEPA EFH, 1999]	3114	3114	3114
Kp (cm/hr) [USEPA RAGS E, 2001]	1.0E-03	1.0E-03	1.0E-03
SWFSadj (cm-yr/kg)	2.61E+03	2.61E+03	2.61E+03

Target Hazard Quotient/Risk	**1.00E-06**	**1**	**1**
	Arsenic[1]	Arsenic[2]	Mercury[3]
Cleanup Goal (ug/l)	**6.3E+01**	**5.1E+03**	**1.7E+03**

[1]Cleanup goal based on cancer endpoint.
[2]Cleanup goal based on noncancer endpoint.
[3]Cleanup goal assuming mercury present as methylmercury

SWFSadj (cm-yr/kg) = (ED Child x SA Child / BW Child) + (ED Adult x SA Adult / BW Adult)
Hazard Cleanup Goal = (Target HI x BW Child x AT ncarc x 1000 ug/mg) / SA Child x Kp x ET x EF x 1 L/1000cm^3)
Risk Cleanup Goal = (Target Risk x AT carc x 1000ug/mg) / (SF_o x EF x SWSFadj x Kp x 1 L/1000cm^3)

DTSC Recommended Surface Water Cleanup Goals
Lava Cap Mine Site - OU1
Recreationalist II Exposure Factors and Surface Water Cleanup Goals

	COPC		
Exposure/Toxicity Factors	Arsenic[1]	Arsenic[2]	Mercury[3]
Toxicity Factors			
CSF_{oral} (mg/kg-day)$^{-1}$	1.5E+00		
RfD_{oral} (mg/kg-day)		3.0E-04	1.0E-04
RfD_{dermal} (mg/kg-day)			
General Factors			
ET (hrs/day)	1.0	1.0	1.0
EF (days/year)	1.04E+02	1.04E+02	1.04E+02
ED Adult (years)	2.4E+01	2.4E+01	2.4E+01
ED Child (years)	6.0E+00	6.0E+00	6.0E+00
BW Adult (kg)	7.0E+01	7.0E+01	7.0E+01
BW Child (kg)	3.5E+01	3.5E+01	3.5E+01
ATncarc (days)	2.2E+03	2.2E+03	2.2E+03
ATcarc (days)	2.6E+04	2.6E+04	2.6E+04
Surface Water Ingestion Pathway			
IR Adult (mg/day)	0.0E+00	0.0E+00	0.0E+00
IR Child (mg/day)	0.0E+00	0.0E+00	0.0E+00
IFSadj (mg-yr/kg-day)	0.00E+00	0.00E+00	0.00E+00
Surface Water Dermal Contact Pathway			
SA Adult (cm^2/day) [USEPA EFH, 1999]	3980	3980	3980
SA Child (cm^2/day) [USEPA EFH, 1999]	4721	4721	4721
Kp (cm/hr) [USEPA RAGS E, 2001]	1.0E-03	1.0E-03	1.0E-03
SWFSadj (cm-yr/kg)	2.17E+03	2.17E+03	2.17E+03

Target Hazard Quotient/Risk	**1.00E-06**	**1**	**1**
	Arsenic[1]	Arsenic[2]	Mercury[3]
Cleanup Goal (ug/l)	**7.5E+01**	**7.8E+03**	**2.6E+03**

[1]Cleanup goal based on cancer endpoint.
[2]Cleanup goal based on noncancer endpoint.
[3]Cleanup goal assuming mercury present as methylmercury

SWFSadj (cm-yr/kg) = (ED Child x SA Child / BW Child) + (ED Adult x SA Adult / BW Adult)
Hazard Cleanup Goal = (Target HI x BW Child x AT ncarc x 1000 ug/mg) / SA Child x Kp x ET x EF x 1 L/1000cm^3)
Risk Cleanup Goal = (Target Risk x AT carc x 1000ug/mg) / (SF_o x EF x SWSFadj x Kp x 1 L/1000cm^3)

