Review of the Draft Mine Area Feasibility Study for the Lava Cap Mine Superfund Site, Nevada City, California Prepared by CH2M Hill for the US EPA Region 9 Dated October 2003

Submitted by
G. Fred Lee, PhD, DEE
TAG Advisor to SYRCL
November 14, 2003

The US EPA has developed a draft Feasibility Study (FS) of the options that the Agency wishes the other regulatory agencies and the public to consider in remediation of the "Mine" area of the Lava Cap Mine Superfund site. On behalf of SYRCL and public stakeholders for the site I have reviewed this FS and have prepared the following comments.

The document is designed to provide information to interested parties on the remediation options for the wastes at the Lava Cap Mine Superfund site. Statements are made throughout this Draft FS that certain activities will be done as part of the remediation option, such as monitoring and maintenance; however, there is no discussion about how long this will be done, by whom, and the cost of this activity for as long as the wastes left at the Lava Cap Mine Superfund site will represent a threat to public health and the environment.

Many of the issues that are mentioned below are issues that are important in helping local stakeholders and the public decide whether a particular remediation approach for a part of the Mine site is appropriate. These are issues that the public is interested in and should be informed about. Without this information it is not possible to reliably evaluate the proposed option for site remediation. As it stands now, the Draft FS does not provide a full disclosure of the issues that need to be considered in helping the public determine whether a particular approach is appropriate and should be supported by them.

Since many of the issues of concern occur repeatedly, I have only discussed them on one or two of the possible remediation approaches. That does not mean that they are not of concern in the others where I have not specifically delineated the problems.

Specific Comments

In the list of acronyms, there are several abbreviations for beneficial use designations, such as "WARM," where it is defined as, "warm freshwater habitat **water supply** designation." REC-1 is defined as "recreational contact **water supply** designation," and REC-2 is defined as "recreational noncontact **water supply** designation." According to my copy of the Central Valley Regional Water Quality Control Board (CVRWQCB) Basin Plan, the words "water supply" are not included in these designations.

On page 1-28, I do not see a discussion of the failure to make measurements of the particulate arsenic and other potential pollutants in stormwater runoff events. Unless these data were gathered last winter, this still represents a significant gap in the studies that have been conducted at the Lava Cap Mine Superfund site during the period of time when there will be the

greatest transport of arsenic from the Mine area and other areas that have received tailings would likely occur.

Page 1-30, under "Organic matter content," in addition to organic matter forming soluble complexes, it can also form particulate complexes when the complexing agent is on the surface of particulate matter. Further, organic matter can influence the size of precipitate particles, through peptization, to make the precipitates appear to be dissolved – i.e., they will pass through filters that are used to distinguish soluble from nonsoluble.

Page 1-33, first full paragraph, last sentence, I do not understand the statement, *"Th*[e] *chance of an individual developing cancer from all other causes is estimated as high as one in three."* Is this for all other causes over the individual's lifetime? This should either be explained or deleted.

Page 1-34, section 1.6.2 Ecological Risk Assessment, second paragraph states,

> *"However, potential mercury risk is likely overestimated, because literature-derived toxicity values are for the highly bioavailable organic (i.e., methyl-mercury) form of mercury, and the mercury found in the Lava Cap Mine site samples is more likely to be in the less bioavailable inorganic form."*

While that statement is believed to be true, it is important to note that any mercury form can be converted to methylmercury, according to Foe (pers. comm., 2003), based on the most recent results from the studies of the Central Valley Regional Water Quality Control Board.

Page 1-36 references the CTR criteria for several constituents. As I have indicated previously, CTR criteria are being superseded by the November 1992 US EPA recommended criteria. According to Phil Woods of the US EPA Region 9, the states will use the November 1992 criteria as they update their water quality standards. Since it will likely be several years before the regulatory requirements are finalized for the Lava Cap Mine site, a comparison should also be made to the November 1992 criteria, in addition to the CTR criteria.

