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Magino Project
Environmental Impact Statement

Technical Support Document 20-11

Air Quality and Noise Abatement Management Plan

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ABBREVIATIONS

ASL	Ambient Sound Level
CCME	Canadian Council of Ministers of the Environment
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CSL	Comprehensive Sound Level
CWS	Canada-Wide Standards
dBA	Decibel-Acoustic
DFO	Fisheries and Oceans Canada
EHS	Environmental, Health, and Safety
EIS	Environmental Impact Statement
EPCM	Engineering, Procurement, and Construction Management
EPP	Environmental Protection Plan
L_{eq}	Energy Equivalent Sound Level
LSA	Local Study Area
MTPA	Million metric tons per annum
NCB	Balance Noise Criteria
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxide Emissions
O_3	Ozone
OSHA	Occupational Safety and Health Association
PDA	Project Development Area
PM	Particulate Matter
PSL	Permissible Sound Level
RSA	Regional Study Area
SARA	*Species At Risk Act*
SO_2	Sulphur dioxide
TSP	Total suspended particulate matter
VC	Valued Component
ZOI	Zone of Influence

SECTION 1.0 - INTRODUCTION

1.1 PURPOSE

This Air and Noise Abatement Management Plan provides guidance on management of air emissions and noise from construction and operation activities. The plan includes action to control airborne particulates and noise hazards. It also defines action to mitigate, prevent, or avoid to the extent practical noise nuisance to site personnel and nearby populations. The plan addresses greenhouse gas emissions and includes an assessment of emissions from the complete lifecycle of the Project, aimed at improving management of energy and greenhouse gas emissions, and building emissions abatement and energy saving considerations into the business decision-making processes.

1.2 REGULATORY STANDARDS

A number of regulations apply to the Project in relation to air and noise abatement as listed below:

- Ontario Regulation 419/05 – Air Quality – Local Air Quality
- Canadian Ambient Air Quality Standards (CAAQS)
- CEPA - On-Road Vehicle and Engine Emission Regulation (SOR 2003-2)
- MOECC regulations and guidelines:
  - NPC-300 – Environmental Noise Guideline – Stationary and Transportation Sources (for Plant Operations NPC-103)
  - NPC-119 (MOECC) – Noise and Vibration Effects from blasting
  - NPC-115 and NPC-119 – Construction Equipment
- *Occupational Health and Safety Act*, R.S.O. 1990, Reg. 854: Mines and Mining Plants, Part XI
- Section 4 of Regulation 833 of the Revised Regulations of Ontario, 1990 (Control of Exposure to Biological or Chemical Agents) made under the Act. R.R.O. 1990, Reg. 854, s. 252 (1); O. Reg. 272/97, s. 46; O. Reg. 496/09, s. 2; O. Reg. 265/15, s. 14. - exposure of a worker to contaminants.
- O.Reg 143/16 under the *Climate Change Mitigation and Low-carbon Economy Act*, 2016 - Quantification, Reporting, and Verification of Greenhouse Gas Emissions Regulation
- ISO 2631-2 provides guidance on perceptibility of blast vibration at receptor sites.

1.3 OBJECTIVES OF THE PLAN

The objectives of the Air and Noise Abatement Plan are as follows:

- Ensure protection of workers;
- Ensure on-going compliance with regulatory standards for ambient air quality in the workplace and at off-site receptors;
- Assess the effectiveness of the Project mitigation;
- Monitor visible emissions and record pertinent operational details to show that equipment and operations are performing consistent with EIS predictions;
- Demonstrate that Project emissions are compliant with applicable regulations and standards;
- Determine the significant changes to air quality that result from the Project, and provide data that can be used, if required, to account for any unforeseen environmental effects;
- Track and report on greenhouse gas emissions; and

- Compliance with Provincial and Federal reporting requirement.

1.4 UPDATE OF THIS MANAGEMENT PLAN

The Air Quality and Noise Abatement Management Plan is a "living document." It will be regularly updated based on management reviews, incident investigations, regulatory changes, or other Project-related changes.