Exposure Unit 1
Outdoor Worker Scenario
Revised 6/03

LEAD RISK ASSESSMENT SPREADSHEET
CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL

VERSION 7 **Outdoor Worker Scena**

INPUT	
MEDIUM	LEVEL
Lead in Air (ug/m^3)	0.028
Lead in Soil/Dust (ug/g)	2320.0
Lead in Water (ug/l)	15
% Home-grown Produce	0%
Respirable Dust (ug/m^3)	**1.5**

OUTPUT							
	Percentile Estimate of Blood Pb (ug/dl)					PRG-99	PRG-95
	50th	90th	95th	98th	99th	(ug/g)	(ug/g)
Blood Pb, ADULT	3.3	5.9	7.0	8.6	9.7	2417	3809
Blood Pb, CHILD	18.0	32.9	38.9	47.3	53.8	255	435
Blood Pb, PICA CHILD	34.3	62.7	74.2	90.2	102.6	128	219
Blood Pb, **OUTDOOR WORKE**	4.1	7.5	8.9	10.9	**12.4**	**1717**	2699

EXPOSURE PARAMETERS			
	units	adults	children
Days per week	days/wk	7	
Days per week, **WORKER**		5	
Geometric Standard Deviation		1.6	
Blood lead level of concern (ug/dl)		10	
Skin area, residential	cm^2	5700	2900
Skin area, **WORKER**	cm^2	***3300***	
Soil adherence	ug/cm^2	70	200
Soil adherence, **WORKER**	ug/cm^2	***200***	
Dermal uptake constant	(ug/dl)/(ug/day)	0.0001	
Soil ingestion	mg/day	50	100
Soil ingestion, WORKER	mg/day	***100***	
Soil ingestion, pica	mg/day		200
Ingestion constant	(ug/dl)/(ug/day)	0.04	0.16
Bioavailability	unitless	0.44	
Breathing rate	m^3/day	20	6.8
Inhalation constant	(ug/dl)/(ug/day)	0.08	0.192
Water ingestion	l/day	1.4	0.4
Food ingestion	kg/day	1.9	1.1
Lead in market basket	ug/kg	3.1	
Lead in home-grown produce	ug/kg	1044.0	

PATHWAYS						
ADULTS	Residential			**Contruction**		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	3.8E-5	0.09	3%	4.5E-5	0.10	3%
Soil Ingestion	8.8E-4	2.04	63%	1.3E-3	2.92	71%
Inhalation, bkgrnd		0.05	1%		0.03	1%
Inhalation	2.5E-6	0.01	0%	1.8E-6	0.00	0%
Water Ingestion		0.84	26%		0.84	20%
Food Ingestion, bkgrnd		0.23	7%		0.23	6%
Food Ingestion	0.0E+0	0.00	0%			0%

CHILDREN	typical			with pica		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	5.6E-5	0.13	1%		0.13	0%
Soil Ingestion	7.0E-3	16.33	91%	1.4E-2	32.67	95%
Inhalation	2.0E-6	0.00	0%		0.00	0%
Inhalation, bkgrnd		0.04	0%		0.04	0%
Water Ingestion		0.96	5%		0.96	3%
Food Ingestion, bkgrnd		0.54	3%		0.54	2%
Food Ingestion	0.0E+0	0.00	0%		0.00	0%

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LEAD RISK ASSESSMENT SPREADSHEET
CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL

VERSION 7 **Construction Scenario**

INPUT	
MEDIUM	LEVEL
Lead in Air (ug/m^3)	0.028
Lead in Soil/Dust (ug/g)	2320.0
Lead in Water (ug/l)	15
% Home-grown Produce	0%
Respirable Dust (ug/m^3)	**1000**

