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August 30, 2001

40-8903

Ms. Tammy Mondragon
P.O. Box 2122
Milan, NM 87021

RE: Odor from Homestake Mining Company Reclamation Ponds

Dear Ms. Mondragon:

The New Mexico Environment Department (NMED) is responding to your telephone call of July 25, 2001 regarding the odor coming from the Homestake Mining Company (HMC) site. You indicated that a rotten egg smell permeates the air, especially towards evening, and that the smell has gotten worse this summer, particularly in the past month.

HMC operates several evaporation ponds as part of their ground water cleanup plan. Every year in the summer, conditions are such that algae bloom in the ponds. HMC responded to complaints of the smell of the algae bloom by hiring a consultant that recommended the addition of copper sulfide to kill the algae. HMC has been adding the copper sulfate to their ponds for the last few summers. The smell that exists now is likely that of decaying algae.

NMED requested that HMC reevaluate whether the current odor problem can be addressed. HMC hired Montgomery Watson Harza consultants to determine if something can be done regarding the smell. The report from the consultant is enclosed for your review. The consultants concluded that HMC is doing all that they can to mitigate the odor problem already by adding the copper sulfate.

Air monitoring stations are located around the ponds. HMC samples air particulates for metal concentrations throughout the year. Air monitoring data show that no air-borne health risk exists. Although the odor is unpleasant, it does not pose a risk to human health, and is not regulated by the State of New Mexico.

Thank you for your interest in this site. Please contact Abbie Phillip at (505) 827-1049, or Mary Heather Noble at (505) 827-2782 with any additional questions or concerns. You can also contact Mr. Roy Cellan at 287-4456 extension 14, for more information on HMC's operations.

NMSOIPublic

Sincerely,

Birgit Landin

Birgit Landin
Environmental Specialist
Superfund Oversight Section
Ground Water Quality Bureau

cc: Ken Hooks, Nuclear Regulatory Commission
Bill Vontel, Nuclear Regulatory Commission
Mark Purcell, Environmental Protection Agency- Region 6
Roy Cellan, Homestake Mining Company
Abbie Phillip, NMED-Superfund Oversight Section
Mary Heather Noble, NMED-Pollution Prevention Section
Milton Head, Citizen

MEMORANDUM

MWH
MONTGOMERY WATSON HARZA

To:	Roy Cellan, HMC	**Date:**	August 21, 2001
From:	Steve Lacy, MWH	**Reference:**	1690452.093501
	Ed Cryer, MWH		
Subject:	Homestake Mining Corporation		
	Grants Reclamation Facility		
	Evaporation Pond Odors		

On July 31, 2001, Steve Lacy made a site visit to the Homestake Mining Corporation (HMC) Reclamation Facility in Grants, NM to discuss with the facility staff the issue of odors from the collection and evaporation ponds, and take a tour of the facility. There was minimal wind on a clear warm day. All facilities appeared to be in operation.

During my visit there was a distinct odor from the ponds. It reminded me of the odor that emanates from stagnant, brackish water in the backwaters of a bay or estuary. The algae bloom from earlier in the year had mostly died off, however, it did not seem that the odor was specific to dead and decomposing plant material. A review of data collected in August 2000 indicated there is some sludge accumulation that could be contributing some decomposition odors, but the amount of sludge appears relatively small. Laboratory data from several samples indicates a high level of sulfates. Sulfate reduces to hydrogen sulfide (rotten egg smell) in the presence of organic matter (algae) and anaerobic bacteria present in the bottom sludges.

It would appear that the odors are a combination of the sulfides and the stagnant organic nature of the ponds. Following is a discussion of several options considered to address odors or control the environment that may be causing the production of odors.

- **Eliminate Odor Causing Conditions**: Under the circumstances experienced at wastewater treatment plants, the solution for obnoxious odors may involve removal and stabilization of the sludges, and aerating to minimize algal blooms and the stagnation (reducing anaerobic conditions) of these pond contents. However, the purpose and use of the ponds prohibit the removal of the sludge. The sheer magnitude of the ponds at over 35 acres and 500,000 ac-ft of water would result in an enormous undertaking to adequately aerate them to eliminate stagnation throughout the volume and provide sufficient oxygen and turbulence to minimize anaerobic conditions.

  The current evaporation spray system draws water from the top two feet of the ponds in order to reduce turbulence (avoid disturbing the settled bottom material) and uses

the warm surface water to enhance evaporation. In theory, this water should be aerated and have the lowest odor potential. Improvements to the surface water collection system are being developed to use only top surface water.

- **Collection and Treatment**: It is common in the wastewater industry to isolate odor producing sources or areas, draw air from the area and treat it with chemicals, activated carbon or through compost beds. This is not a viable alternative for the HMC ponds since it would require that the ponds be covered, which would defeat the purpose of the ponds, which is to evaporate water.

  Pilot testing in the summer of 1999, to assess the impact of ozone addition to the pond spray water for odor control, were inclusive and disappointing. The use of other chemicals (i.e., chlorine and $KMNO_4$) used to reduce odor potential in wastewater treatment were not considered due to the potential to generate even more noxious odors as a result of the interaction with the chemical constituents in the pond water. The use of granular or powdered carbon is expected to be ineffective due to the inorganic salt content of the water that would tend to coat the adsorptive carbon particles and make them unavailable for adsorption of the odor components in the water.