SECTION 2.0 - TARGETED VECS

Targeted valued components (VCs) for the Air Quality and Noise Abatement Management Plan are:

- air quality;
- noise;
- vibration; and
- greenhouse gas emissions and climate change.

2.1 AIR QUALITY

Both gaseous and particulate emissions can result in air contaminants such as Total Suspended Particulate (TSP), particulate matter (PM10, PM2.5), SO2, nitrogen dioxide (NO2), and carbon monoxide (CO). These can be measured as concentration of mass of contaminants per volume of air (µg/m3). Because of gravitational settling and other influences, TSP can be deposited on the earth's surface and potentially accumulate in terrestrial and aquatic systems. Here the contaminant is measured as deposition on a mass per area basis (g/m^2). Depending on the composition of TSP, this deposition can range from a nuisance to an environmental concern. The VEC associated with these contaminants is air quality.

Baseline air quality conditions for the Magino Project are presented in the EIS Chapter 4.

2.1.1 Air Quality Metrics

For the Magino Project, the concerns are mainly TSP, SO_2 and NO_x, as well as greenhouse gas emissions (GHG). Thus, the air quality metrics are:

- TSP and total particulate deposition (dustfall);
- Sulphur dioxide (SO_2) and NO_2; and
- GHG emissions.

2.2 NOISE AND VIBRATION

High levels of environmental noise and vibrations can affect people by impairing their enjoyment of using the land. They can also affect wildlife, causing changes in behaviour or avoidance of affected areas, for at least temporary periods of time. Environmental noise and vibration levels are therefore the VEC selected for mitigation and monitoring.

2.2.1 NOISE METRICS

Environmental sound levels vary continuously over time. To account for both daily and short-term variations in sound levels, several single numerical descriptors have been developed based on large-scale psycho-acoustic studies of annoyance by environmental noise. These allow sound monitoring to be conducted for a constantly varying sound environment over extended periods,

with the results described as a single number that accurately describes the environment.

The single number descriptor commonly used in most international standards for environmental sound measurements is the energy equivalent sound level (Leq). The Leq value, expressed in Decibels-Acoustic (dBA), is the energy-averaged, A-weighted sound level for the complete measurement interval.

It is the steady, continuous sound level over a given period that has the same acoustic energy as the actual varying sound level over a given period that has the same acoustic energy as the actual varying sound levels occurring over the same period in the measured environment. It is one of the most common and useful predictors of human response to noise, and, is also the noise descriptor used to establish environmental noise criteria. The A-weighting accounts for the frequency content of measured sound based on a frequency response similar to that heard by the human ear.

The noise descriptors specific to this Air Quality and Noise Abatement Management Plan are:

- 24-h A-weighted energy equivalent sound level Leq(24), referred to as daily sound level;
- 15-h A-weighted energy equivalent sound level LeqDay or Leq(15), referred to as daytime sound level;
- 9-h A-weighted energy equivalent sound level LeqNight or Leq(9), referred to as nighttime sound level; and
- 1-h A-weighted energy equivalent sound level Leq (1), referred to as hourly sound level.

2.3 VIBRATION METRICS

Vibration impacts can be divided into impacts in two zones: terrestrial (above ground, on land) and underwater.

2.3.1 Terrestrial

Human perception of ground-borne vibration can be ranked as follows (Bender, 1996):

- barely to distinctly perceptible - 0.5 to 2.5 mm/s ppv;
- distinctly to strongly perceptible - 2.5 to 6.25 mm/s ppv;
- strongly perceptible to mildly unpleasant – 6.25 to 25.4 mm/s ppv; and
- increased potential for structural damage - 12.5 to 25.4 mm/s ppv.

The potential for structural damage increases for airborne vibration overpressure in excess of 120 dB (MOE, 1997).

2.3.2 Underwater

Fisheries and Oceans Canada (DFO) has produced *Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters* to protect marine wildlife, including fish and marine mammals from underwater vibrations (DFO, 1998).

