

Part XXIX Underground Operations

Index

Section	Title	Revision Date
E541	<u>Mine rescue emergency procedures</u>	June 2014
E542	<u>Tests and reports of emergency warning systems</u>	December 2013
E544	<u>Ambient air quality monitoring program</u>	December 2013
E549	<u>Underground illumination</u>	December 2013
E564	<u>Plotting of diamond drill-holes</u>	December 2013
E566	<u>Refuge stations</u>	June 2014
E573	<u>Fire suppression system</u>	December 2013
E582	<u>Mine ventilation and auxiliary ventilation systems</u>	December 2013
E586	<u>Auxiliary fans</u>	December 2013
E587	<u>Brattice or vent tubes</u>	December 2013
E592	<u>Internal combustion engines underground</u>	June 2014
E599	<u>Safety stations</u>	December 2013

Explanations

Section E541 Mine rescue emergency procedures

Subsection E541(g) The mine rescue equipment required for underground operations is as follows:

Mine Rescue Equipment required for Underground

Breathing Apparatus and Standard Support Equipment

<i>Qty</i>	<i>Description</i>
16	<i>BG4's complete</i>
3	<i>Sets of Standard Equipment which include gas monitor, first aid kit, OXY-SR-45, whistle, clipboard, caulk, 2 probe sticks</i>
5	<i>SSR 90 M or equivalent – for conscious victim. i.e. self – contained, closed circuit oxygen breathing apparatus such as Drager OXY SR-45, or SR-100, to be used by trapped workers being rescued.</i>
1	<i>Carevent CA resuscitator or equivalent – for unconscious victim, to allow automatic breathing. i.e. Drager O2 system.</i>
1	<i>RZ 25 Universal Tester</i>
1	<i>RZ35 Negative Leak Tester</i>
2	<i>Basket/stretchers complete – which includes as bare minimum 2 fire blankets, splints, first aid kit/burn kit, neck collar, back boards, axe, buck saw, fire extinguisher, spray paint/caulk, spare oxygen bottles for BG-4's, emergency rope, 5 foot linkage lines, etc.</i>
16	<i>BG4 cylinders – filled spare bottles available at all times</i>
1	<i>Equipment dryer – dryer apparatus</i>
1	<i>Haskel O₂ booster pump – charging oxygen bottles</i>

3	<i>Gas detection monitors with calibration kit – gas monitor must be able to perform multiple gas testing and be dependent on the type of mining. Carbon Monoxide, Hydrogen Sulphide, Oxides of Nitrogen – (Nitrogen dioxide, Nitric oxide, Dinitrogen tetraoxide), Sulphur Dioxide, LEL's, Oxygen, Methane, etc.</i>
10	<i>244 ft³ oxygen cylinders</i>
25	<i>300 ft³ air cylinders</i>
200	<i>Scrubber filters</i>
600 lbs	<i>Soda lime</i>
1	<i>BG4 spare parts container</i>
1	<i>Oxy SR 45 M spare parts container</i>
1	<i>Air Cascade System (4 cylinders)</i>
1	<i>Oxygen Cascade System (3 cylinders)</i>
8	<i>PA 94 Airboss</i>
1	<i>BG4 Isolation kit</i>
2	<i>Scrubber Filling Station</i>
1	<i>Trainer Oxy SR 45 M</i>
1	<i>Trainer SSR 90 M</i>
1	<i>Set of Oxy SR 45 M tools (without testing adaptor and hose)</i>
1	<i>Tool kit</i>
1	<i>First Aid and Burn kit</i>
2	<i>Safety lamps</i>
1	<i>Freezer – optional</i>
5	<i>BG4 Ice making molds – optional</i>

Fire Fighting Equipment

<i>Qty</i>	<i>Description</i>
1	<i>MSA 6000 cfm foam generator</i>
2	<i>Low expansion foam eductor, nozzle, and foam tube</i>
15	<i>AFFF low expansion foam concentrate</i>
15	<i>Hi-Ex foam concentrate</i>
400 ft	<i>Fire hose</i>
300 ft	<i>Disposable tubing (discharge tube for foam generator)</i>