OUTPUT							
	Percentile Estimate of Blood Pb (ug/dl)					PRG-99	PRG-95
	50th	90th	95th	98th	99th	(ug/g)	(ug/g)
Blood Pb, ADULT	7.1	12.9	15.2	18.5	21.1	870	1371
Blood Pb, CHILD	21.0	38.4	45.5	55.2	62.9	215	368
Blood Pb, PICA CHILD	37.4	68.2	80.8	98.1	111.7	117	200
Blood Pb, **CONSTRUCTION**	9.8	18.0	21.3	25.8	**29.4**	**595**	935

EXPOSURE PARAMETERS			
	units	adults	children
Days per week	days/wk	7	
Days per week, **construction**		5	
Geometric Standard Deviation		1.6	
Blood lead level of concern (ug/dl)		10	
Skin area, residential	cm^2	5700	2900
Skin area, **construction**	cm^2	***5700***	
Soil adherence	ug/cm^2	70	200
Soil adherence, **constructio**	ug/cm^2	***200***	
Dermal uptake constant	(ug/dl)/(ug/day)	0.0001	
Soil ingestion	mg/day	50	100
Soil ingestion, **construction**	mg/day	***200***	
Soil ingestion, pica	mg/day		200
Ingestion constant	(ug/dl)/(ug/day)	0.04	0.16
Bioavailability	unitless	0.44	
Breathing rate	m^3/day	20	6.8
Inhalation constant	(ug/dl)/(ug/day)	0.08	0.192
Water ingestion	l/day	1.4	0.4
Food ingestion	kg/day	1.9	1.1
Lead in market basket	ug/kg	3.1	
Lead in home-grown produce	ug/kg	1044.0	

PATHWAYS						
ADULTS	Residential			**Contruction**		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	3.8E-5	0.09	1%	7.8E-5	0.18	2%
Soil Ingestion	8.8E-4	2.04	29%	2.5E-3	5.83	59%
Inhalation, bkgrnd		0.05	1%		0.03	0%
Inhalation	1.6E-3	3.80	54%	1.2E-3	2.72	28%
Water Ingestion		0.84	12%		0.84	9%
Food Ingestion, bkgrnd		0.23	3%		0.23	2%
Food Ingestion	0.0E+0	0.00	0%			0%

CHILDREN	typical			with pica		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	5.6E-5	0.13	1%		0.13	0%
Soil Ingestion	7.0E-3	16.33	78%	1.4E-2	32.67	87%
Inhalation	1.3E-3	3.03	14%		3.03	8%
Inhalation, bkgrnd		0.04	0%		0.04	0%
Water Ingestion		0.96	5%		0.96	3%
Food Ingestion, bkgrnd		0.54	3%		0.54	1%
Food Ingestion	0.0E+0	0.00	0%		0.00	0%

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Exposure Unit 1
Residential

LEAD RISK ASSESSMENT SPREADSHEET

CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL

USER'S GUIDE to version 7

INPUT	
MEDIUM	LEVEL
Lead in Air (ug/m^3)	0.028
(ug/g)	2320.0
Lead in Water (ug/l)	15
% Home-grown Produ	7%
(ug/m^3)	1.5

OUTPUT							
	Percentile Estimate of Blood Pb (ug/dl)					PRG-99	PRG-95
	50th	90th	95th	98th	99th	(ug/g)	(ug/g)
BLOOD Pb, ADULT	8.8	16.1	19.0	23.1	26.3	676	1063
BLOOD Pb, CHILD	30.8	56.3	66.6	81.0	92.2	146	247
BLOOD Pb, PICA CHILD	47.2	86.2	101.9	123.9	141.0	94	159
BLOOD Pb, OCCUPATIC	2.6	4.8	5.6	6.8	7.8	3475	5464

