BCCSA
BC Construction Safety Alliance

CARBON MONOXIDE

A Guide to Developing an Exposure Control Plan

BCCSA
BC Construction Safety Alliance

TABLE OF CONTENTS

Note: Sections surrounded by blue boxes like this one are for background information to assist you with developing your ECP. **Do not copy them to the ECP**.

BCCSA
BC Construction Safety Alliance

BACKGROUND

This guide was developed by the BC Construction Safety Alliance (BCCSA). The BCCSA is a not-for-profit association that provides services to more than 52,000 construction companies employing more than 220,000 workers. As a safety association recognized by WorkSafeBC, the BCCSA promotes workplace health and safety in compliance with WorkSafeBC regulations and guidelines.

Carbon monoxide exposure is a potential concern at construction worksites. This guide was developed to assist construction employers in proactively managing carbon monoxide exposure at work.

Note that this guide focuses specifically on carbon monoxide exposure as a result of combustion engine exhaust; there may be other sources of carbon monoxide (e.g., from wildfire smoke). This guide also does not address the additional requirements of work in a confined space or a trench.

Sections of the *Workers Compensation Act* (WCA) that may apply to carbon monoxide exposure include the following:

WCA 21 **General duties of employers**
WCA 22 **General duties of workers**
WCA 23 **General duties of supervisors**

Sections of the Occupational Health and Safety Regulation (OHSR) that may apply to carbon monoxide exposure include the following:

Part 4, Emergency preparedness and response
Part 5, Controlling exposure
Part 5, Ventilation
Part 5, Internal combustion engines
Part 8, Respirators

INSTRUCTIONS FOR USE

This document provides guidance for creating an Exposure Control Plan (ECP) that meets the requirements of **Section 5.54** of the Occupational Health and Safety Regulation (OHSR).

Some sections may be copied directly into an ECP with little modification, while other sections should be modified to reflect individual companies and the work they perform.

ECPs should cover the specific work performed, and not include controls for work a company does not perform.

The following elements must be included in your ECP:

- A statement of purpose and responsibilities
- Risk identification, assessment, and control
- Education and training
- Written work procedures (when required)
- Hygiene facilities and decontamination procedures (when required)
- Health monitoring (when required)
- Documentation and annual review (when required)

Please refer to Appendix A which provides an outline for the ECP and the elements to include. This consists of the seven elements outlined above, as well as additional sections from this guide.

Remember: The ECP must be specific to each company and its work. It must stand on its own.

COMPANY INFORMATION

Complete this section and copy to the ECP.

Company Contact Information

- [Name]
- [Address]
- [Contact information — names and phone numbers, at a minimum include Prime Contractor and company completing work]

Worksite Information

- [Project name]
- [Address]

PURPOSE

Copy and paste this section to the ECP – add information about specific exposure scenario, if applicable.

Companies have a duty to protect their workers from exposure to carbon monoxide during construction activities. Effective controls are available to protect workers from exposure.

A combination of control measures is required to achieve this objective. The company commits to being diligent in its efforts to select the most effective control technologies available, and to ensure the best practices, as described in this Exposure Control Plan (ECP), are followed at its worksite(s).

The protective measures and work procedures established will protect not only the company's workers, but also other on-site workers not involved in these operations.

RESPONSIBILITIES - INCLUDING WORKSAFEBC EXPECTATIONS

Copy and paste this section to the ECP – delete any sections that do not apply to your work.

Refer to Workers Compensation Act Part 2, Division 4, Section 24 and OHSR 20 for full details of the required roles and responsibilities.

Coordination at Multiple-Employer Workplaces

In this section:

"Multiple-Employer Workplace" means a workplace where workers of two or more employers are working at the same time.

"Prime Contractor" means, in relation to a multiple-employer workplace:

- The directing contractor, employer or other person who enters into a written agreement with the owner of that workplace to be the Prime Contractor for the purpose of this part,

or

- If there's no agreement, the owner of the workplace is considered the "Prime Contractor."

Prime Contractor

The Prime Contractor of a multiple-employer workplace is responsible for the following:

- Coordinating the activities relating to occupational health and safety of employers, workers, and other persons at the workplace.
- Doing everything reasonably practicable to establish and maintain a system or process that ensures compliance with the occupational health and safety provisions and the regulations in respect of the workplace.

Each employer of workers at a multiple-employer workplace must provide the Prime Contractor with the name of the person the employer has designated to supervise the employer's workers at that workplace.