Page 2-2, in section 2.1.2, the fifth bullet mentions *"… a seismic event producing 60 percent ground acceleration or 0.3g."* In order for the public to understand this, it needs to be translated into an approximate Richter number.

The sixth bullet is concerned with *"… release of contaminated sediments during surface-water flow up to the 100-year event."* During such flows there will be appreciable erosion of tailings-containing soils, which also need to be considered.

Page 2-3, in section 2.2.1.1 Discharges to Surface Water, in the second paragraph, states,

> *"Additional beneficial uses that may apply to Little Clipper Creek include: Agricultural Supply (AGR); Industrial Service Supply (IND); Contact and Non-contact Water Recreation (REC-1 and REC-2); Warm and cold freshwater habitat (WARM and COLD); and Wildlife Habitat (WILD)."*

I do not understand why the word "may" is used. By the Tributary Rule, they apply if the downstream waters are classified for these beneficial uses.

Table 2-1 has a number of problems, such as for arsenic. As I have discussed in the past, it is not appropriate to apply a politically developed MCL, such as the arsenic MCL, as the basis for establishing cleanup levels. The US EPA (2002) National Recommended Water Quality Criteria: 2002 lists the "human health for consumption of water plus organisms" criterion for arsenic as 0.018 µg/L and for "organisms only" as 0.14 µg/L. These numbers should be used in evaluating critical concentrations of arsenic. The least that should be done in the FS is to discuss why they are not being used at the Lava Cap Mine site even though the US EPA has recommended these values as national criteria.

Page 2-8, Table 2-3 lists the preliminary cleanup goal for arsenic in surface water as 10 µg/L. This value is too high. Ten µg/L is not a proper assessment of the potential risk of arsenic in surface water. That is a political number that is not based on risk. I believe it is the Central Valley Regional Water Quality Control Board's position that pollutants like arsenic or other constituents that are added to the environment above background levels must be cleaned up to background levels.

Recently, Jon B. Marshack of the CVRWQCB has prepared a discussion on "Selecting Water Quality Goals" (Marshack, 2003). This discussion provides considerable information that is pertinent to remediation of contaminated sites. It should be reviewed, since it apparently establishes a number of stricter requirements for remediation than are being proposed by the US EPA in this Draft FS. On pages 6 and 7 of "Selecting Water Quality Goals" a "Cleanup Policy" is presented. It is stated on page 7 that,

> *"In determining cleanup levels for polluted water and for contaminated soils which threaten water quality, background constituent concentrations in water are the initial goal. If attainment of background concentrations is not achievable, cleanup levels must be set as close to background as technologically and economically feasible. They must, at a minimum, restore and protect all applicable beneficial uses of waters of the state, as measured by the water quality objectives, and must not present significant health or environmental risks."*

As I understand this policy, and where I have seen it applied to other sites, this means the cleanup of the Lava Cap Mine site should be to background, for both water and contaminated soils. In the Preface to the August 2003 Edition, mention is made that, *"To use this report correctly, it is necessary to read the enclosed narrative* Selecting Water Quality Goals *carefully before selecting numeric water quality limits from the tables."*

There is a discussion beginning on the lower right side of page 17 of "Selecting Water Quality Goals" on addressing human health risks of chemicals, based on a risk approach. Under the heading, "MCLs May Not Protect Water Resources" on page 18, information is provided on why it is inappropriate to use the US EPA 10 µg/L arsenic MCL as a water cleanup objective for the Lava Cap Mine site.

I have reviewed chapters 4 and 5 of the Draft FS, which present information on alternative approaches for remediation of the Mine site area, and find that, in general, as far as the discussions go in this draft write-up, they are appropriate. However, there are a number of recurring issues that need to be more fully discussed so that the public and elected representatives from the County, State and elsewhere, fully understand the consequences of various remediation approaches, as they may affect them at some time in the future. A discussion of various issues that I feel need further discussion in this document is presented below.