EXPOSURE PARAMETERS			
	units	adults	children
Days per week	days/wk	7	
Days per week, occupational		5	
Geometric Standard Deviation		1.6	
Blood lead level of concern (ug/		10	
Skin area, residential	cm^2	5700	2900
Skin area occupationa	cm^2	2900	
Soil adherence	ug/cm^2	70	200
Dermal uptake consta	(ug/dl)/(ug/	0.0001	
Soil ingestion	mg/day	50	100
Soil ingestion, pica	mg/day		200
Ingestion constant	(ug/dl)/(ug/	0	0.2
Bioavailability	unitless	0.44	
Breathing rate	m^3/day	20	6.8
Inhalation constant	(ug/dl)/(ug/	0.1	0.2
Water ingestion	l/day	1.4	0.4
Food ingestion	kg/day	1.9	1.1
Lead in market basket	ug/kg	3.1	
Lead in home-grown produc	ug/kg	1044.0	

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PATHWAYS						
ADULTS	Residential			Occupational		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	3.8E-5	0.09	1%	1.4E-5	0.03	1%
Soil Ingestion	8.8E-4	2.04	23%	6.3E-4	1.46	56%
Inhalation, bkgrnd		0.05	1%		0.03	1%
Inhalation	2.5E-6	0.01	0%	1.8E-6	0.00	0%
Water Ingestion		0.84	10%		0.84	32%
Food Ingestion, bkgrnd		0.22	2%		0.23	9%
Food Ingestion	2.4E-3	5.55	63%			0%

CHILDREN	typical			with pica		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	5.6E-5	0.13	0%		0.13	0%
Soil Ingestion	7.0E-3	16.33	53%	1.4E-2	32.67	69%
Inhalation	2.0E-6	0.00	0%		0.00	0%
Inhalation, bkgrnd		0.04	0%		0.04	0%
Water Ingestion		0.96	3%		0.96	2%
Food Ingestion, bkgrnd		0.50	2%		0.50	1%
Food Ingestion	5.5E-3	12.86	42%		12.86	27%

Operable Unit 1
Recreational I

LEAD RISK ASSESSMENT SPREADSHEET
CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL

USER'S GUIDE to version 7

INPUT	
MEDIUM	LEVEL
Lead in Air (ug/m^3)	0.028
(ug/g)	2320.0
Lead in Water (ug/l)	15
% Home-grown Produ	7%
(ug/m^3)	1.5

OUTPUT							
	Percentile Estimate of Blood Pb (ug/dl)					PRG-99	PRG-95
	50th	90th	95th	98th	99th	(ug/g)	(ug/g)
BLOOD Pb, ADULT	8.3	15.2	17.9	21.8	24.8	730	1142
BLOOD Pb, CHILD	19.6	35.7	42.3	51.4	58.5	240	405
BLOOD Pb, PICA CHILD	24.2	44.2	52.4	63.6	72.4	191	322
BLOOD Pb, OCCUPATIC	4.0	7.2	8.5	10.4	11.8	1825	2869

EXPOSURE PARAMETERS			
	units	adults	children
Days per week	days/wk	2	
Days per week, occupational		5	
Geometric Standard Deviation		1.6	
Blood lead level of concern (ug/		10	
Skin area, residential	cm^2	5700	2900
Skin area occupationa	cm^2	2900	
Soil adherence	ug/cm^2	3000	3000
Dermal uptake consta	(ug/dl)/(ug/	0.0001	
Soil ingestion	mg/day	50	100
Soil ingestion, pica	mg/day		200
Ingestion constant	(ug/dl)/(ug/	0	0.2
Bioavailability	unitless	0.44	
Breathing rate	m^3/day	20	6.8
Inhalation constant	(ug/dl)/(ug/	0.1	0.2
Water ingestion	l/day	1.4	0.4
Food ingestion	kg/day	1.9	1.1
Lead in market basket	ug/kg	3.1	
Lead in home-grown produ	ug/kg	1044.0	

