APPENDIX I

AIR QUALITY

IDAHO-MARYLAND MINING CORPORATION

PERMIT APPLICATION - AIR QUALITY SECTION

CONSTRUCTION IMPACTS

Construction activities will occur on all three project sites, the Idaho-Maryland, New Brunswick and Round Hole sites. The work will consist of clearing and grubbing, excavation, backfilling, grading, and construction of ponds, buildings and other structures. These activities will take place in three phases over a period of 5 years. The initial construction phase will take place on the Idaho-Maryland and New Brunswick sites and is planned to be completed with 18 months. The second phase of construction will be restricted to the Idaho-Maryland site and will take approximately 18 months to complete. The last construction phase will take place on the Idaho-Maryland and Round Hole sites and will take approximately 12 months to complete.

All of these activities will generate fugitive dust. Fugitive dust will occur both during the construction activity and as a result of wind erosion over exposed earth surfaces. Clearing and earthmoving activities comprise the major source of construction dust emissions, but traffic and general disturbance of the soil also generate significant dust emissions.

Construction activities are also a source of organic gas emissions. Solvents in adhesives, non-waterbase paints, thinners, some insulating materials and caulking materials would evaporate into the atmosphere and would participate in the photochemical reaction that creates urban ozone. In general, these types of sources are small and intermittent, and do not significantly affect air quality.

The primary effect of construction activities would be increased dustfall and locally elevated level of particulate matter, although the severity will vary greatly over the period of construction with the level and type of activities occurring and the weather. Dustfall could be a temporary nuisance at neighboring properties, requiring more frequent washing of exposed surfaces during the construction period. This is considered to be a potentially significant impact, although only within a limited area and short interval of time.

Dust control measures would include:

Water sprays to control dust during demolition. Loading and unloading activities;
Suspend dust producing activities during periods of high winds when dust control measures are unable to avoid visible dust plumes;
During the dry season (May-October) provide equipment and staffing for watering of unpaved haul roads, areas being graded and equipment/vehicle parking areas at least twice daily.
Daily removal of mud and dirt carried out from the site to adjacent paved roads;
Limit the speed of equipment and vehicles to 15 miles per hour while traveling on unpaved surfaces on the site.

Concurrent with site construction operations, parking areas and access roads on sit shall be paved, graveled or treated with a dust palliative to control fugitive dust.

OPERATIONAL IMPACTS

Air pollutant impacts include dust and fume emissions from the following activities:

Underground operations – drilling, blasting, mucking, screening, crushing
Ore transport and storage – conveying, stockpiling
Ore communition – screening, crushing, grinding, classification
Ceramic feed preparation and heating
Glaze preparation and application
Vehicle traffic

Underground Operations – drilling, blasting, mucking and grading, screening, and crushing

Underground operations will involve ore drilling and blasting. Mucking is the removal and transport of broken ore from the rock faces to chutes that channel the broken ore to the primary crusher screen. Oversize material from the screen will report to the primary crusher and undersize material will report to the belt conveyor. Crushed ore will be re-circulated back to the screen. The belt conveyor will transport the crushed ore to surface. All of these activities will generate fugitive dust underground but the air quality impacts relative to these sources are considered less-than-significant.

Pollutants created by explosives include carbon monoxide, nitrogen oxides, hydrogen sulfide, particulate matter and sulfur dioxide. The emission rate (per ton of explosive) ranges from 1 pound per ton for sulfur dioxide to 104 pounds per ton for carbon monoxide (U.S. Environmental Protection Agency, Compilation of Air Pollutant Emission Factors Volume 1, Fourth Edition, AP-42, 1985). The frequency of blasting will be less than twice per day and would involve only a small area for any one blast. Blasting pollutants would be released initially at surface during the construction of the decline portal then progressively deeper underground as the decline is advanced further towards production mining depth. Mining depth will vary from location to location but will be carried out below 500 ft. from surface. The blasting pollutants will eventually be released to the atmosphere by the mine ventilation system. It is likely that considerable dilution of these pollutants and removal through depositions upon the wet walls of the mine and absorption into water within the mine would occur prior to release to the atmosphere. Additionally, the mine ventilation system will be designed to provide a high air change rate to ensure ambient air quality which will result in further substantial dilution of any pollutants.

Mucking will be performed with Load Haul Dump (LHD) vehicles, front end loaders and dump trucks. There will also be graders used for drift access maintenance. Dust generation from these operations is anticipated to be minimal as the Idaho-Maryland mine workings have historically been very wet as evidenced by an estimated 1400 USGPM continuous dewatering rate. Should excessive dusting occur, water sprays will be used to knock down fugitive dust.

