Technical Review of

Grants Reclamation Project
Updated Corrective Action Program (CAP)
NRC Radioactive Material License SUA-1471
Homestake Mining Company of California, March 2012

By
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For
Multicultural Alliance for a Safe Environment (MASE)

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Background

The following comments are based on a technical review of the Grants Reclamation Project Updated Corrective Action Program (CAP) or other documents as referenced. The comments have been developed on behalf of the Multicultural Alliance for a Safe Environment (MASE) and are intended to address key issues of public safety, existing remedy protectiveness, proper processes for development of effective reclamation and closure/remediation measures, protection of public financial liability, and public participation.

The comments are based on the reviewer's extensive professional expertise together with regulations, guidance and scientific references as noted in these comments. The reviewer has more than 30 years professional experience in the mining and environmental fields and is knowledgeable in mine development, operations, reclamation and closure, water management and treatment, and financial assurance. The reviewer has provided technical expertise as a contractor to numerous county, state, federal and tribal governments including the EPA and New Mexico Environment Department, including development of EPA guidance for hardrock mine cleanup. The reviewer has been involved in a primary capacity at numerous federal Superfund sites either as a remedial contractor, or agency or public (TAG) technical advisor including at Chevron Questa in NM and Butte Silver Bow, Anaconda Smelter, Milltown Reservoir, Zortman and Landusky, and Beal Mountain in MT. From 2006 to 2012 the reviewer provided technical assistance to Anaconda-Deer Lodge County, MT in development of an institutional controls program together with review of the existing (1996) RI/FS and ROD. In addition to the development of a model institutional controls program for mining Superfund sites the work led to the discovery of significant additional contamination resulting in a determination by the EPA that the remedy was not protective and promoted a new RI/FS to be conducted resulting in the recent issuance of a revised Proposed Plan for cleanup of community soils and other residential areas.

In developing these comments the reviewer has focused on consistency of the proposed remedy with New Mexico Environment Department (NMED) and EPA regulations and other requirements together with recognized viable "best practices" for hardrock mine reclamation and closure.

Consistency with Superfund Expectations

The Grants site was originally added to the National Priorities List (NPL) in 1983, establishing it as a Superfund site and therefore subject to the National Contingency Plan (NCP) and Remedial Investigation /Feasibility Study (RI/FS) Process. The reviewer therefore assumed that the information provided for the site, as well as the site history, would at a minimum provide some similarity to typical Superfund protocols for site characterization, data collection and availability, risk assessment, alternatives analysis, feasibility evaluations, and determination of proposed plans and implementation follow-up. Instead, the CAP describes activities which have been conducted since 1977 as part of a corrective action plan to address contamination discovered at that time, prior to the site being added to the NPL. While some modifications have been made to the CAP during that time, the site has clearly not undergone a comprehensive

evaluation and determination as to the best methods for remediation and ultimate final closure as one would expect given the sites Superfund status.

As noted by EPA[1] "As a practical matter, to the extent that questions about the effect of Homestake's closure activities on areas outside those covered by the license are not sufficiently addressed and documented in real time, EPA will be compelled to revisit them in the context of compiling the record for deletion, whether in the form of an Expanded Site Investigation, a full Remedial Investigation, or some other NCP-mandated investigation to build the record necessary to support site deletion."

Based on our review of the available information as contained by the CAP and supporting documents, a full RI/FS should be performed by EPA for the site. As noted by the CAP (p. 1-10), deletion would require that:

- The responsible party under CERCLA or other designated party(s) has implemented all appropriate response actions required.
- All appropriate fund-financed response under CERCLA has been implemented, and no further response action by the responsible party is appropriate.
- The Remedial Investigation (RI) has shown that the release poses no significant threat to public health or the environment; therefore, taking of remedial measures is not appropriate.