Fifty-Year Funding Estimates

In the write-up there is repeated reference to funding needs for a 50-year period. There is no discussion, however, as to why the US EPA Region 9 chose 50 years. Any of the arsenic-containing tailings that are left at the Mine site property or along Little Clipper Creek for the region that is discussed in this FS will be a threat to public health and the environment far beyond 50 years. Someone not knowledgeable in the topic might conclude that 50 years is adequate funding, and the cost estimates based on the 50-year period are appropriate. However, such a conclusion would be highly inappropriate for many of the proposed remediation approaches.

Many of the remediation approaches discussed involve leaving or placing arsenic-containing tailings at some location. For many of these, there will be need for *ad infinitum* funding to monitor, maintain and remediate the site where the tailings are located. As was mentioned at one of our previous ARAR meetings and in the Draft FS, funding for monitoring and maintenance will become the responsibility of the State and, while not mentioned, the local County, such as Nevada County, could be put in the position, in order to protect its residents, of having to fund monitoring and maintenance. The State and Nevada County officials need to understand the real cost associated with a particular management approach over the infinite period of time that the wastes (tailings that contain arsenic) will be a threat. For calculation purposes, I suggest a period of not 50 years, but 500 years. If funding is not made available for this length of time and beyond, the people in the vicinity of the Lava Cap Mine "remediated" Superfund site will be exposed to hazardous conditions again at some time in the future. They need to know this. A remediation approach that does not fully prevent escape of the arsenic in the remediation containment system for as long as the arsenic will be a threat will affect future property owners' health, welfare and interests.

Another issue of concern is that, for several of the remediation approaches, an HDPE (or similar) plastic sheeting layer will be used. While no one knows how long such plastic sheeting will function effectively, there is no doubt that the wastes that are contained above or under such a layer will be a threat long after the plastic sheeting has degraded. This issue needs to be discussed, in terms of the need for eventual replacement of the plastic sheeting, and in terms of the cost estimates, which, as I understand them, do not include this replacement. Another aspect of this situation is that it will be difficult to detect when the plastic sheeting layer first begins to fail, because of the nature of the plumes that will be generated by such failure. This is the fingerlike plume issue raised by John Cherry some years ago, that I have mentioned in my previous correspondence.

Specific Issues on Remediation Approaches

Page 4-8 lists costs. These costs are for 50 years, and they are low for required maintenance such as low-permeability cap replacement, etc.

Page 4-21 discusses various processes for treatment of waters containing tailings or arsenic derived from tailings. The proposed treatment process is quite expensive compared to normal waste treatment. It will require high-quality operation and maintenance to function reliably. As with other proposed remedial approaches, there will be high costs that someone will have to bear. Further, if this approach is recommended, the FS must clearly delineate these costs and the source of funds to be used.

Page 4-21, third paragraph states that, *"Monthly sampling of influent, effluent, and sludge would be conducted to monitor process performance."* Monthly sampling is not adequate for this type of system. This system should be sampled at least weekly, and especially during high flow events.

Page 4-23, section 4.2.3.3 Regrade and Cap Tailings, states,

> *"The tailings would be regraded and capped to minimize seepage into the tailings. For alternative development and cost estimating, the cap would consist of a sand layer, 60-mil HDPE liner, and soil cover. Areas to receive the cap would be regraded to slopes of 4:1 or flatter. A minimum of 6 inches of sand would be placed on the graded areas prepared to receive the liner to reduce the potential for damage to the liner."*

This is the type of cap that will not prevent moisture from entering the landfilled wastes for as long as the wastes in the landfill are a threat. Over time, the 60-mil HDPE liner will deteriorate and allow water that passes through the soil and sand layers above the wastes to enter the wastes through areas of deterioration of the cap liner. As discussed elsewhere, how will deterioration of the HDPE liner in the cap be detected? What will be done when and if it is detected? When it becomes evident that the cover is no longer functioning as designed and failure is detected, likely through off landfill site groundwater pollution, who will pay for the large costs of replacing the cover?

