

GUIDELINE *for*

mobile diesel generating plants

The Infrastructure Health and Safety Association (IHSA) is the health and safety association serving surface mines, pits, quarries, and related sectors in Ontario. We provide auditing and consulting services, training, and information to help our members meet our shared vision of safe and healthy workplaces free from incidents, injuries, illnesses, or fatalities.

Mobile diesel generating plants are widely used within Ontario's aggregate industry, but there are very few written standards or guidelines for their safe operation. A mobile diesel generator is a self-contained diesel generator that can be transported to a worksite. IHSA's Mining and Aggregates Working Group identified an industry need for information on the safe operation of mobile diesel generating plants to be distributed.

Using this guideline

This booklet is for reference purposes only. The following should be in place at each company:

- Manufacturer's specifications for all mobile diesel generating plants on site should be followed, as well as the design, layout, and hazards of their own work area
- Policies and procedures to ensure safe work in and around mobile diesel generating plants

Section 1: General considerations

a. Training requirements

Training workers properly is essential for the safety of those working around the generator. A training program should require, at minimum, the following:

- Completion of the company's orientation and training program
- Completion of *Surface Common Core* training, including the module *U5031: Lockout* and the specialty module *U5051: Operate Generator over 10kVa*
- Site-specific lockout training for each site the worker may visit, including the employers written lockout program as required by Section 158(2) of the Mines and Mining Plants regulation (R.R.O. 1990, Reg. 854)
- Ongoing crew safety meetings to create awareness of generator hazards
- Proper fire extinguisher training
- Awareness of all pertinent legislation, including the limits of approach to electrical conductors as defined in Section 159 of the Mines and Mining Plants regulation (R.R.O. 1990, Reg. 854), Section 188(2) of the Construction Projects regulation (O. Reg. 213/91), or sections 42 and 60 of the Industrial Establishments regulation (R.R.O. 1990, Reg. 851)
- Regular review of the manufacturer's recommendations for all equipment

b. Personnel considerations

Workers should not connect cables or modify electrical equipment unless they are under the direction of a certified electrician (as per O. Reg. 213/91, s. 182).

c. Personal protective equipment

See your company's and the manufacturer's guidelines for personal protective equipment (PPE) to be worn near the generator. At minimum, IHSA recommends hard hats, safety glasses, safety boots, and hearing protection. Loose clothing, long hair, or jewellery that can catch on equipment should be avoided.

d. Signage

Ensure all descriptive, directional, procedural, and warning signs required by legislation and industry best practices are posted, such as:

- PPE requirements (e.g., noise levels, hearing protection)
- Electrical panel and switchgear labels (e.g., voltage levels, name of feeder or load)
- Fire protection procedures/devices (e.g., fire extinguisher locations, hot surface warnings)
- Operational instructions for the diesel generator (e.g., start up, shut down, lockout policy and procedures, schematic diagram for electrical distribution and routing)

Section 2: Equipment considerations

Proper site selection and preparation are essential to the stability and performance of a mobile diesel generating plant.

a. Site selection and placement

Before installing a plant at a worksite, site planning needs to take place. Proper placement of a generator requires a location that ensures the following:

- The ground is level and stable.
- The generator is a reasonable distance from machinery that requires electricity.
- Exhaust fumes are properly ventilated into the atmosphere.
- Noise is properly dissipated.
- The generator housing has two available exits.
- Fuel berms are available for external fuel tanks (see Section 3(g) of this guideline).
- The generating plant is located away from main travel ways in a non-congested area, if possible.
- The mobile generator is not placed underneath overhead powerlines, as per the *Ontario Electricity Safety Code* (OESC).

b. Placement

If using lift or hoist equipment to place the plant, the following should be checked before lifting begins:

- Proper equipment to set up the generators is available (e.g., forklifts, boom trucks, proper slings and adequate blocking).
- The path is clear of obstacles.
- Hoist equipment has appropriate tires for terrain.
- Proper lifting and rigging techniques are used.
- Communication between ground crew and operator is predetermined.

c. Tear down

Safe tear down of equipment requires the following:

- Procedures for disconnecting and retrieving cables are followed.
- Fuel is drained before generator is transported to a new location.
- Loose equipment is secured before transport.
- Rig and truck are inspected prior to transport—including wheels and rims, hitch point, brakes, lights, etc.