Owner

Some worksites are private homes. The owner is considered the "Prime Contractor" until a work authorization is signed naming the contractor as Prime.

The owner of a workplace is responsible for the following:

- Providing and maintaining the owner's land and premises being used as a workplace in a manner that ensures the health and safety of workers and other persons at, or near the workplace.
- Giving the employer or Prime Contractor at the workplace the information known to the owner that is necessary to identify, eliminate, or control hazards to the health and safety of persons at the workplace.
- Complying with the occupational health and safety provisions, the regulations, and any applicable orders.

NOTE: *The owner may have additional obligations under Part 6 and Part 20 of the OHSR, including providing the employer or Prime Contractor with a copy of the hazardous material survey for the building.*

Employer

The employer is responsible for the following (specific to carbon monoxide exposure):

- Identifying and assessing work procedures that might lead to worker exposure to carbon monoxide.
- Controlling carbon monoxide exposure to levels that are below the occupational exposure limits referenced in the Occupational Health and Safety Regulation.
- Ensuring supervisors and workers are educated in the hazards of carbon monoxide exposure and trained to work safely under carbon monoxide exposure.
- Ensuring that internal combustion engine operated equipment is used in accordance with the Occupational Health and Safety Regulation.
- Ensuring the materials (for example, tools, equipment, chemicals, personal protective equipment [PPE], and other resources such as worker training) required to fully implement and maintain this ECP are readily available when required.
- Conducting a periodic review (at least annually) of the effectiveness of the ECP. This includes a review of available control technologies to ensure these are selected and used when practical
- Ensuring workers follow the requirements of the Occupational Health and Safety Regulation and the *Workers Compensation Act*.

- Ensuring workers follow the requirements of the Occupational Health and Safety Regulation and the *Workers Compensation Act*.
- Maintaining records of training, fit tests, crew talks, and inspections.
- Investigating all near misses and exposure incidents and reporting these to WorkSafeBC.
- Coordinating work with clients and other employers to ensure a safe work environment, including the following:
    - » Inform all subcontractors of the specific hazards on the worksite.
        - Site Safety Assessment form
        - Hazardous materials survey, if applicable
    - » Review subcontractor's scope of work.
    - » Review subcontractor's safe work procedures.
    - » Ensure all subcontractors have the proper PPE.

Supervisor

Supervisors are responsible for the following:

- Verifying workers have received adequate instruction on the hazards associated with carbon monoxide.
- Ensuring proper selection and implementation of appropriate control measures.
- Properly fit-testing workers using supplied-air respirators (if used), including temporary workers (temps), and recording results.
- Directing work to ensure the risk to workers is minimized and adequately controlled.
- Coordinating with other employers and clients to ensure a safe work environment.
- Ensuring all subcontractors follow proper safe work procedures.
- Ensuring materials (for example, tools, equipment, PPE, and other resources such as worker training required to fully implement and maintain this ECP) are readily available when required.
- Ensuring all required tools, equipment, chemicals, and PPE are used as required by the ECP.
- Correcting unsafe acts and conditions immediately.

Workers

Workers are responsible for the following:

- Attending educational sessions provided by the employer.
- Using the assigned PPE in an effective manner.
- Following established work procedures.
- Reporting any unsafe acts or conditions to the supervisor.
- Knowing how to report exposure incidents.
- Reporting any exposure incidents or signs/symptoms of illness related to carbon monoxide exposure to the employer or supervisor.
- Seeking first aid attention promptly if displaying any signs or symptoms of illness, such as nausea, shortness of breath, dizziness, or drowsiness.
- Refusing unsafe work.

BCCSA
BC Construction Safety Alliance

Joint Occupational Health and Safety Committee

At smaller worksites without a Joint Occupational Health and Safety Committee, the worker health and safety representative would have these responsibilities

The Joint Occupational Health and Safety Committee is responsible for:

- Consulting with management and workers regarding the effectiveness of this ECP.
- Consulting with affected workers regarding identified health and safety issues not covered by this ECP.
- Providing recommendations regarding any additional worker health and safety training that might be required.
- Participating in accident/incident investigations.
- Assisting in the annual review of this ECP.

RISK IDENTIFICATION, ASSESSMENT AND CONTROL

The hazards posed by carbon monoxide are substantial. It is strongly recommended that the hazard be eliminated by replacing combustion engine-powered sources with electric alternatives whenever possible. Aside from generating carbon monoxide, combustion engines often also produce hazardous levels of noise, particulate matter and nitrogen oxides.