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PATHWAYS						
ADULTS	Residential			Occupational		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	4.7E-4	1.09	13%	6.0E-4	1.38	35%
Soil Ingestion	2.5E-4	0.58	7%	6.3E-4	1.46	37%
Inhalation, bkgrnd		0.01	0%		0.03	1%
Inhalation	7.0E-7	0.00	0%	1.8E-6	0.00	0%
Water Ingestion		0.84	10%		0.84	21%
Food Ingestion, bkgrnd		0.22	3%		0.23	6%
Food Ingestion	2.4E-3	5.55	67%			0%

CHILDREN	typical			with pica		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	2.4E-4	0.55	3%		0.55	2%
Soil Ingestion	2.0E-3	4.67	24%	4.0E-3	9.33	39%
Inhalation	5.6E-7	0.00	0%		0.00	0%
Inhalation, bkgrnd		0.01	0%		0.01	0%
Water Ingestion		0.96	5%		0.96	4%
Food Ingestion, bkgrnd		0.50	3%		0.50	2%
Food Ingestion	5.5E-3	12.86	66%		12.86	53%

Operable Unit 1
Recreational II

LEAD RISK ASSESSMENT SPREADSHEET

CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL

USER'S GUIDE to version 7

INPUT	
MEDIUM	LEVEL
Lead in Air (ug/m^3)	0.028
(ug/g)	2320.0
Lead in Water (ug/l)	15
% Home-grown Produ	7%
(ug/m^3)	1.5

OUTPUT	Percentile Estimate of Blood Pb (ug/dl)					PRG-99	PRG-95
	50th	90th	95th	98th	99th	(ug/g)	(ug/g)
BLOOD Pb, ADULT	8.3	15.2	17.9	21.8	24.8	730	1142
BLOOD Pb, CHILD	19.6	35.7	42.3	51.4	58.5	240	405
BLOOD Pb, PICA CHILD	24.2	44.2	52.4	63.6	72.4	191	322
BLOOD Pb, OCCUPATIC	4.0	7.2	8.5	10.4	11.8	1825	2869

EXPOSURE PARAMETERS	units	adults	children
Days per week	days/wk	2	
Days per week, occupational		5	
Geometric Standard Deviation		1.6	
Blood lead level of concern (ug/		10	
Skin area, residential	cm^2	5700	2900
Skin area occupationa	cm^2	2900	
Soil adherence	ug/cm^2	3000	3000
Dermal uptake consta	(ug/dl)/(ug/	0.0001	
Soil ingestion	mg/day	50	100
Soil ingestion, pica	mg/day		200
Ingestion constant	(ug/dl)/(ug/	0	0.2
Bioavailability	unitless	0.44	
Breathing rate	m^3/day	20	6.8
Inhalation constant	(ug/dl)/(ug/	0.1	0.2
Water ingestion	l/day	1.4	0.4
Food ingestion	kg/day	1.9	1.1
Lead in market basket	ug/kg	3.1	
Lead in home-grown produc	ug/kg	1044.0	

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PATHWAYS						
ADULTS	Residential			Occupational		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	4.7E-4	1.09	13%	6.0E-4	1.38	35%
Soil Ingestion	2.5E-4	0.58	7%	6.3E-4	1.46	37%
Inhalation, bkgrnd		0.01	0%		0.03	1%
Inhalation	7.0E-7	0.00	0%	1.8E-6	0.00	0%
Water Ingestion		0.84	10%		0.84	21%
Food Ingestion, bkgrnd		0.22	3%		0.23	6%
Food Ingestion	2.4E-3	5.55	67%			0%

CHILDREN	typical			with pica		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	2.4E-4	0.55	3%		0.55	2%
Soil Ingestion	2.0E-3	4.67	24%	4.0E-3	9.33	39%
Inhalation	5.6E-7	0.00	0%		0.00	0%
Inhalation, bkgrnd		0.01	0%		0.01	0%
Water Ingestion		0.96	5%		0.96	4%
Food Ingestion, bkgrnd		0.50	3%		0.50	2%
Food Ingestion	5.5E-3	12.86	66%		12.86	53%