Page 4-23, fourth paragraph states that soil samples would be tested for STLC, and if violating the STLC limits, would be deposited in a Class I landfill. STLC testing is a variation of a theme developed by the US EPA for the original Extraction Procedure Toxicity Test and now the Toxicity Characteristic Leaching Procedure (TCLP). This testing procedure is recognized to be arbitrary with respect to properly defining whether a waste placed in a particular landfill is a threat to cause groundwater pollution. The appropriate approach to take in making the evaluation about the appropriate method of disposal of solid wastes in one type of landfill versus another is a risk-based analysis, in which the wastes in the landfill would be evaluated with respect to whether there is a potential, based on landfill design, to lead to groundwater pollution.

Page 4-26, first full paragraph needs to consider whether there is any galvanized metal used in building construction. If there is, then there is a potential for zinc and lead that is often a

contaminant in galvanizing to cause aquatic life toxicity in the receiving waters for the waters that come in contact with the galvanized surfaces or the soils where the zinc coating has eroded over the years.

Page 4-27 states, in section 4.2.5 Alternative 2-5 – Excavation and Onsite Disposal, that, *"The goals of Alternative 2-5 are to prevent migration of contaminated sediment into Little Clipper Creek…."* The proposed approach can be effective when the landfill is new, if it is properly constructed; however, over time, especially under conditions of inadequate monitoring and maintenance and the associated inadequate funding to carry out this monitoring and maintenance, it can fail to achieve this goal.

Page 4-28, section 4.2.5.5 Ex situ Chemical Treatment of Adit Seepage states that the high flow estimate for alternative 2-5 is 400 gpm. How well is this value known? The measurements of flow at the Lava Cap Mine site have not been conducted with the same rigor as is normally done at Superfund or other hazardous chemical sites. What will happen if the flows are actually 600 or 1,000 gpm? How well will the treatment plant be able to treat these flows?

On page 4-29, the second paragraph states, *"The area outside the creek channel would be backfilled with waste rock and regraded. Waste rock would be maintained outside of the 100-year flow of Little Clipper Creek."* The public needs to know what would happen in the event of a 101-year flow of Little Clipper Creek. What are the consequences of choosing 100-year flow as opposed to a 500-year flow or some other flow above the design flow? This issue should be discussed.

Page 4-30 discusses the development of onsite disposal of tailings, where it mentions that the *"… conceptual design criteria for the onsite disposal cell are based on requirements for California Title 27 Group A wastes. The assumed closure design is also based on the Group A criteria."* It is important to understand that Title 27 (formerly Chapter 15) specifies the minimum design, which can be used at some locations, for landfilling of wastes. It also specifies a groundwater **Performance Standard** that provides for groundwater quality protection for as long as the wastes in the landfill are a threat. The US EPA, as the lead agency for the Lava Cap Mine site, should provide the public with a detailed analysis that properly determines whether the proposed design of an onsite landfill can comply with the Title 27 groundwater protection Performance Standard for Class II landfills of no leachate leakage, and for Class III landfills of no impairment of the groundwaters underlying the landfill for as long as the wastes in the landfill will be a threat.

As part of performing this analysis, the US EPA should include a detailed discussion of the plausible worst-case scenario failure of the landfill containment system and monitoring situations for any landfilled wastes, indicating the potential failure for each of the components, such as the leachate collection system, liner, leak detection system, groundwater monitoring system, etc. What is the expected reliability of each of these systems to prevent pollution by the landfilled wastes for as long as they are a threat? Further, as part of this analysis, the magnitude and impacts of failure to prevent groundwater pollution of the landfilled wastes for as long as they are a threat should be discussed, and the costs of remediation of the groundwater pollution. In addition, who is going to pay these costs? Will there be a dedicated trust fund set aside by the

US EPA, State, and/or County to pay for all plausible worst-case scenario failures of the landfill containment system for as long as the wastes represent a threat? If not, then where will the funds come from to pay for these failures? This kind of information is essential to properly evaluating onsite landfilling as a remediation approach for the Lava Cap Mine Superfund site.