Special Equipment – Own or have access to the following:

<i>Qty</i>	<i>Description</i>
1	<i>Lifting Bag System</i>
2	<i>11 ton bags</i>
2	<i>22 ton bags</i>
1	<i>Set of compact Lifting Bags (1, 4, 7 ton bags)</i>
1	<i>Bolt Cutter</i>
1	<i>Reciprocating Saw</i>
1	<i>GripTech Rope Rescue System</i>
2	<i>KED jackets</i>
1	<i>Jaws of life</i>
1	<i>Thermal imaging camera</i>

Communication Equipment:

Qty	Description
11	Two way radios with chargers, plus five more accessible for third team.

Designated Headlamps on Charging Rack:

Qty	Description
15	Miners head lamps, plus 5 more accessible for standby

NOTE-This is currently being reviewed by the provincial mines rescue technical committee.

Section E542 Tests and reports of emergency warning systems

In these sections, when “shift” is referenced, it means each group of workers, or crew, such that all workers are aware of the emergency procedures and the warning system.

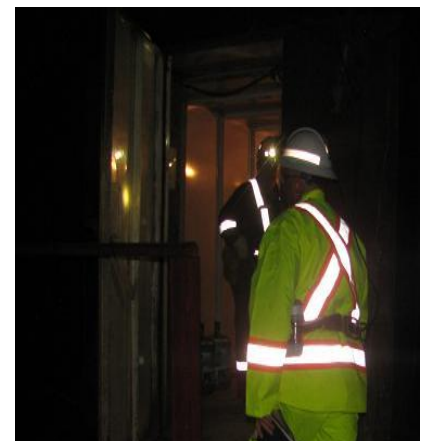
Section E544 Ambient air quality monitoring program

In addition to contaminants listed in 544(2), mining operations need to consider radon gas, hydrogen sulphide and silica as other potential contaminants. The Silica Code of Practice may be applicable to the property and should be included in the ambient air quality monitoring program.

Section E549 Underground illumination

Subsection E549 (2) Retro-reflective material on headgear and outer clothing.

This is a requirement for all underground places of employment. The goal is to ensure all workers are visible to equipment operators under all conditions in the underground environment. Since low light levels are often encountered, retro-reflective



materials on headgear and outer clothing are required.

Section E564 Plotting of diamond drill-holes

Subsection E564(5) The guarding may be done by a person, chains and appropriate signage, or the installation of a full barricade or plate that would stop any debris from a blast from a diamond drill hole in the area.

Section E566 Refuge stations

Subsection E566(2)(a) A refuge station is perceived as the ultimate place of safety in an underground emergency. Its location should therefore be as secure from all hazards as possible. A refuge station, when constructed in host rock should be, free from normal rockmass features such as faults, fractures and dykes and the susceptibility of these features to seismic activity or other disruptive influences should be thoroughly assessed. Major ground movements associated with seismicity can damage the station, its external service equipment, or restrict access to or from the station. The ground support installed in the refuge station and its vicinity must be of the highest standard possible and shall include, as a bare minimum: rockbolts, screen and shotcrete on both the back and walls.

Subsection E566(3)(m) The testing of compressed air shall comply with CSA Z180.1-13, Compressed Breathing Air and Systems, or the most recent revision.

Section E573 Fire suppression system

The fire suppression systems referenced shall be automatic for all scenarios, with a manual override.