In our professional opinion:

- It is highly likely that significant additional response actions will be necessary at this site beyond those described in the CAP.
- The existing remedial actions described in the CAP are not appropriate because they are inconsistent with recognized best practice and agency approaches at other similar sites as discussed further in our comments.
- In addition EPA and NMED ARARs must be considered which the present actions described in the CAP do not adequately address.
- It is also highly likely, based on the site characteristics and similarities to other hardrock mining sites, that long-term maintenance and monitoring will be required to protect any final remedy together with long-term water management and treatment activities.
- Although long-term funding might be addressed by financial assurance, unless a mechanism that can assure funding in perpetuity, versus the standard of 30-100 years can be demonstrated, funding for the site, particularly if it becomes a DOE property (p. XX), will eventually fall to the public domain.

Unless an new and thorough remedial investigation is performed showing no threat to public health or the environment, it is improbable that this site will meet the criteria for delisting within the next 25 years, if ever, particularly if the present remedy proposed in the CAP is not significantly altered. Given the contaminants of concern and their likely geochemical nature and concentrations in the source material there is a high likelihood of rebound and long-term seepage for some time (50+ years) following closure. Given the numerous pathways which could lead to human exposures via

[1]Coleman 2011. Letter from Samuel Coleman, EPA to Larry Camper, NRC dated July 08, 2011 Re: Homestake Mining Company Superfund Site, Grants, New Mexico

groundwater, it is highly unlikely that a RI, provided it is properly conducted, will find no threat to public health or the environment at this site.

It is our opinion that additional supplemental RI data in terms of site characterization (source characterization including geochemical leaching characteristics, draindown, and seepage predictions, hydrological characterization, human health risk assessment) will be required for EPA to adequately address the site in accordance with NCP requirements. It is further our opinion that EPA should require a complete Feasibility Study to be conducted including consideration of all viable technological alternatives to those presently proposed in the CAP. This should include a full range of alternatives including relocation alternatives (distant isolated repository versus local repository). Failure by the PRP to conduct such an analysis in an unbiased manner, and by NRC to require the PRP to do so, suggests that EPA should assume primary responsibility for oversight and potentially conduct of the RI/FS process.

CAP Remedial Measures

Tailings Flushing

According to the CAP (p. xv) flushing of the tailings is being performed to expedite the draindown of seepage from the LTP to the groundwater. The CAP does not provide information how continuing to maintain the tailings in a saturated condition expedites draindown, when draindown is a direct function of discontinuing actions which maintain the tailings in a saturated condition thereby allowing them to drain of residual fluids. The flushing appears to prolong, rather than expedite, the draindown for as long as it is being performed.

The Nevada Department of Environmental Protection together with the Bureau of Land Management (BLM) have developed a protocol for tailings fluid management during the draindown period based on their extensive experience with tailings sites in Nevada and elsewhere. Figure 5.3[2] shows the various phases of draindown that are recognized. Phase 1, consisting of recirculation, is similar to the present "flushing" activity taking place at the site. As the figure demonstrates, once phase I is completed, draindown proceeds (and a final cover is placed on the tailings) which is typically followed by 30 years or more of decreasing seepage flow until steady state conditions, reflective of seepage conditions at final closure, will be realized. By continuing flushing as part of the CAP draindown and eventual final closure of the tailings is being delayed at the Grants site rather than expedited.

Source controls for hardrock mining applications are described in numerous publications and guidance documents including EPA's 2005 Draft Hardrock Mine Cleanup Guide and the Global Acid Rock Drainage Guide (GARD 2012)[3]. Those highly regarded sources of information identify source controls to include materials handling and management methods such as selective disposal of acid generating or reactive