Section 3: Specific hazards

Mobile diesel generating plants have their own specific hazards; companies must have a plan in place to eliminate or control them.

a. Electrical

The transfer of electricity from the generator to machines, crushers, or other machinery on the worksite must be carefully set up and monitored by a competent person. The competent person must verify the following:

- The generator and equipment must be grounded properly (see Figure 1).
- Cables running from the generator to machinery are stored securely off the ground or protected from accidental contact.
- Cables are anchored to prevent strain.
- Electrical equipment is approved and labelled with a certification mark. See the Electrical Safety Authority's website for the latest approval marks.
- Switches, controls, and panels are labelled clearly.
- A lockout program is in place and in use.

b. Guarding

Proper guarding prevents workers from coming in contact with the diesel motor's moving parts and hot surfaces (see Figure 2). The following should be in place before a worker operates a generator:

- All protective guards and covers are installed according to manufacturer's specifications and comply with Section 185 of the Mines and Mining Plants regulation (R.R.O. 1990, Reg. 854).
- There are proper stairs entering the generator and handrails are bolted securely in place.
- All work levels above 1.5 metres (4.9 feet), including the generator's rear doors, must have appropriate safe work platforms and guardrails.

c. Lockout and tag

Lockout programs should include procedures for the generator site. Neutralizing energy sources before maintenance is critical to preventing injuries. Proper lockout programs and procedures require workers to:

- Identify energy sources.
- Neutralize energy sources.
- Lock and tag equipment. Tag must include the reason why the equipment is locked out, the date, and the name of the person who locked out the equipment.
- Verify zero-energy.
- Remove isolation devices after work is completed.
- Start up.

IHSA recommends a lockout station located at the diesel generator that includes the following items:

- Policies and procedures
- Log book
- Additional locks
- Tags
- Multi-lock devices

Older equipment must be retrofitted to ensure a worker is able to lock it out (as per R.R.O. 1990, Reg. 854, s. 185(7)(c)).

d. Excessive noise

The Ministry of the Environment, Conservation and Parks and the *Environmental Protection Act* (EPA) classify sound as a contaminant and prohibit excessive noise from industrial activity. Accepted noise levels vary by time of day, location of worksite, and frequency. Refer to the EPA for further details. Consider the following guidelines regarding noise:

- To restrict the amount of noise directed toward private property by the generator, the generator must be placed so that the ventilation doors face into the pit.
- As part of the company's noise control program, sound levels must be posted to ensure proper hearing protection is worn by workers.
- Mufflers on the generator should be maintained as per the manufacturer's guidelines.
- Buffer pads can be placed around the generator to protect workers from excessive noise.