Section E582 Mine ventilation and auxiliary ventilation systems

Subsection E582(1) An employer must ensure that plans are prepared describing the ventilation system that show all of the following:

- (a) the location and description of all fans or air-moving devices;
- (b) the location and description of all surface openings;
- (c) the location of the measurement stations that are used to determine the air flow;

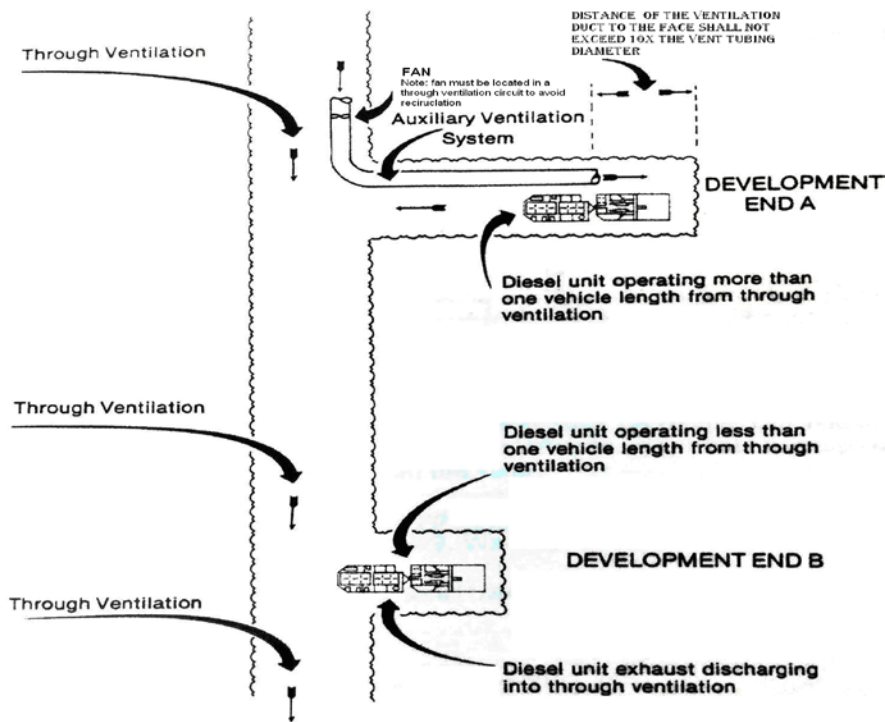
- (d) the direction, velocity and air flow of the main air currents;
- (e) the location of all proposed and existing ventilation devices, including all of the following:
 - (i) main fans,
 - (ii) auxiliary fans,
 - (iii) booster fans,
 - (iv) ventilation doors and ventilation curtains,
 - (v) airways and crossings,
 - (vi) air ducts,
 - (vii) brattices,
 - (viii) bulkheads,
 - (ix) flammable-gas drainage pipes and holes,
 - (x) explosion-proof barriers,
 - (xi) stoppings,
 - (xii) seals,
 - (xiii) dams,
 - (xiv) overcasts,
 - (xv) undercasts,
 - (xvi) regulators,
 - (xvii) doors,
 - (xviii) connections with adjacent mines;

- (xix) locations of areas withdrawn from the ventilation system;
and
 - (xx) significant changes in the ventilation system projected for one year.
- (f) the location of all underground workings and splits;
 - (g) the flow of air entering and leaving each working area;
 - (h) the amount of air at each open crosscut in a room and pillar section;
 - (i) cross-sectional areas of all travel ways, tunnels and shafts and any other devices or airways through which ventilating air is moved;
 - (j) any means of heating the ventilating air;
 - (k) any compressed air lines used for ventilation;
 - (l) the location of all fixed ventilation monitoring equipment and remote sensing equipment;
 - (m) transportation systems for all of the following:
 - (i) persons,
 - (ii) material being mined,
 - (iii) materials other than materials being mined;
 - (n) the location of first aid stations and refuge stations;
 - (o) the location of any non-explosion risk zone and the location and type of any fixed equipment in the zone that is not intrinsically safe or not flameproof;
 - (p) the location of obstructions to air flow;
 - (q) the number and type of internal combustion engine units used underground, including make and model of unit, type of engine, make and model of engine, brake horsepower rating of engine, and approval number.