Page 4-31, third paragraph discusses the development of a detection monitoring system that would be installed beneath the disposal cell liner. As shown in the figure covering Alternative 2-5 Lava Cap Mine Area, sheet 9, drawing C-16, the typical disposal cell will have two feet of soil cover and a 60-mil HDPE liner as the cover, 12-inch drain sand and a 60-mil HDPE geomembrane, which evidently is placed on the original ground surface. Part of the landfill's footprint will be underlain by a leak detection system, underlying a sand layer with a 80-mil HDPE liner laying on the surface of the natural and recreated soils. The liner leak detection system will be used for only 25 percent of the area of the disposal cell. The other 75 percent of the disposal cell base, which is underlain by a single composite liner which will fail to prevent groundwater pollution for as long as the wastes are a threat, has no liner detection system. There is a significant likelihood that the leachate collection system will plug over the time that the wastes are a threat. How will these drains be cleaned for as long as the wastes will be a threat? What will be the cost? Who will do this?

The plugging of the drains will build up head in the areas of the liner that are not underlain by the leak detection system. The leakage through these areas as the HDPE plastic sheeting liner deteriorates due to the increased head will pollute groundwater. The 80-mil HDPE liner, drains, sand and collection piping should extend throughout the full base of any landfill system used at the site. Another aspect of this design that has to be addressed is the backing for the HDPE liner. Will this be the native soil? Or will it be a low-permeability (such as 10^{-7} cm/sec) clay – i.e., will the leak detection system be a composite liner system? If it is not, then there is a significant possibility that the detection system will fail at a rate greater than the overlying liner system.

Page 4-31, in the fifth paragraph, states that,

> *"Cover maintenance would include prompt cover repair and vegetation maintenance. The integrity of the soil cover would be monitored to identify problem areas such as areas of the vegetative cover requiring replanting, eroded or damaged areas, areas lacking free drainage, and areas having repeated or severe differential settlement."*

While it is possible to detect surface soil problems such as those mentioned, the key issue that needs to be addressed is how deterioration of the low-permeability layer of the cover will be detected. This can occur without being manifested in the surface of the cover.

Another issue on cover maintenance is the management of the vegetation on the cover. There will be a potential for deep-rooted vegetation to translocate arsenic from the wastes in the landfill through the cap to the surrounding area. Will someone, for as long as the wastes are a threat, manage this vegetation to prevent this problem?

Page 4-31, the last paragraph states, *"Potential impacts to groundwater from leachate or surface runoff from the onsite disposal cell would be monitored periodically according to Title 27 regulations for waste management units."* Title 27 is explicit in requiring protection of groundwaters from pollution from Class III landfilled wastes for as long as the wastes are a threat. For Class II landfills, Title 27 requires that the liner system prevent leachate escape from the landfill. How will these requirements be carried out in any landfill that is developed at the Lava Cap Mine Superfund site for as long as the wastes the remediation landfill are a threat? There will be significant need for developing a highly reliable monitoring system, which is not now proposed to be developed at the site to detect failures. Who is going to fund this? Will this responsibility become the responsibility of the State, with its massive budget deficits that exist now (and will likely exist in perpetuity)? Even under the budget surpluses of a few years ago the State still did not offer to significantly improve its monitoring and maintenance of landfilled wastes.

Page 4-32, section 4.2.5.10 Surface Water Monitoring mentions that Little Clipper Creek will be monitored quarterly. Will any of these monitoring events be specifically targeted to high flow conditions? If not, they should be.

Page 4-35 states, in section 4.3.2.1, that signs will be posted along the creek channel "… *prohibiting trespassing, and prohibiting recreational activities."* Such statements are not realistic, since there will be trespassing and there will be recreational activities along the creek. While posting of the creek area may deter some individual from using the creek area, it will not "prohibit" trespassing. There is need to discuss the public health and environmental consequences of these trespassing activities after the area along the creek and the mine site has been remediated.