Highlights of the guidelines in relation to the Project include the following:

- No explosive is to be detonated in or near fish habitat that produces, or is likely to produce, an instantaneous pressure change (i.e., overpressure) greater than 100 kPa in the swim bladder of a fish; and
- No explosive is to be detonated that produces, or is likely to produce, a peak particle

velocity greater than 13 mm/s in a spawning bed during the period of egg incubation.

The guideline also presents tables of weight of explosive change versus distance and other estimation methods to help determine the potential impacts.

This guideline is relevant mostly for the construction phase of the Project (construction of docking facilities, creek/river crossings).

2.4 CLIMATE CHANGE AND GREENHOUSE GAS

At present, low sulphur diesel fuel is the only economically viable source of energy for the Project mining fleet. The Company, however, is continuing its investigation of alternative sources of energy to satisfy Project energy requirements.

Prodigy will use *Ontario Regulation 452/09* and the Guideline for Greenhouse Gas Emissions Reporting (December, 2015) to prepare emissions reports.

2.5 RECEPTORS

Off-site receptors for air quality, noise and vibrations were identified in the EIS Chapter 7 (Table 7.2.2.4) which is reproduced below:

Table 1: Location of the Identified Points of Reception for Air Quality and Noise

POR ID	LOCATION	EASTING (M)	NORTHING (M)
POR1	Goudreau Community	683601	5348128
POR2	Cemetery	685071	5348873
POR3	Herman Lake (Cottage)	683855	5351940
POR4	Herman Lake (Cottage)	683522	5352712
POR5	Trapper Cabin B	684837	5355701

SECTION 3.0 - MITIGATION MEASURES

Refer to EIS Chapter 6, Section 6.5 for a complete list of Project mitigation measures.

3.1 LIFE OF PROJECT MITIGATION MEASURES

Mitigation measures that will be implemented over the life of the Project to minimize identified adverse impacts on air quality, noise, and vibration.

3.1.1 Occupational Health and Safety

At all times, workplace conditions will be compliant with OSHA standards for workplace ambient air quality and noise. When and where necessary, employees will be provided with hearing protection for work in noisy areas and respiratory masks for work in dusty environments. Health and safety procedures and standards will be strictly enforced throughout the life of the Project.

3.1.2 Procurement Policy

Procurement practices will incorporate emission standards as specified in equipment vendor contracts and for general contractors' use of equipment and machinery on site. Emission and noise standards will be based on Ontario or Canadian regulatory guidelines, or best available technologies as follows:

a. Vehicles Emissions – meet Tier 4 emission requirements for off-road diesel vehicles;
b. Noise – specification for noise level in procurement contracts; and
c. Purchase low sulphur diesel fuel for mining fleet.

3.1.3 Mitigation by Design

Mitigation by design is where identified point sources of emissions are the target of specific design and construction considerations and methods with the objective of reducing, controlling, and/or eliminating atmospheric emissions/noise/vibration at the source. These include:

a. On-site roads will be constructed and maintained using granular material that contains metals at concentrations below the Ontario Typical Range (MOE, 1993) concentration for most metals;
b. Process equipment enclosed in building (crusher, grinding mill, mill equipment) and vented to baghouse system;
c. Point source of dust emission to be fitted with ventilation hoods and vented to dust collection equipment;
    i. Dust collection system for dry material (reagents) storage and handling areas.
    ii. Lime silo and lime slaking system vented to a baghouse.
    iii. Control and ventilation systems for mixing of dry reagents.
    iv. Cyanide destruction unit installed at processing plant with effective monitoring control equipment to ensure effective removal of residual cyanide from tailings water pumped to the TMF.
d. Particulate outlet loading concentrations for dust collectors were assumed to be less than 5 mg/m^3; and
e. Mobile equipment equipped with mufflers.