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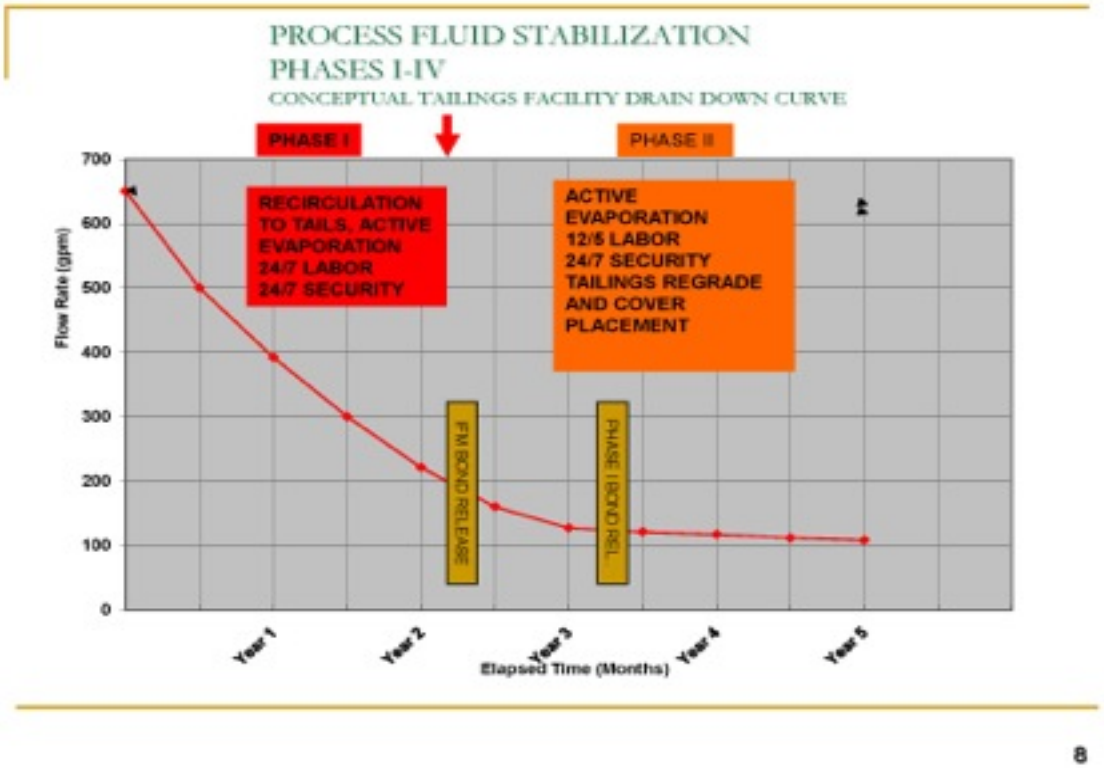
[2]See Heap Leach Draindown Estimator (HLDE) at http://www.blm.gov/nv/st/en/prog/minerals/mining.htm

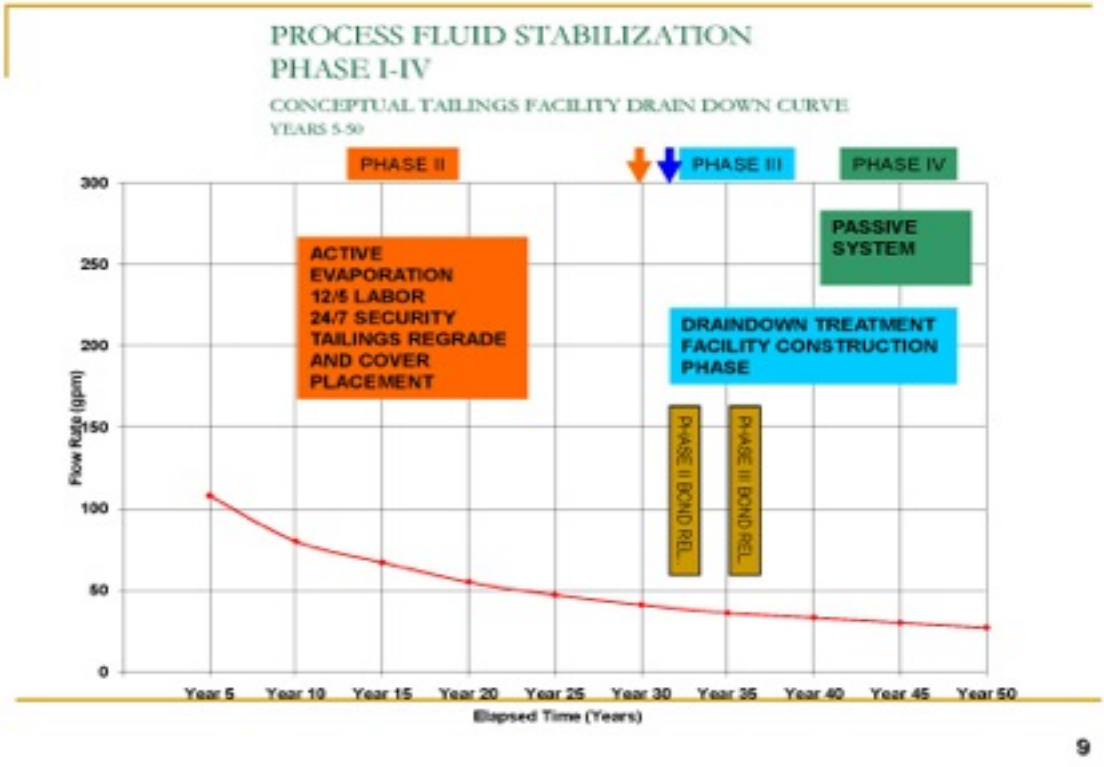
[3] http://www.inap.com.au/GARDGuide.htm –this publication also addresses neutral and alkaline mine drainage.