The exposure risks of carbon monoxide depend on the airborne concentration and the exposure duration. The airborne concentration of carbon monoxide is affected by:

- The rate of generation at the source: the higher the rate of carbon monoxide generation, the higher the concentration.
- The ventilation and airflow of the surrounding space: ventilating the space to introduce clean air and removing air from the source area will decrease the concentration. Increasing the number of outdoor air changes per hour in a space will reduce the levels of carbon monoxide in the air.
- The environment around the source and whether it is enclosed: carbon monoxide concentrations increase in enclosed or partially enclosed spaces as the airflow is often too low to sufficiently remove carbon monoxide from the space. Carbon monoxide can accumulate in low-lying areas (for example, pits and trenches).

Enclosed spaces include, but are not limited to, indoor spaces such as residential homes, commercial buildings, parkades, basements, attics, and vehicle cabs, as well as partially completed building structures, temporary enclosures, and temporary containments.

Case studies (e.g., as described by Fairfax), field sampling (as performed by Hafildson et al.), and modelling (as described by Tharr) have consistently shown a very high likelihood of overexposure when combustion engines are used in enclosed spaces. Standard recommendations for controls often state that the space must be "well-ventilated". However, modelling previously done by the National Institute of Occupational Safety and Health (Earnest et al.) suggests that a very high number of air changes per hour (e.g., 120) would be required to prevent a breach of exposure limits.

The probability of overexposure when working with combustion-engine powered equipment in enclosed spaces is very high and in many cases, it is unlikely that workplaces can achieve sufficient air change rates to reduce exposure to safe levels. Safe work planning should relocate the associated tasks outdoors whenever practicable.

Combustion engine powered equipment should not be used near building ventilation intake vents or occupied spaces. Use of other controls should be carefully considered when there is inadequate ventilation in enclosed spaces.

Air purifying respirators cannot be used to control exposure to carbon monoxide. If respirators must be used, air-supplied respirators are required.

A walkthrough survey must be conducted by a qualified person at each worksite to identify equipment and work locations and conditions that could result in overexposure to carbon monoxide. If a potential for overexposure is identified, airborne concentrations of carbon monoxide may be estimated through previous airborne sampling or real-time monitoring sensors (direct reading instruments). Residential carbon monoxide sensors are not suitable for this purpose. Industrial carbon monoxide detectors can be purchased from health and safety suppliers. Carbon monoxide monitoring instruments must be calibrated and maintained in accordance with manufacturer instructions.

Real-time monitors can also be used to alert workers to hazardous conditions. Monitors should be equipped with alarms (i.e., visual or audible indicators) that are triggered when carbon monoxide levels exceed certain thresholds, which ideally can be user-programmed. These monitors may not be the same monitors that are used to factory settings may not match WorkSafeBC occupational exposure limits. Alarms should sound when levels reach 25 ppm. If possible, another alarm should sound when levels reach 100 ppm.

When selecting real-time monitoring sensors, the criteria that should be considered include, but are not limited to:

1. Physical characteristics: size, weight, interface, battery life.
2. Data processing: memory capacity, data display, software interface, alarms/indicators.
3. Instrument performance: operating conditions, calibration requirements, response time, accuracy.

Exposure Controls

What is an exposure control program?

An exposure control program consists of the necessary steps to protect workers from exposure to a hazardous substance and the procedures required to monitor exposure and health. Hazardous substances include biological, chemical, or physical agents that, by reason of their properties, are hazardous to the health or safety of persons exposed to them. A written workplace hazard control program should outline which methods are being used to control exposure and how these controls are monitored for effectiveness. Any hazardous situations identified should be corrected by someone qualified to do so.

- Under Part 1 (1.1) of the OSHR, Qualified “means being knowledgeable of the work, the hazards involved and the means to control the hazards, by reason of education, training, experience or a combination thereof