  The use of ferric salts to react with the hydrogen sulfide (H_2S) in the water was considered (insoluble iron sulfide formed) but rejected since it was not determined that H_2S was the primary cause of the odors. The primary source of the H_2S was the decomposition of material that had settled to the bottom of the ponds and this material cannot be removed under the current NRC license that the Grants facility must operate under.

- **Biological Treatment**: There have been several enzymes developed that are intended to enhance the biological treatment of sludges to reduce volumes and improve the efficiency of facilities that are undersized to meet treatment requirements. Their use has been mainly with concentrated sludges and other areas of wastewater treatment plants, and in some isolated areas of stagnant streams. We are not sure of the effectiveness of enzymes in the HMC ponds with the low organic content of the feed water, high chlorides and total dissolved solids (TDS).

- **Masking Agents**: Masking agents have been introduced in the air down wind of a facility in a mist form. These agents usually are used to cover the odor with a different scent such as citrus or floral. They are not intended to treat or eliminate the odor. Masking agents have a checkered past as to their effectiveness. When we have witnessed their use in wastewater treatment plants, they have not been found to be effective. In situations where high dosages are required, the masking agent becomes as obnoxious as the original odor. Pilot testing of an odor masking system could be considered.

- **Copper Sulfate addition**: Copper sulfate has been added with some effectiveness to control the growth of algae in the HMC ponds. Analysis of algae samples has found that most of the types of algae found in the ponds are very susceptible to susceptible to copper sulfate toxicity. If a sufficiently high concentration of copper sulfate is

present, algae growth would be inhibited. It is necessary to maintain a strict and careful monitoring of the algae level in the ponds in spring in order to stop a "bloom" at the beginning of the growth cycle.

Due to the use and purpose of the ponds, it is not feasible to totally address the potential causes of odors from the ponds. The ponds cannot be covered. What sludge has accumulated is intended to remain in the ponds and cannot be removed. The pond surface area and volume, and minimal flow addition of brackish groundwater make treatment impractical.

What we recommend is to continue the addition of copper sulfate and citric acid (dispursant) to inhibit future algae blooms, which provide a source of organic matter for the growth of anaerobic bacteria. The copper sulfate will not eliminate algae, but should limit its growth and thus limit the further accumulation of sludge and a future source of organic matter for bacteria growth (H_2S generation). In time the intensity of odors should decrease due to the reduction in the hydrogen sulfide component. The significant buffer zone between the adjacent homes and the ponds should in time become a more effective barrier to the migration of odors, but even then will not completely eliminate the possibility of odors reaching the boundaries of the HMC site.

It will be critical to monitor the agal level in the pond in spring once the surface water temperature increases above 60°F in order to control the algae growth potential (AGP). Since the pond water contains sufficient nutrients (nitrogen and phosphorus) to support luxuriant algae growth, the early and judicious use of copper to control the agal cell count can be effective in avoiding new organic growth and cutting into the growth/death/putrification/release of nutrient/growth cycle. While some algae are resistant to copper (i.e., some green algae are more so than others, see Table 1), for the most part copper or other algaecides (propriation, commercial produces and organic solvents – zylent toluene) have been used in the United States for over 100 years. Application rates in waters with high alkalinity need to be in excess of 5-6 lb/acre but this dosage needs to be determined on a site-specific basis.

Other methods to limit algae growth (i.e., increasing turbidity to prevent high penetration, nutrient extraction, lime treatment of bottom solids) could be investigated but for the most part are not economically or operationally practical in this application based upon our experience.

cc: Si Gilbert, MWH (BOI-1)
Ron Waterland (Homestake)

/ps

TABLE 1

RELATIVE TOXICITY OF COPPER SULFATE TO ALGAE

Group	Very Susceptible	Susceptible	Resistant	Very Resistant
Blue-Green	Anabaena, Anacystis, Aphanizomenon, Gomephosphaeria, Rivularia	Cylindrospermum, Oscillatoria, Plectomena	Nostoc, Phormidium	Cathothrix, Symploca
Green algae	Closterium, Hydrodictyon, Spirogyra, Ulothrix	Botryococcus, Cladophora, Coelastrum, Draparnaldia, Enteromorpha, Gloeocystis, Microspora, Tribonema, Zygnema	Characium, Chlorella, Chlorococcum, Coccomyxa, Cricogemoa. Desmidium, Golenkinia, Mesotaenium, Oocystis, Palmella, Pediastrum, Pithophora, Staurastrum, Stigeoclonium, Tetraedron	Ankistrodesmus, Chara, Elaktothris, Kirchneriella, Nitella, Scenedesmus
Diatoms	Asterionella, Fragilaria, Melosira, Navicula	Gomphonema, Nitzschia, Stephanodiscus, synedra, Tabellaria	Achnanthes, Cymbella, Neidium	
Flagellates	Dinobryon, Synura, Uroglenopsis, Volvox	Ceratium, Cryptomonas, Euglena, Glenodinium, Mallomonas	Chlamydomonas, Peridinium, Haematococcus	Eudorina, Pandorina