Subsection E582(3) This applies to the development stage only when starting at the surface/portal. Until suitable effective auxiliary ventilation is provided, the working must be considered a confined space.

Section E586 Auxiliary fans

This section applies to all areas of the mine where workers are required to work. If not ventilated it must be barricaded (temporary or permanent). The amount of ventilation depends on a risk assessment of the area, as per Figure 1.



NOTE: VENTILATION
The engine must be approved as being suitable for underground use by a testing laboratory and the approval shall specify the amount of ventilation required, or in the absence of this approval, then 144.8 CFM per BHP is required.

Figure 1 Illustration of Auxiliary Mine Ventilation for Underground

Section E587 Brattice or vent tubes

Distance of the ventilation duct to the face shall not exceed 10x the tubing diameter. (Refer to *Figure 1 Illustration of Auxiliary Mine Ventilation for Underground*).

Section E592 Internal combustion engines underground

Subsection E592(1) See [Notice of Diesel –Powered Equipmentⁱ](#)

Subsection E592 (4)(c) See [Sample Emission Testing Procedureⁱⁱ](#)

Subsection E592 (5)(b) The time weighed average of 0.4 mg/m^3 applies to total carbon as measured using NIOSH Method 5040; it is the average airborne concentration in the worker's breathing zone that must not be exceeded over a shift; monitoring for diesel particulate must be included in the ambient air quality monitoring program required under Section 544.

The OHS Regulations, 2012, adopt the ACGIH exposure limits for hazardous substances (see s. 42). In the absence of an ACGIH exposure limit for diesel particulate matter, and until such time that one is adopted, the time weighted average exposure limit of 0.4 mg/m^3 will be in effect in NL.

Section E599 Safety stations

Where workers are required to travel underground, safety stations / bays shall be installed at intervals not exceeding 30 metres from each other.

i Notice of Diesel-Powered Equipment

In accordance with section 592 (1) (2) of the Occupational Health and Safety Regulations 2012, made under the *Occupational Health and Safety Act*, before diesel equipment is first used in an underground mine the employer shall complete this form and submit it to the Minister for approval. An application for approval must also be submitted for rental, short term use or contractor units at the mine site used underground.

Employer Information

Operating Name:	
Legal Name:	
Address Street #	Street Name:
City/Town:	PO Box:
Postal Code:	Province:
Telephone Number:	Fax Number:

Owner of Site

Name: † Same as Employer	
Address † Same as Employer Street #	Street Name:
Postal Code:	PO Box:
City/Town:	Province:
Telephone Number:	Fax Number:

Name of Operation:

Location of Operation: (Directions)

<u>Diesel-Powered Equipment</u>		
Type		
Purpose		
<u>Unit Identification</u> Make	Model	Employer Unit No.
<u>Engine</u> Make	Model	Serial Number
Rated power kw	Rated RPM	Maximum Fuel Injection Rate kg/hr
<u>Engine Certified</u> <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, provide name of testing laboratory, Certificate number and Ventilation Rate prescribed: <div style="text-align: right;">CFM</div>		
<u>Emission Control Device</u> Type	Model	Serial No.
Type	Model	Serial No.

Fuel/Hydraulic Fluid

The type of fuel on site conforms to:

- CAN/CGSB-3 16-99 "Mining Diesel Fuel", Special-LS
- CAN/CGSB-3.517 "Automotive Low Sulphur Diesel Fuel" Type AL-S
- Other (specify)

Capacity of Fuel Tank Litres	Capacity of Hydraulic Fluid Tank Litres
Fuel Sulphur Content % wt	

<u>Fire Suppression System</u> Type	No. of Nozzles	Size of Unit kg
---	----------------	------------------------

Note: Fire Suppression Systems are required on each piece of equipment containing more than 25 Litres of flammable fluids (s.573)

Fire Extinguisher Type	Size kg	Quantity
------------------------	------------	----------

Ventilation Requirement

Pursuant to subsection 592 (2) of the OHS Regulations, the flow of air provided to the workplace where diesel-powered equipment is operating must be 144.8 CFM per BHP in the absence of an approval by a testing laboratory.