e. Exhaust

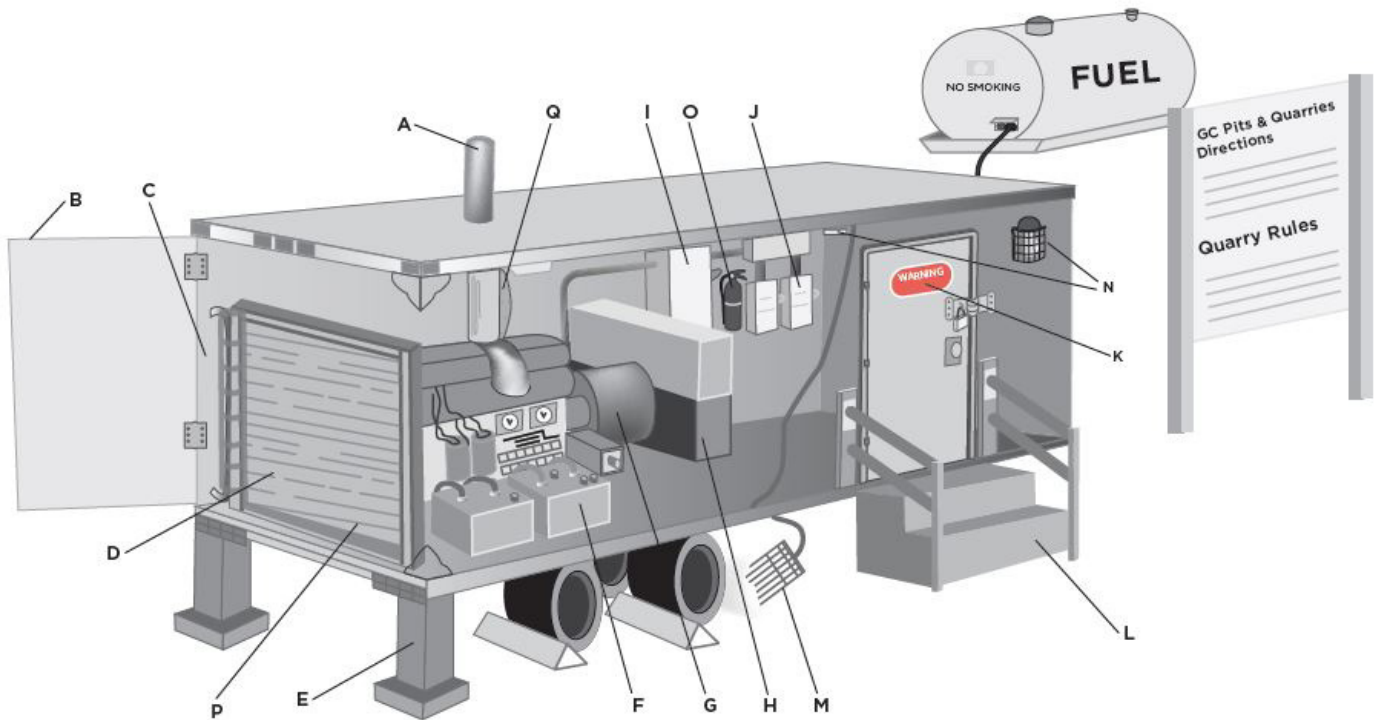
Diesel engine exhaust contains carbon monoxide (CO). Poorly ventilated areas may result in workers succumbing to heat stress, CO poisoning, or both. Symptoms can include dizziness, nausea, headaches, and drowsiness. To prevent complications arising from inhaling engine exhaust, ensure the following:

- Exhaust fumes from the generator funnel outside, up, and away.
- Hot exhaust gases are never directed toward anything flammable.
- The engine and exhaust system is maintained as per the manufacturer's specifications and recommendations.

f. Storage of flammable substances

Fuels, lubricants, and some coolants are considered flammable. To avoid fire hazards, ensure that the following precautions are taken:

- Fuel must be stored in an approved container, as per Technical Standards and Safety Authority (TSSA) standards.
- Underslung tanks meet engineering specifications and recommendations.
- Fuel tanks located inside the generator must be in compliance with Section 42 of the Mines and Mining Plants regulation (R.R.O. 1990, Reg. 854).
- Fuel tanks located inside the generator must be protected by a one-hour fire-resistant wall (as per R.R.O. 1990, Reg. 854, s. 43(d)(iii)).
- Fill pipes and vent pipes must be outside of the structures.
- All other flammable materials are stored in suitable well-marked containers away from the generator, as per Workplace Hazardous Materials Information System (WHMIS) standards.
- Flammable substances must be handled in accordance with WHMIS, including safety data sheets (SDS) and available eyewash stations.



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| A - Exhaust system | I - Main switch |
| B - Doors (ventilation, maintenance) | J - Auxiliary switches, loads identified |
| C - Guarding in place when open | K - Entrance door (warning signs) |
| D - Radiator | L - Stairs and guard rails |
| E - Proper stands rated to take the weight of the suspension (front, middle, and back) | M - Proper grounding |
| F - Batteries and master switch | N - Interior and exterior lighting |
| G - Generator | O - Fire extinguisher |
| H - Control panel | P - Direct noise into the pit or quarry |
| | Q - Exhaust muffler |