3.1.4 Best Management Practices

Implementation of Best Management Practices (BMPs) and Standard Operating Procedures (SOPs) which target the activities and operation susceptible to generating air pollutants, noise and excessive vibrations will include:

a. Reduce vehicle speed and enforce speed limits on site roads;
b. Use of coarse granular material for construction of haul roads;
c. Use of water for dust suppression or other MOECC approved dust suppressant on roads and stockpiles;
d. Develop tailing deposition strategy to minimize exposed beach;
e. Adjust blast size so that objectives of O.Reg. NPC-119 are achieves for noise and vibration;
f. Site equipment operated to comply with NPC-300 operational noise limits;
g. Where possible, maintain 1 km setback for Project blasting activities from off-site receptors; and
h. Follow manufacturer's recommended guidelines regarding water infiltration and time of explosives usage to minimize emissions of NOx.

3.1.5 Employee Training and Awareness

On-going training and awareness program for operators to ensure they are aware of potential emission sources and adhere to SOPs when operating equipment/machinery.

3.1.6 Schedule Maintenance Program

Preventive maintenance program that ensure equipment is functioning as intended will include:

a. Development and implementation of a rigorous preventive maintenance program to ensure equipment is maintained in good working order and to ensure that emissions are in line with emission criteria and vendor's specifications;
b. Installation of air quality monitoring equipment to track equipment and operation performance; and
c. Investigation of alternatives for reduction in fossil fuel consumption and implementation of energy efficiency program for reduction of fossil fuel consumption.

3.1.7 Waste Segregation for Open Air Burning

The combustion of plastic can lead to the formation of dioxin and furans. Where practical, such waste will be separated from the waste stream and disposed of at the landfill. Only scrap wood and combustible packaging materials will be burnt on the burn pile.

3.1.8 Vehicle Traffic

Vehicle traffic at the mine site (haul road and service roads) is expected to be the major contributor to dust generation for all stages of the Project. Mitigation to minimize dust generated by vehicular traffic will include:

a. Use granular material for road construction and maintenance;
b. Limit speed of vehicle on all roads; and
c. Use of water or other MOECC approved dust suppressant as required on roads and stockpiles.

3.1.9 Greenhouse Gas and Energy Efficiency Programs

The Company will investigate alternatives for reduction in fossil fuel consumption and implement energy efficiency programs for reduction of fossil fuel consumption.

3.2 CONSTRUCTION AND CLOSURE PHASES

For the construction and closure phases, air pollutant sources will include:

a. Emissions from mobile equipment used for construction and the earthwork activities involved in preparing sites for Project infrastructure and roads; and
b. Dust generated by material handling and earthworks.

Activity-specific mitigation measures are outlined in the Environmental Protection Plan.

The potential air quality impacts resulting from the operations phase activities are as follows:

- SO_2 and NO_2 levels from mobile equipment are expected to be lower than indicator thresholds during construction and closure activities; and
- Elevated dust deposition levels are expected in the immediate vicinity of construction. These levels could occasionally exceed indicator thresholds.

3.2.1 Mitigation Measures for Construction and Closure Phases

Best management practices for dust control will be implemented throughout the construction and closure phases. These best management practices include:

- The use of coarse granular material for road construction;
- Watering roads, as necessary, to reduce visible plumes when it is practical to do so (e.g., when temperatures are above freezing);
- Using other approved dust suppressants as appropriate;
- Using well-defined haul routes to minimize disturbed surfaces;
- Limiting traffic to essential use over construction areas;
- Limiting speed over construction areas; and
- Minimizing drop distances (i.e., using adjustable stackers) for stockpiling activities.

Implementation of these measures will reduce the magnitude and extent of dust deposition.

3.2.1.1 Anticipated Effectiveness of Mitigation Measures

Dust emissions will result primarily from traffic onsite. These sources can be readily minimized because of Prodigy control and ease of access. Enforcing strict speed limit for Project vehicles is expected to minimize dust generation from traffic.

