

1) PROPOSAL TITLE: Establishing Baseline Data for Microbial Populations of the Homestake Mine Before and After Dewatering

2) List of participants (partial):

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3) Brief Description of proposed program:

-Before major construction and dewatering are conducted at Homestake as the mine is converted to a research facility, it is important that selected measures of the microbial populations in the mine be taken, so that any changes in microbial populations after dewatering and construction can be noted. It is also important to assay microbial populations in the mine so that presence of any microorganisms that pose public health threats can be monitored. If hazardous microorganisms are found, measures could be taken to remove the health threat. It will be important to assure safe working conditions for all occupants of the mine, including making sure that there is no threat to their health from microorganisms in the mine.

Some of the measures of microbial populations would include:

a) Inventory and characterization of biofilms on different surfaces in the mine before and after dewatering. Some initial work has been done (Bleakley) on biofilm materials found in selected mine locations before the pumps were turned off.

b) Characterization of microbial populations present in water seeps before and after dewatering

c) Characterization of airborne microorganisms in the air of the mine, and in the different waters of the mine, before and after dewatering.

-Methodological approaches would include traditional pure culture work; fluorescence microscopy employing fluorescent in situ hybridization (FISH); and molecular

approaches to extract, purify and characterize DNA from biofilms, waters, and other selected mine environments so that the non-culturable microbial population can be assayed.

**Science goals:** Goals of the work would be:

- 1) Establish sites in the mine where air, water, rock, weathered materials, biofilm, and other materials can be sampled and monitored for microorganisms (both culturable and non-culturable). Some or all sites would continue to be monitored for the long term (months to years) to verify that few or no hazardous microorganisms are present in Homestake; and to monitor whether the microbial populations change over time as dewatering of the mine proceeds.
- 2) Provide monitoring information to other researchers in the mine regarding any possibly hazardous microorganisms found in the mine. Also make such information available to South Dakota Department of Public Health. Collaborate and consult with Animal Disease Research Laboratory at South Dakota State University if any infectious agents that are potentially zoonotic are found in the mine.
- 3) Thoroughly check all accessible historic records from Homestake to see if any infectious diseases and/or outbreaks of microbial origin occurred amongst mining personnel. Correlate this to any potentially hazardous microorganisms found in the mine at present.
- 4) Find funding to allow collaborators to visit the mine and each other's laboratories to have students or other personnel trained as needed in new methods and techniques.

**Hypotheses:-** Changes in microbial populations would be noted as dewatering in the mine proceeds, and construction takes place.

-Airborne spores of some fungi and actinomycetes will be present at elevated concentrations during and soon after the dewatering process; and will diminish after dewatering is completed or nearly completed.

Results would be published in scientific journals; and also made available to the general public by educational outreach.

#### **4) Infrastructure requirements:**

Rough estimate of space requirements and specific or unusual technical issues involved in proposal:

Some laboratory facility at BL2 level would be useful in or near the mine to allow some processing of samples, to allow some of the microbial work to be done soon after sampling. Some samples would be transported back to campuses or other research facilities on ice for processing and study. Monitoring of air, water, and surfaces at one or more “hot spots” in the mine where water seeps occur would be likely. These sites would also be likely foci for work in geology, engineering, and other disciplines.

At sites that are chosen for long-term monitoring, for both basic science and for public health purposes, selected equipment and monitoring devices may be installed to provide physical, chemical, and biological data acquisition.

Lab facilities should include running water; electricity; ice machine; refrigerators and freezers; lab cabinets and lab benches; lab furniture; sinks; toploader and analytical balances; pH meter; stir plates and hot plates; computer with Internet access; a chemical fume hood vented to the outside; at least one autoclave; gas and vacuum lines; controlled pressurized air flow in lab areas; eye wash stations, fire extinguishers, and fire blankets; chemical spill containment kits; a floor model centrifuge and one or more tabletop centrifuges; and at least one laminar flow hood for microbial culture work.

This lab facility would be available to other workers/researchers in the mine for their needs.

#### **5) Readiness for deployment-technology:**

Estimate of when access to underground facility would be required: In order to get baseline data for assaying initial microbial populations before dewatering and construction, access to selected areas of the mine would be needed as early as possible, ideally sometime in 2006. Access would be required from that initial point on for the duration of the study. Monitoring for microorganism posing potential health threats should be continuous and probably require on site analysis that could be done in a microbiology laboratory that is part of the mine.

**6) Readiness for deployment-effort and funding:** Efforts could begin in 2006 to write and submit grants to fund the proposed work. Some preliminary sampling and characterization work could be done without major additions of new funds and resources. But new personnel (graduate students, etc.) and O & M funds to help them do their work will be needed to move this work forward.

**7) Environment, safety, & health issues/hazards:** Microbiology facilities that are built as part of the mine infrastructure should be BL2 to safely contain and allow work with the microorganisms that are most likely to be found which might pose a public health threat. A plan should be in place to protect and/or evacuate mine personnel if a large or small amount of infectious, hazardous microbial agent is somehow dispersed by water or air in the mine.

Part of the proposed work (regular monitoring of air, water, and selected other environments in the mine) would be an on-going part of mine operations, to keep facility personnel informed about potential allergens (fungal and actinomycete spores), and about any potentially dangerous infectious agents that are detected in the mine.

Outreach activities: Will be coordinated with the research, and developed with outreach personnel.