BCCSA
BC Construction Safety Alliance

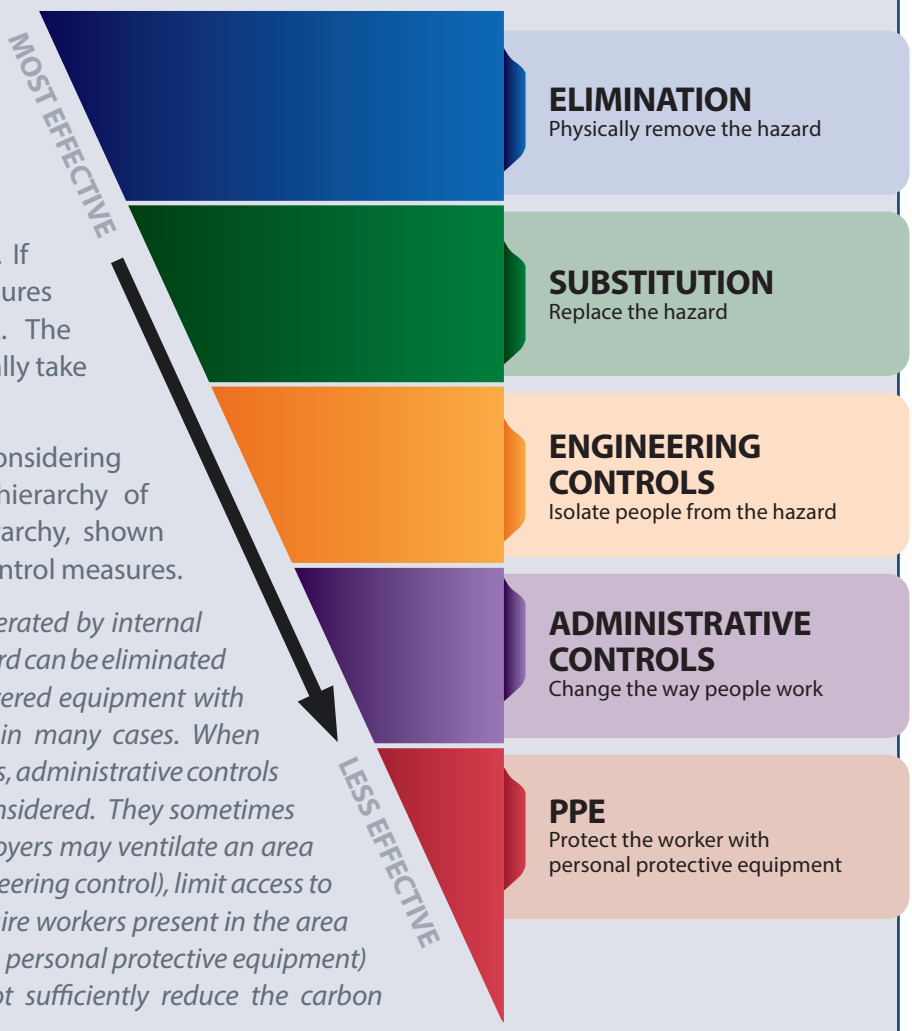
Hierarchy of controls

Following completion of a workplace risk assessment, any risks identified as high or moderate may require additional controls. Unsafe conditions must be controlled to an acceptable risk level.

The highest risk should be addressed first. If a risk cannot be eliminated, control measures must be implemented to minimize the risk. The hierarchy of controls can help to systematically take action to minimize risk.

A certain order should be followed when considering how to reduce risk. This is called the "hierarchy of controls." It's important to follow the hierarchy, shown below, rather than start with the simplest control measures.

Note: *Elimination of carbon monoxide generated by internal combustion engines is often possible. This hazard can be eliminated by replacing internal combustion engine powered equipment with electric alternatives. This is the best option in many cases. When elimination is not possible, engineering controls, administrative controls and personal protective equipment can be considered. They sometimes work best in combination. For example, employers may ventilate an area where combustion engines are used (i.e., engineering control), limit access to the area (i.e., administrative control), and require workers present in the area to wear supplied air respiratory protection (i.e., personal protective equipment) when there is a risk that ventilation will not sufficiently reduce the carbon monoxide concentrations.*



Background on Carbon Monoxide

Copy and paste this section to the ECP.

Carbon monoxide (abbreviated using its chemical formula "CO") is a colourless and odourless gas. Under normal circumstances, it cannot be detected by the human senses. Carbon monoxide is the byproduct of incomplete combustion. On construction sites, the main source of carbon monoxide is from the emissions produced by operating combustion engines in equipment and vehicles. These include:

- Generators
- Propane heaters
- Power trowels
- Power washers
- Heavy machinery
- Concrete and lift trucks
- Concrete cutting saws
- Propane and natural gas torches (e.g. Tiger Torches)

Carbon monoxide can accumulate in enclosed areas and pose a health hazard to exposed workers. Exposure can also reach unsafe levels outdoors when workers are working near or downwind of combustion engine-powered sources

Health Hazards

Copy and paste this section to the ECP.