3.2.1.2 Effects of Mitigation Failure or Malfunction

Dust-suppression measures are not prone to failure, as such, but do show relative degrees of success. All materials from which dust could be generated are non-reactive and low in contained heavy metals, such that there is no chemical risk to the environment. Dusting of vegetation surfaces has the potential to reduce plant growth rates, but most dust from Project activities will fall in close proximity to roads and well within construction site boundaries.

3.2.1.3 Contingencies

The main contingencies for controlling dust are increased frequency of water spraying, and the selection of a more effective dust suppressant in the case of road dust.

3.3 OPERATION PHASE

The ore will be transported to the ore stockpile by 220 tonne haul trucks and the mine rock will be transported to the MRMF.

3.3.1 Sources of Air Emissions

Activities likely to have an impact on air quality are:

- Mining activity (blasting);
- Mobile engine operation in and around the mine pit, including shovels, drills, loaders, and trucks;
- Traffic of mine haul trucks traffic;
- Ores stockpiles and ore reclaiming;
- Ore crushing;
- Cushing plant ventilation; and

- Processing plant emission from ventilation equipment (cyanide destruction unit and reagent ventilation).

3.3.1.3 Expected Ambient Air Contaminant Concentrations for Mine Site

Airborne contaminant dispersion modelling was carried out as part of the EIS. For air quality modelling, a 3-km zone was used to define the local study area (LSA) and a 1.5-km zone was used for evaluation of model results against appropriate air quality criteria.

Air quality parameter concentrations in excess of their respective thresholds are predicted, though these exceedances are generally confined to the LSAs and are fully reversible. Effects of the Project on air quality are predicted to be not significant.

3.4 GREENHOUSE GAS EMISSIONS REDUCTION PROGRAM

Once the facilities are in operation and a baseline for GHG emission is established, the Company will bench-mark its operation against other similar mining operations and implement a Greenhouse Gas Emission Reduction Program.

SECTION 4.0 - ROLES AND RESPONSIBILITIES

Senior management is ultimately responsible for all policy creation, while the onsite management team is responsible for monitoring and reporting to senior management and regulatory bodies. The respective contractors will each have their own EHS personnel to ensure compliance and implementation of their particular scope of work with regards to EHS.

For specific Roles and Responsibilities and Training, refer to TSD-20-1.

4.1 CONTRACTORS

With respect to this Air Quality and Noise Abatement Management Plan, the Company intends to contract out its air monitoring and noise survey programs. A well-defined scope of work will be developed that will identify:

- Specific locations for sampling;
- Duration of the sampling campaign;
- Analysis required; and
- Reporting format and other requirements.

A call for tender will be sent to competent contractors, requesting the following:

- Qualification and expertise of the contractor;
- Experience in a northern climate;
- Details of QA/QC for sampling and analysis; and
- Client references.

4.2 COMMUNICATION

Refer to TSD-20-1.

SECTION 5.0 - PERFORMANCE INDICATORS AND THRESHOLDS

Table 2: Performance Indicators and Thresholds – Air Quality and Noise

Parameter	Indicator	Averaging Time	Ontario AAQC	Indicator Threshold
Air Quality	TSP (µg/m^3)	24 hour		
		Annual		
	PM_{10} (µg/m^3)	24 hour		
	$PM_{2.5}$ (µg/m^3)	24 hour		
	SO_2 (µg/m^3)	1 hour		
		24 hour		
		Annual		
	NO_x (µg/m^3)	1 hour		
		24 hour		
		Annual		
	CO (µg/m^3)	1 hour		
		8 hour		
	Dust deposition	One month	70 mg/100cm^2/30 day	15.8mg/100cm^2/30day
			7 g/m^2/30 day	5.3 g/m^2/30 day
		Annual	4.6 g/m^2/30 day	55 g/m^2/year
			55 g/m^2/year	
Noise	Nighttime equivalent noise levels ($L_{eq,\ night}$)			• Change in $L_{eq,\ night}$ • Project-related $L_{eq,\ night}$
Vibration	Peak Air Pressure Level (PAPL)		Maximum air vibration, as Peak Air Pressure Level (PAPL), is 128 dBL	>90 dBL
	Peak Particle Velocity (PPV)		Maximum ground vibration, as Peak Particle Velocity (PPV), is 12.5 mm/s.	>0.3 mm/s

SECTION 6.0 - MONITORING

Monitoring for air quality, noise and vibration are described in the Environmental Monitoring Plan (TSD 20-9). Monitoring will focus on:

- Meteorology;
- Air quality at receptor; and
- Noise at receptor.