materials into repositories or specially designed facilities. Source controls also include engineered methods intended to prevent or reduce the occurrence of contaminant leaching by preventing or minimizing infiltration of oxygen and meteoric water as well as flow of groundwater into source materials. Commonly used methods employ a variety of covers or caps to limit infiltration. The use of liners below potential sources to protect groundwater and recover seepage is also gaining in acceptance as a source control method. In some cases neutralization may also be used as a source control method.

None of the measures which have been identified by industry references or regulatory agencies, with the exception of a few sites under NRC jurisdiction including the Grants site, have recognized much less utilized tailings flushing as a source control measure. Heap leach flushing is sometimes performed in the gold mining industry, however that practice has largely been discontinued because of failure to effectively remove residual process solution, and eventual rebound of contamination in seepage

Figure 5.3 Tailings Process Fluid Stabilization Phases





after rinsing is discontinued. In many cases rinsing has also been demonstrated to cause unpredicted undesirable effects such as leading to conditions where the solubility of a particular constituent, such as more alkaline conditions increasing arsenic or selenium mobility, have unintentionally occurred.
While the author knows of no examples of tailings flushing being practiced elsewhere in the hardrock mining industry in the US outside of those with NRC jurisdiction, from an engineering practices standpoint the same outcomes, namely that of incomplete flushing and high likelihood of rebound, would be likely to occur.

We recommend that immediate implementation of conventional source controls be evaluated for this site to expedite cleanup activities. This lack of typical process further demonstrates the need for an RI/FS to be conducted by EPA. This should include not only evaluation of measures to cover/cap the tailings in place, but also measures involving moving the tailings to a suitable nearby, or regional repository. Such a repository could be built using a lined system thereby preventing release of contaminants to the maximum extent.

Plume Control

According to the CAP ((p. xv) the plume control program involves the creation and maintenance of a hydraulic barrier downgradient of the LTP to inhibit the flow of contaminated groundwater and "Maintenance of the hydraulic barrier requires pumping of large volumes of groundwater." The water balance around the system is apparently maintained by the use of a land application disposal (LAD) method for discharging excess contaminated water. Beginning in 2010, however, NMED began to limit HMC's use of land treatment as part of its remediation strategy. According to the CAP, "if these land treatment limitations continue, additional delays should be expected, as this strategy is a critical component of the CAP."