Almost all underground vehicles used in at the Idaho-Maryland Mine will be diesel engine driven and will be fitted with catalytic converters and exhaust filters. Mine Safety and Health Administration (MSHA) regulations require that for all underground diesel equipment, each engine type will require a formal approval. The approval process involves emission testing on an engine dynamometer using the International Standards Organization (ISO) 8178 C1 test cycle. Based on the test results, mine ventilation rates will be calculated for each approved engine model. The ventilation rates will be computed as the quantity of additional ventilation air that has to be provided to the mine in order to dilute raw exhaust emissions to the respective Threshold Limit Values (TLV) levels (Table 1 - MSHA).

Fugitive dust from the underground screening and crushing operation will be generated at the screen face, the crusher feed opening and the crusher discharge onto the re-circulation conveyor. Directed water sprays will be utilized at these locations to control dust spread.

The release of the combined underground operations pollutants from the mine ventilation system would not have the potential for causing a violation of the ambient air quality standards near the exhaust ventilation shafts. The daily new emissions associated with theses pollutants would amount to a few pounds per day of several pollutants. These quantities released would not contribute substantially to existing or projected air quality violations. Emissions from underground operations are therefore expected to have a less than significant impact.

Ore Transport and Storage

Crushed ore from underground will be transported to surface by a single long belt conveyor running inside the decline. The long belt conveyor will discharge to two smaller belt conveyors, each discharging to its own outdoor stockpile. Apron feeders under each stockpile will withdraw ore and discharge it onto a fourth conveyor which will feed the secondary crusher located in the process building. Fugitive dust will be generated at each ore transfer point. Dust emissions will be contained by a combination of enclosed transfer chutework with rubber curtains and water sprays.

Ore Communition – Screening, Crushing, Grinding, Classification

The ore communition circuit is a dry crushing and grinding operation and will generate fugitive dust. The communition circuit will be designed to produce particles that are 80% less than 100 mesh (150 microns) in size. The communition equipment includes vibrating screens, cone crushers, grinding rolls, dynamic separators, rotary dryers, belt conveyors and bucket elevators. Dust can potentially escape into the atmosphere at the screen faces and crusher, grinding roll and rotary dryer inlets and outlets, and belt conveyor discharge points. The dynamic separators and bucket elevators are sealed systems with dust collection suction connection points.

To mitigate the dust at the point sources, a Pulse Jet Cleaned Fabric Filter dust collection system is proposed to be used in conjunction with vacuum hoods located at specific locations to capture fugitive dust. All captured dust will be returned to the process. The proposed type of dust collection system is used throughout the mineral processing industry and is acceptable to the U.S. Environmental Protection Agency. The following is an excerpt from an EPA publication pertaining to this type of dust collection system:

> *EPA-CICA Air Pollution Technology Fact Sheet*
> *Fabric Filter Pulse-Jet Cleaned Type 1*
>
> *1. Name of Technology:*
> *Fabric Filter - Pulse-Jet Cleaned Type*
> *(also referred to as Baghouses)*
>
> *2. Type of Technology:*
> *Control Device - Capture/Disposal*
>
> *3. Applicable Pollutants:*
> *Particulate Matter (PM), including particulate matter less than or equal to 10 micrometers (µm) in aerodynamic diameter (PM10), particulate matter less than or equal to 2.5 µm in aerodynamic diameter (PM2.5), and hazardous air pollutants (HAPs) that are in particulate form, such as most metals (mercury is the notable exception, as a significant portion of emissions are in the form of elemental vapor).*
>
> *4. Achievable Emission Limits/Reductions:*
> *Typical new equipment design efficiencies are between 99 and 99.9%.*

The quantity of dust that may be generated is not known at present but there are plans for air quality testing including a Health Risk Assessment to be conducted on a demonstration scale unit within the next year.

The rotary dryers will likely be natural gas fired. The burning of natural gas produces nitrogen oxides and carbon dioxide. Methane, a primary component of natural gas and a greenhouse gas, can also be emitted into the air when natural gas is not burned completely. Emissions of sulfur dioxide and mercury compounds from burning natural gas are negligible. The use of natural gas is in itself considered to be a mitigation measure as it is the cleanest burning fossil fuel available.