6.1 METEOROLOGY

Three meteorological stations have been established. The stations record air temperature, relative humidity, precipitation, wind direction, and wind speed. Data collected from the meteorological stations are establishing a climatic record or baseline in key project areas.

6.2 AIR QUALITY MONITORING

Potential sources of project-related effects on air quality include exhaust emissions from vehicles, mining activities, aircraft, generators and other equipment, camp incinerators, and fugitive dust emissions from road traffic during snow-free periods.

Daily inspection of facilities will ensure strict compliance with this Air Quality and Noise Abatement Management Plan. The EPP outlines detailed procedures for dust-suppression techniques. Training/instruction will be provided to all employees and contractors as required on the use of dust suppressant.

Scheduled maintenance on mobile equipment and stationary equipment will ensure that emissions are in line with vendors` specifications and emission criteria.

6.2.1 Ambient Air Quality Monitoring

Passive air quality monitoring will be conducted. Passive sampling will include collecting SO2, NO2, O3, and dustfall samples simultaneously. During both construction and operation, the monitoring program will focus on TSP and dust deposition.

Air quality data will be collected via passive sampling methods (SO2, NO2, O3, and dustfall, including metal deposition). The sampling locations and frequency will be established before the onset of construction and will be revised/updated before start of operation. Table 2 presents an overview of the indicators and corrective action to be taken should thresholds be exceeded.

6.3 NOISE

The purpose of the noise monitoring program is to assess the magnitude of noise impacts from Project activities. The main activities expected to cause noise impacts include the mine site camp operations (including vehicles, generators, and incinerators), aircraft activities, mining, crushing, and transportation activities related to ore, overburden, and mine rock.

Field activities will be conducted in accordance with the EPP to minimize potential effects on people and wildlife. More specifically, equipment will be operated with modern mufflers, and subjected to regular maintenance. In remote areas, drilling and other site activities will be guided by the presence and response of wildlife.

Table 2 presents performance indicators, thresholds, and corresponding corrective action. The site management will also need to ensure certification of noise compliance is current, where applicable.

SECTION 7.0 - REPORTING REQUIREMENTS

7.1 REPORTING

Refer to Environmental Monitoring Plan – TSD 20-9.

7.2 DOCUMENTATION AND DATA CONTROL

The Company's Environmental Superintendent will coordinate preparation, review, and distribution, as appropriate, of the data and reports required for regulatory purposes.

Execution of some of the monitoring programs detailed in the Air Quality and Noise Abatement Management Plan will be conducted by, or supported, by consultants and contractors. Data and

reports will be prepared and delivered to the Company by its consultants for internal and external distribution and use, as appropriate.

All formalized documents and reports will follow data-control procedures, with revision numbers and revision tracking. Documents and data that are issued and are liable to change will be controlled to ensure they are approved before issue, and that the current issue or revision is known to and available to those requiring them.

7.3 INTERNAL AND EXTERNAL REPORTING

Implementation of monitoring under the Air Quality and Noise Abatement Management Plan will result in the collection of data and generation of various reports. Whereas there are regulatory requirements for formal monthly and annual reports, including disclosure of issues of non-conformance, internal reporting is used to provide direction to personnel and to provide operational updates to site and corporate management. Internal reporting mechanisms might include weekly environment reports, weekly operations reports, and routine inspection reports. Site-based toolbox and management meetings are also important internal reporting tools commonly used.