NMED is concerned that HMC's practice of blending contaminated water with groundwater from the San Andres aquifer that presently achieves site alluvial aquifer groundwater standards. This practice essentially constitutes dilution followed by discharge of contaminants directly into groundwater, which is specifically disallowed by the New Mexico Water Quality Act.[4] NMED has required HMC to provide a demonstration, underpinned by observational data, that the continued land application of blended contaminated water as proposed in the CAP will not cause exceedance of site ground water standards at any time in the future. If HMC is unable to make this demonstration, NMED will not allow such land application to continue. NMED has also required HMC to submit preliminary plans for evaporation pond construction, which is a proven water treatment methodology that can replace land application, in the event that HMC cannot make the required demonstration, and to submit a comprehensive feasibility study of its work to date in evaluating alternative ground water treatment methods.[5]

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[4] See recent NM AG opinion on proposed copper rules.

[5] NMED Comments on Grants Reclamation Project – Homestake Mining Company Superfund Site, Updated Corrective Action Program (CAP), Draft-Final CAP, dated March 2012, Reviewed: May 29, 2012

The NMED is entirely correct in their concerns about the viability of LAD systems to not result in exceedances. LAD systems have been notoriously unpredictable and in many circumstances have resulted in either undesirable ecosystems (e.g. forage containing high quantities of contaminants) or impacts to water quality. Given New Mexico's highly protective groundwater regulations it is doubtful that any LAD system could be successfully operated to result in no discharge to groundwater of contaminants above standards if the discharge contains significant concentrations or quantities of contaminants. If an LAD system is to be used the following information needs to be collected and evaluated:

- Survey of surface waters (locations of streams, springs, lakes, wetlands).
- Depth of the shallowest water table or ground water aquifer.
- Hydrogeological characteristics of the disposal area.
- Ground water quality (State regulation).
- Soils and subsurface lithology, including attenuation analysis as needed.
- Vegetative survey including representative nearby riparian and wetland areas within a defined area of influence even if not included in area of disturbance.
- Ecological survey.
- Screening Level Ecological Risk Assessment/Ecological Risk Assessment.

These analyses would include, but not be limited to, state-required analyses for potential degradation of waters of the State. This should also include methods for validating operators' predictions, such as monitoring wells, lysimeters, and water-quality sampling.

As noted by NMED, there are alternatives to LAD which are much more environmentally acceptable than infiltration and dilution. In addition to passive evaporation, which is presently used at the site, active evaporation, using mechanized spray machines which enhance evaporation are routinely used throughout the mining industry for this purpose. In addition, evapotranspiration cells, wetlands and other means are available for discharge and are generally more acceptable and reliable than LAD systems.

Also according to the CAP (p. xvi) in 2001, the total mass of dissolved uranium in the alluvial plume was estimated to be 80,000 kilograms (kg) and in 2009, the total mass was estimated to be 30,000 kg. The CAP goes on to state that "furthermore, the results of this analysis directly address EPA and NMED concerns by conclusively demonstrating that the decrease in dissolved uranium concentrations observed in the plume is due to mass removal, not dilution from injected water. HMC conducted a mass removal analysis of dissolved uranium to demonstrate the effectiveness of the plume control program.

The results HMC presents are anything but conclusive. The "mass removal analysis" conducted by HMC is an unorthodox approach that is limited to consideration of the plume as defined by the model. It does not account for loss to groundwater outside of the plume and most importantly, does not account for the fate and transport of the total mass of 50,000kg dissolved uranium that mysteriously disappears from the plume in the mass removal analysis. A more orthodox approach would have been to conduct a standard site wide mass balance for all sources of contamination, existing contamination in groundwater, pumping and water treatment operations, LAD and

evaporation operations, and any operations which might actually remove uranium from the site other than by discharges to the LAD system or losses to groundwater.