Ceramic Feed Preparation and Heating

Ore from the communition circuit will either report to the ceramics plant directly as ceramic feed material or alternatively, report to the gold recovery circuit if it is gold bearing. The gold recovery circuit will be a wet process and hence will not impact air quality. From the gold recovery circuit, the processed ore, now barren of gold and are now called tailings, will be dried in a rotary drier and will report to the ceramic plant as ceramic feed material. Both types of ceramic feed material will be stored in different silos in accordance with composition. Material drawn from each silo will be conveyed to a set of blenders used to mix predetermined quantities of feed material for different end products. From the blenders, the feed material will be conveyed to a bank of preheaters. Each preheater will feed multiple manufacturing lines. A manufacturing line will consist of a vacuum extrusion system, a forming system and a cutting system. All of the above operations may generate dust and fume which may impact the air quality.

The main sources of dust include the pneumatic conveyors used to transport the ceramic feed material, the feed material blenders and screw feeders. To mitigate the dust at theses sources, a Pulse Jet Cleaned Fabric Filter dust collection system is proposed to be used in conjunction with vacuum hoods located at specific locations to capture fugitive dust. All captured dust will be returned to the process.

The vacuum extrusion system will use furnaces to heat the ceramic feed material. There is a high likelihood of fume generation from the heating process because of the high temperatures involved. A vacuum pump will be used to draw off the fumes which will be cooled and discharged into a Pulse Jet Cleaned Fabric Filter dust collection system fitted with downstream activated carbon filters designed to capture chemical fume. Activated carbon filters can adsorb a broad spectrum of chemicals and have traditionally been used in laboratory fume hoods and have now found wide spread usage in other industries including home air purification.

The chemistry of the ceramic feed material was determined by a series of whole rock analyses performed by Kappes Cassiday & Associates in Reno, NV. The composition of the dust and fume anticipated will be formed from a portion of the chemicals listed below. Note that As, Hg and W were not detectable (the presence of Cl and F was not tested for):

Component	units	Average	Minimum	Maximum	Detection Limit
Si	%	23.09	19.80	30.00	0.01
Al	%	8.34	7.35	11.25	0.01
Ca	%	5.70	1.22	8.87	0.01
Fe	%	6.38	2.89	8.22	0.01
Mg	%	4.97	1.40	7.29	0.01
Na	%	2.65	1.36	4.81	0
K	%	0.29	0.08	1.14	0.01
Ti	ppm	5035	600	6900	100
Mn	ppm	1172	569	1800	1
Cr	ppm	295	0	832	1
P	ppm	577	300	800	300
Cu	ppm	146	40	653	2
V	ppm	220	72	311	1
Ni	ppm	73	0	218	5
Ba	ppm	53	3	210	1
Zn	ppm	76	37	177	2
Co	ppm	38	11	56	1
Bi	ppm	25	0	52	10
Pb	ppm	3	0	44	10
Cd	ppm	5	0	10	1
Mo	ppm	0.4	0	10	5
As	ppm	0	0	0	10
Hg	ppm	0	0	0	0.05
W	ppm	0	0	0	10

The exact composition and quantity of dust and fume that may be generated during heating varies depending on rock type and therefore is not known at present. In preparation for air emissions mitigation, air quality testing including a Health Risk Assessment will be conducted on a demonstration scale unit within the next year. The type of activated carbon filters will be selected based on the air quality results.

Glaze Preparation and Application

The glaze preparation system and application system will involve the handling of finely ground powders. The handling processes may generate fugitive dust and fume. The chemical compounds contained in the in the contemplated ceramic glazes are listed below:

Al, Co, Cr, Fe, Mn, Ni, Pr, Si, Sn, V, Zn, and Zr.

Chemical analyses of the dust and fume that may be generated by the contemplated glazes will be conducted at the appropriate time. The planned mitigation of glazing emissions will also use a Pulse Jet Cleaned Fabric Filter dust collection system fitted with downstream activated carbon filters designed to capture chemical fume. The exact composition and quantity of fume that may be generated during heating is not known at present but there are plans for air quality testing including a Health Risk Assessment to be conducted on a demonstration scale unit within the next year. The type of activated carbon filters will be selected based on the air quality results.

Vehicle Traffic

There will be vehicle traffic both on paved and unpaved areas within the plant site. The extent of the pavement has been designed to mitigate dust generation from the operation of the large ceramic product transport trucks, delivery trucks and employee vehicles. Other areas where there will be frequent vehicle movement will be graveled such as the areas surrounding the truck shop (for underground mining vehicles) and the tile storage area (for forklifts). The graveled areas will be maintained to minimize dust generation.