Carbon monoxide is very hazardous and exposure occurs through inhalation. Carbon monoxide is a chemical asphyxiant; it deprives the body of oxygen by preventing oxygen from being absorbed into the blood when it is inhaled. This can be fatal.

The health effects of carbon monoxide exposure depend on its concentration. In enclosed spaces, the airborne concentration of carbon monoxide can increase. This can happen very quickly in poorly ventilated spaces.

Higher concentrations can cause:

- Loss of consciousness
- Coma
- Death

Lower concentrations can cause:

- Headaches
- Nausea
- Shortness of breath
- Dizziness
- Drowsiness
- Confusion

Carbon monoxide can also cause permanent damage to organs, including the brain and heart.

Exposure Limits

Copy and paste this section to the ECP.

The Occupational Health and Safety Regulation (OHSR) section 5.48 establishes exposure limits for a worker's exposure to hazardous substances. The employer must ensure that no worker is exposed to a substance that exceeds the eight-hour Time Weighted Average (TWA) or the 15 minute short-term exposure limit (STEL). The TWA limit and STEL for carbon monoxide are 25 ppm and 100 ppm, respectively.

A short-term exposure to high concentrations of carbon monoxide can cause sudden illness and death, which can result in an immediate emergency. The immediately dangerous to life and health (IDLH) value is the airborne concentration at which, if exceeded, a worker risks injury, death, or irreversible adverse health effects in the event of a failure of respiratory protection equipment. The ILDH for carbon monoxide levels is 1200 ppm.

Carbon monoxide also has a "reproductive toxin" notation in section 5.48 of the OHSR.

Reproductive toxins identified by the American Congress of Governmental Industrial Hygienists (ACGIH) in their annual publication Threshold Limit Values and Biological Exposure Indices. Their definition from the OSHR Guidelines, G 5.57 (1)(b) is quoted below:

"ACGIH reproductive toxins are substances described by the ACGIH as having the potential for causing adverse reproductive effects on female and male reproductive organs, tissues or cells, on fertility, on the embryo or fetus, and may result in developmental abnormalities, tumours, and adverse effects on newborns." , which indicates that it can cause adverse health effects on reproductive organs, tissues, cells, fertility, the embryo, or the fetus."

As a reproductive toxin, carbon monoxide is a designated substance under section 5.57 of the OHSR. It must be eliminated or replaced in the workplace, if practicable. In situations where carbon monoxide-generating equipment cannot be replaced, exposure to carbon monoxide must be reduced to levels that are As Low As Reasonably Achievable (ALARA).

BCCSA
BC Construction Safety Alliance

CONTROL METHODS FOR EXPOSURE TO CARBON MONOXIDE

Note: these control procedures are the "Written Work Procedures" required by the Regulation. Once you've identified the hazards of carbon monoxide exposure and have assessed the risks, appropriate control measures must be put in place. The following control options are examples of how to eliminate or reduce the risk of exposure to workers (unless air monitoring or your historical sampling data suggests otherwise).

Select the control strategy that will be implemented at your worksite below and copy and paste this section to the ECP. The following are examples. Each company will develop its own procedures.

- Elimination: replacing the combustion engine-powered source with one that does not generate carbon monoxide (e.g., electric-powered)
- Substitution: replacing the combustion engine with one that has lower emissions

MAKE/MODEL OF COMBUSTION ENGINE-POWERED EQUIPMENT	LOCATION AND USE	DATE SERVICED

The Occupational Health and Safety Regulation requires employers to select controls based on the following hierarchy:

Elimination and Substitution

Where possible work with combustion engine powered machinery will be eliminated or substituted with electric equipment.