Air Volume requirement for the diesel-powered equipment **CFM**

Braking System Type Emergency	Service	Parking
----------------------------------	---------	---------

Braking system performance requirements

The service brake system meets the requirements of:

† CAN/CSA-M424.3-M90 “Braking Performance-Rubber-Tired, Self-Propelled Underground Mining Machines” s.534 (1) or

† ISO 10265: 1998 “Earth-Moving Machinery-Crawler Machines-Performance Requirements and Test Procedures for Braking Systems” s.534 (3)

Acknowledgement

† I confirm that I am authorized to complete and submit this form.

† I hereby certify that the information provided is true and correct to the best of my knowledge.

Last name of person completing this form	First name of person completing this form
Position	Date (yyyy/mm/dd)
Email Address	

To facilitate processing of this application, attach the following:

- 1.) Maintenance procedures for emission devices.
- 2.) Mine ventilation plan and most recent ventilation survey.
- 3.) Exhaust emission testing procedures
- 4.) Engine approval certificate, if Applicable.

ii Emissions Testing Procedures

Purpose:

To establish a guideline for measuring emissions of mine and mine related equipment.

Scope:

Applies to the PM testing of all Diesel mining equipment used underground.

Responsibility:

Testing shall be conducted under the guidance of the maintenance department by a qualified technician or mechanic.

Equipment Required:

Appropriate portable combustion analyzer; a gas monitor.

Hazards:

Emissions – CO, NO², diesel particulate

Thermal – High temperature metal parts due to running equipment

Motion of equipment – Crushing by accidental movement of equipment at full throttle.

Controls:

½ face air purifying respirator with organic/P100 filter, gas monitor, building ventilation, work gloves, wheel chocks

Preparation:

- Bump test the gas monitor as per manufacturer specifications. Upon passed test, hang unit within 2 feet of testing area to monitor gas levels.
- Run equipment outside for a minimum of 30 minutes to bring up to operation temperature
- Install chocks on front and back of equipment wheels.
- Ensure the respirator has clean filters and has been maintained and is used as per CSA standards.
- Turn on combustion analyzer tester to allow analyzer to perform self test/calibration, as per manufacturer specifications.

Procedure:

- Ensure that unit has been run to operating temperature. Be sure to observe ventilation requirements if measuring inside. Turn on garage ventilation system.
- Have qualified operator in cab of vehicle to control brakes and throttle.
- Have operator apply emergency brake.
- Start vehicle again if operator had turned off. If machine off for more than 10 minutes, it may be necessary to idle for additional time to return exhaust to testing temperature.
- Ensure equipment is in neutral and have operator accelerate to high idle.
- Put on gloves and respirator. Position gas monitor at tester level to monitor exposure levels.
- Install probe unit into full stream of exhaust and push run button to start test.

-
- Once Oxygen reading reaches 16%, push the hold button to save your readings and have the operator return the vehicle to idle.
 - Test performed during PM should have the plug on the inlet side of the catalytic convertor removed and perform a test again using the above procedure through this port.
 - Remove testing unit from exhaust and record CO, NO_x, NO², and O² readings from the unit onto the control sheet.
 - If at any time the gas monitor goes into alarm, cut the engine, open all bay doors and exit building until gas reading return to normal levels.
 - Records of the testing shall be kept by Mobile maintenance. Emission testing shall be conducted at minimum every 250 hours of equipment operation or if conditions dictate otherwise. A summary should be copied to health and safety monthly.
 - Emission levels are taken in flow on surface at time of PM. Levels will be checked underground at the operator level once a week and recorded on the equipment checklist. These will be taken by the operator using an appropriate gas monitor.

Maintenance

- The portable combustion analyzer shall be maintained as per manufacturer specifications. Bump test, calibration and record keeping also shall be performed as per manufacturer's specifications.