Need for a Contemporaneous Project Evaluation

According to the CAP (p. xvi) HMC has completed and is currently conducting numerous evaluations to determine if the performance and/or operation of the five existing components of the CAP has been effective or can be further optimized. While continued evaluation and operation of the existing CAP is one option, the project should be evaluated in terms of application of reclamation and closure practices contemporaneous with current development of the science and engineering underlying those practices. Over the past 30 years, essentially after the current remedial approach was developed and implemented in large part (the plume control program at the site began in 1977 (CAD p. 2-8)) much has been learned about the practice of mined land reclamation and methods to address potential sources of seepage related to geochemical leaching of residual toxic materials contained in mining and mineral processing sources. The recognized approach today is to utilize source controls which minimize or prevent infiltration or collect all discharges at the source and to only utilize methods which rely upon continuous water management and treatment as a last resort. But perhaps the most important development has been the recognition that a full tool-box of reclamation and closure measures needs to be considered, in the context of site specifics including current rather than historic adjacent land use.

A contemporaneous project evaluation would include the following:

- An updated source characterization providing detailed information on the tailings piles and their present geochemical composition including whole rock, static and kinetic testing as warranted.
- An updated hydrological characterization providing detailed information on the existing water (and elemental) balance for the site as well as evaluating likely post-present scenario hydrologic conditions under a variety of final remediation scenarios.
- A detailed fate and transport analysis showing the predicted discharge and groundwater quality as a result of various final remediation scenarios.
- Scenarios should be developed based on a consideration of all viable technological alternatives and a clearly understood set of remedial action objectives based on current ARARs.
- At a minimum the project alternatives considered should include: 1) an option for immediate cessation of tailings flushing and installation of a final reclamation source control cap on the tailings, 2) removal of the tailings to a repository (local or regional).

In 1983, the site was placed on the NPL. At that time, the EPA did not require additional response actions to remediate the groundwater because HMC was already implementing a state-approved plan. A Record of Decision (ROD) for OU3 was signed by the EPA on September 27, 1989, with the final selected remedial action being that no further action was required. However, the decision presented in the ROD did not constitute a finding by the EPA that adequate protection had been achieved within the neighboring subdivisions. Based on sampling of the soils and air in the neighboring

subdivisions, the EPA continues to review outdoor monitoring and particulate data collected at the site boundary. Under CERCLA, EPA may reopen the administrative record to include new information. The EPA has been collecting air and soil sampling data in support of the development of a Human Health Risk Assessment, which includes both indoor and outdoor radon samples. A final Human Health Risk Assessment is expected to be issued by the EPA in the spring of 2012 (EPA 2011a). Therefore, determination of the protectiveness of the OU3 remedy will be deferred until the risk assessment report is completed.

The reviewer finds it remarkable that at this site, after almost 30 years of being listed on the NPL, there has yet to be a determination of whether the remedial actions are protective, and in fact has not yet conducted adequate site characterization/remedial investigation work to allow community members to have any confidence in their own health and welfare with respect to potential risks from this site. This is not to discount the work that has been done, but to point out that the health risks present at a site such as this are very real and significant and warrant a much higher level of concern that has been shown to date by both HMC and the government agencies involved. Inaction has potentially allowed the community to unnecessarily be exposed for more almost 30 years beyond when it was first determined to be a potential threat.

Institutional Controls

Based on my experience at the Anaconda Smelter Superfund site and other sites, these early NPL mining sites have demonstrated a propensity to have allowed inadequate and in some cases erroneous remedial approaches due to the lack of overall as well as agency specific experience in both the art and science of mined land reclamation and remediation of associated impacts such as to groundwater. In addition, most of those sites have not established the necessary institutional controls to ensure present or future protectiveness of either the remedial action in the future, or individual protectiveness of those community members living in close proximity to the site. This requires a substantive institutional capacity at the county or state level to provide both development controls (e.g. well drilling restrictions) and community health programs (e.g. medical monitoring) as well as an ability to enforce and fund such programs. Without a competent remedial plan in place it is not possible to develop an institutional controls program.

One of the main requirements under Superfund is to establish an effective ICs program at Superfund sites, and in the reviewer's opinion this is even more important at hardrock mining sites such as Grants where the risk of contaminant migration and exposure is relatively high and likely to be long-term.

Deed restrictions, without compensation, are likely unenforceable and provoke the likelihood of tort (takings) actions from property owners who are involuntarily subjected to them.