On page 4-37, section 4.3.4.2 Surface Water Monitoring indicates that, *"Periodic surface-water monitoring would be conducted in Little Clipper Creek just upstream of Greenhorn Road as described for alternative 3-2."* How long will this monitoring be conducted? Who will conduct it, and who will pay for it? What are the projected costs per year for as long as the wastes at the Lava Cap Mine that are left there after remediation will be a threat?

Figure 4-1 indicates that chlorine dioxide will be used as an oxidant. I am familiar with the potential hazards associated with chlorine dioxide, its decomposition products and their hazards. Why was chlorine dioxide chosen as an oxidant? How will the chlorine dioxide be generated?

Page 5-1, in the middle of the page, lists as item 9, "Community acceptance" of the ROD. While I do not speak for the community, from my discussions with them I would be surprised if they would accept a remediation approach that only temporarily contains the wastes and for which there is not adequate assured funding to properly monitor, maintain and remediate the waste management approach for as long as the wastes in the management approach are a threat. In order for the public to effectively comment on the proposed remediation approach, they need a specific proposal of a remediation approach for the Mine area in which the issues that are discussed herein and others that are raised by the public are addressed.

Page 5-11, in the fifth paragraph, states,

> *"The NCP requires that (for fund-financed sites) the state ensure that institutional controls implemented as part of the remedial action are in place, are reliable, and will remain in place after the initiation of operation and maintenance [40 CFR 300.510(c)(1)]. For Superfund-financed and private sites, the NCP also requires the state to hold any interest on property that is acquired (once the site goes into O&M) to ensure the reliability of institutional controls [40 CFR 300.510(f)]."*

DTSC needs to carefully review the proposed remediation approach to be sure the state can and will carry out these requirements for as long as the wastes represent a threat. This is an issue that needs to be carefully considered in light of the significant financial problems that exist and will likely continue to exist for state agencies.

Page 5-13, second paragraph states, *"The total project duration was estimated as 50 years of cover maintenance and continued land use controls."* Why 50 years? The wastes will be a threat forever, not just 50 years.

Page 5-15, section 5.2.2.1 Alternative 2-1 – No Action, in the second paragraph mentions the US EPA allowed cancer risk of 1×10^{-4} to 1×10^{-6}. In California, the specified allowed cancer risk is 1×10^{-6}. As I understand the regulations, 1×10^{-4} is not allowed in this state.

Mention is made on page C-6 of using existing groundwater monitoring wells. To my knowledge, there has been no discussion of how reliably these monitoring wells characterize the pollution of groundwaters at the site. As I have pointed out, monitoring groundwater quality at this site is extremely difficult if not impossible to do reliably, because of the fractured rock aquifer system.

In section G Cleanup Goals from Risk Assessments, Figures 14 and 20 present mercury proposed cleanup concentrations for sediments and water. It appears that this is based on toxicity to certain forms of aquatic organisms and does not consider the potential for the mercury to convert to methylmercury and therefore accumulate through the food web and be adverse to fish-eating birds. Recently, I heard a presentation by Schwarzbach (Schwarzbach and Adelsbach, 2003) of the USGS at the Sixth Bienniel State of the Estuary conference, in which he pointed out that the concentrations of mercury to prevent excessive bioaccumulation that is adverse to birds are much lower than for direct toxicity.

A similar problem exists on Figure 18 for arsenic cleanup, in which it appears that there has been no consideration of the potential for bioaccumulation of arsenic in accord with the US EPA November 2002 Recommended Criteria. This should be considered.

References

Marshack, J. B., "A Compilation of Water Quality Goals," August 2003 Edition, California Regional Water Quality Control Board, Central Valley Region, Sacramento, CA (2003).

Schwarzbach, S. and Adelsbach, T., “The Biological Legacy of Mercury Contamination: Implications of Methylmercury Bioaccumulation for Estuarine Birds in San Francisco Bay,” Sixth Bienniel State of the Estuary Conference, San Francisco Estuary Project, Oakland, CA (2003).

US EPA, “National Recommended Water Quality Criteria: 2002,” EPA-822-R-02-047, US Environmental Protection Agency, Washington, D.C. (2002).