Figure 1: Generator legend

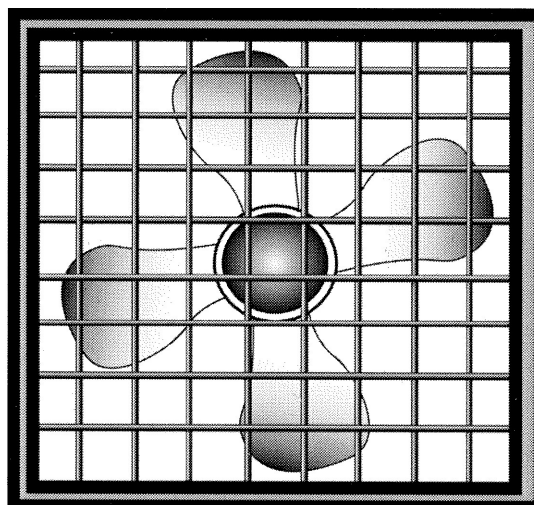


Figure 2: Proper guarding around moving parts

g. Re-fueling protocol

To prevent fire and environmental hazards, the following should be in place:

- The fuel tank should be grounded.
- The generator and related equipment must be turned off.
- “No smoking” signage must be visible near the fuel tank and enforced.
- A spill kit is available.
- A shut-down procedure for the fuel tank is posted.

Section 4: Checklists

Sample pre-operational and operational checklists for mobile diesel generating plants are located in Appendix A.

a. Pre-operational checklists

Before start up, a pre-operational check must take place. A site-specific checklist should be developed and observations should be recorded, dated, and signed. The checklist should prompt users to check for the following items:

- All electrical equipment is protected from contact with dust, metallic particles, shock, and vibration.
- The ground conductor and ground plate are not visible.
- The structure and exterior of the generating plant are inspected.
- Cables are guarded, protected, and secured in place.
- Entrance and stairs are clear and handrails are secure.
- Appropriate fire extinguishers (i.e., Class ABC) are in place.
- Housekeeping is in good order.
- The diesel engine has been visually inspected according to the manufacturer’s specifications and recommendations, including:
 - Belts
 - Pulleys
 - Leaks
 - Radiator/coolant/hoses
 - Batteries and battery cables
 - Master switch
 - All fuel levels topped off

b. Operational checklists

While the generating plant is in operation, supervisors should continue to monitor for engine temperature, excessive heat, and leaks.

Section 5: Emergency plan

Company-wide emergency plans should be re-evaluated to take the introduction of a mobile diesel generating plant to the worksite into consideration. The emergency plan has to take into account any potential hazards (e.g., spill or fire) that may be related to the generating plant. Emergency planning for generating plants should include:

- A notification system suitable for the area where the plant is located.
- A procedure to shut off fuel and/or air supply to stop the engine in the event of runaway on start up.
- A procedure for containing generator fires, including availability of proper fire extinguishers, and a method to contact the local fire department.
- A procedure to summon the required emergency services.

Where appropriate, employees should be trained to call the Ontario government's Spills Action Centre toll-free at 1-800-268-6060 in the event of motor oil or diesel fuel spills that are over 1,000 litres at sites restricted from public access, over 25 litres at sites with public access, or under 25 litres if the spill creates a hazard to public health or safety, contaminates any fresh water source or waterway, interferes with the rights of any person, or enters into a sewer system, underground stream, or drainage system.

Section 6: Applicable legislation and related documents

- *Regulation for Mines and Mining Plants* (R.R.O. 1990, Reg. 854)
- *Occupational Health and Safety Act and Regulation for Construction Projects* (O. Reg. 213/91)
- *Regulation for Industrial Establishments* (R.R.O. 1990, Reg. 851)
- *Building Code* (O. Reg. 332/12)
- *Fire Code* (O. Reg. 213/07)
- *Ontario Electrical Safety Code* (OESC)
- *Fire Protection and Prevention Act*
- *Technical Standards and Safety Act*
- *Environmental Protection Act*
- *Aggregate Resources Act*
- Municipal by-laws
- Canadian Standards Association (CSA) Z-462: *Workplace electrical safety*; Z-432-04: *Safeguarding of machinery*; Z-460-13: *Lockout: Control of hazardous energy*
- *The rigger's pocket guide* (V010)
- *Five-point safety system, a pocket guide*

Section 7: More IHSA resources

Safe work practices for the aggregates industry (M075)

This booklet provides aggregates workers with guidelines for performing their work safely. All personnel should read, understand, and use these rules in their everyday work.

The pocket lockout guide (B011)

This pocket-sized booklet reviews the six steps to lockout:

1. Identify all energy sources.
2. Neutralize energy sources.
3. Lock and tag.
4. Verify zero-energy.
5. Complete work, reinstall safety devices, and remove isolation devices.
6. Start up.

The booklet includes relevant legislation, various situations, and equipment workers may encounter when locking-out energy in their workplace.

Construction health and safety manual (M029)

Heat stress can be a serious health hazard for workers, whether they are exposed to the summer sun in surface operations or heat in deep mines year-round.

Chapter 6 of IHSA's *Construction health and safety manual* focuses on heat stress, including risk factors and controls.

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Appendix A**Pre-operational checklists**

The following are sample checklists. Companies must adapt and adjust the checklist to reflect their own equipment. When creating a checklist, consultation should take place with the equipment manufacturer, the joint health and safety committee, technical experts, and operating personnel.

Date: _____

Operator: _____

1. Before start up

- Check the condition of the generator trailer and entrance for decay or instability.
- Check that the ground plate or electrode are covered with earth (i.e., not exposed) and the ground cable is secured.
- Check interior and exterior lighting.
- Examine the ground wires for continuity from the electrical distribution panel and from the generator to the ground electrode.
- Ensure each electrical panel and switch is identified with a label.
- Ensure all power cables are properly protected and secured and have not experienced any damage (cables should be anchored/strapped within 300 millimetres of a cable connection or entrance).

- Ensure the proper fire extinguisher(s) is present.
- If applicable, check condition of fire suppression nozzles, actuators, and storage tanks.
- Check for availability of spill containment kits/absorbent material.
- Check installation of all signage, generator plaques, and labels.
- Ensure the generator lockout is complete before mechanical equipment is checked.
- Check engine and generator anchor bolts.
- Check battery connections, lockable master switch, and starter cables.
- Check air intake filter systems for damage and condition of filter.
- Check the level and condition of the crankcase engine oil.
- Check the coolant level, radiator cap, and reservoir (check on cold engine only).
- Check the coolant system, fans, accessory belts, radiator, hoses, and fan guard.
- Grease all prescribed fittings or couplings.
- Check fuel lines and fuel filter.
- Check condition of the turbo charger and exhaust.
- Check and record fuel levels: _____ litres
- Record the hours from the hour meter: _____ hours

2. After start up

- Record instrument readings, frequency, voltage, load current as prescribed:
hertz _____
volts _____
amps _____
- Check for fluid leaks: fuel, coolant, engine oil.
- Check exhaust system for leaks and loose shields.
- If inaccurate readings, excessive noises, or any unusual activity occurs, the engine should be shut down, locked out, and the occurrence should be reported to a supervisor.

3. Periodic checks during operation

- Every hour or as prescribed, repeat the steps in Appendix A, Section 2.

4. Monthly inspections (or as prescribed by the manufacturer)

- Clean machine and radiator core (protect electric components).
- Inspect entire frame and engine mounts for cracks.
- Check for loose bolts, radiator, fan mounts, starter motor, generator shrouds, coupling guards.
- Change engine oil and filter (as per manufacturer's recommendations).
- Check coolant for alkaline pH balance and appropriate freezing point.
- Replace water separator, fuel filters, and air filters.
- Check vents, tank signage, and condition of fuel tanks and lines.
- Check for worn coupling(s) to the generator.
- Check for deterioration of electrical switches and wire insulation.

- Check to ensure electrical schematics are accurate.
 - Check to ensure operator and service manuals are available.
 - Record all maintenance in the log book.
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Mobile diesel generating plants are frequently used in aggregate operations. This booklet outlines the hazards associated with mobile diesel generating plants and how worksites can take steps to eliminate and control these hazards. Topics include considerations for set up, training, operation, fuel storage, noise control as well as emergency plans. Generic samples of pre-operational checklists are included as well as list of applicable legislation and regulations.

Upon direction of IHSA's Mining and Aggregates Working Group, this pocketbook was developed for use in Ontario's aggregate industry.