Engineering controls:

- Equipment-specific local exhaust ventilation

MAKE/MODEL OF VENTILATION UNIT	LOCATION OF VENTILATION UNIT	VENTILATION EXHAUST LOCATION	DATE SERVICED

- Catalytic converter installation (to reduce tailpipe carbon monoxide emissions)
- General ventilation (e.g., parkade ventilation system)

  Add ventilation system diagram as an appendix to this ECP

LOCATION OF AIR INTAKE	VENTILATION SYSTEM CONTACT PERSON	AIR CHANGES PER HOUR

- Air movers/fans (to bring fresh air into the work area)

EQUIPMENT LOCATION	AIR INTAKE LOCATION

- Exhaust hoses and/or fans (to draw carbon monoxide emissions away from the work area). The exhaust location must be an open-air unoccupied location

EQUIPMENT LOCATION	EXHAUST LOCATION

Administrative controls:

- Where possible, work will be conducted outdoors rather than in enclosed spaces.
- Keep windows and doors open when working with combustion engine powered equipment.
- Workers will not work downwind of combustion engine exhaust.
- Perform regular inspection and preventative maintenance of combustion engines (to ensure optimal engine efficiency to reduce unnecessary emissions):

MAKE/MODEL	DATE SERVICED

- Use real-time carbon monoxide monitoring sensors. Alarms should sound when levels reach 25 ppm. If possible, another alarm should sound when levels reach 100 ppm.

MAKE/MODEL OF VENTILATION UNIT	LOCATION OF VENTILATION UNIT	VENTILATION EXHAUST LOCATION	DATE SERVICED

- Site specific evacuation procedures will be used when carbon monoxide monitoring sensor alarms sound.

  Include site-specific evacuation procedures as an appendix to this ECP

- Plan work to:
  - » Avoid engine idling
  - » Spread out work times (to allow for emissions to dilute and vent out)
  - » Position work so that emissions are not in the vicinity of other workers (including avoiding being upwind)

- Post warning signage to prevent workers and the public from entering areas where carbon monoxide exposure is possible.
- Enable shift-rotation to reduce full-shift exposure to carbon monoxide

Personal Protective Equipment (PPE):

Only air supplied respirators will be used when respiratory protection is required to work safely with combustion engine powered equipment

LOCATIONS AND TASKS FOR WHICH RESPIRATORS ARE REQUIRED	

Respirators

Copy and paste this section to the ECP.

- Workers will be fit tested for tight-fitting facepieces, where supplied. Fit testing must be conducted with other PPE that could impact the seal.
- If a worker wears a respirator that requires an effective face seal for proper functioning, the worker will be clean-shaven where the respirator seals with the face.
- Workers will inspect the respirator and conduct a seal check each time a respirator is donned.
- Only supplied air respirators will be used when working with carbon monoxide. Air-purifying respirators are not appropriate. These respirator systems and associated air supply will be maintained according to the manufacturer's instructions.
- Compressed breathing air must meet the requirements of CSA Standard CAN/CSA-7180.1-00 and must be tested at least annually in accordance with OSHR 8.37. The air must be depressurized and refilled if the cylinder has not been used for over one year.
- Respirators will be used, cleaned, and stored in accordance with the respirator program.

Other PPE and hygiene

Copy and paste this section to the ECP.

- Workers will wear other PPE (e.g., protective eyewear, gloves, hearing protection, safety footwear, hard hats, or high-visibility vests), as required.

Safe work planning

Copy and paste this section to the ECP.

- Inspect all equipment and tools to ensure they are in good working order.
- Use and maintain all tools and equipment as specified by the manufacturer.
- Workers will inspect their respirators before work begins, if used.

EDUCATION AND TRAINING

Copy and paste this section to the ECP.

- Training will be provided by the employer or the employer's designate.
- Attendance records, training dates, and training material will be documented and retained.
- Additional training or reference material will be made available to workers upon request,
- Training topics:
    - » Recognizing carbon monoxide hazards in the workplace
    - » Use of carbon monoxide real-time monitors and procedures to follow when warning alarms are activated
    - » Health hazards associated with carbon monoxide
    - » Evacuation procedures for carbon monoxide
    - » First aid measures for carbon monoxide exposure
    - » Hazard identification (Site Safety Assessment (SSA) form)
    - » Safe work practices used to protect workers
    - » Engineering controls
    - » PPE
    - » Housekeeping and storage of combustion engine-powered equipment
    - » Details of the exposure control plan for carbon monoxide
    - » Documentation

DOCUMENTATION AND ANNUAL REVIEW

Copy and paste this section to the ECP.

Exposure Monitoring

- When a qualified person has identified a risk of overexposure in a walkthrough survey, the employer will retain records of workplace exposure monitoring conducted to estimate carbon monoxide exposure levels associated with each location where internal combustion engine operated equipment is used.

Training records

- Complete training records for each employee upon completion of training. Keep these documents for the remainder of employment.
    - Dates of training sessions
    - Contents or summary of training sessions
    - Names and qualifications of persons conducting training
    - Names and job titles of all workers attending the training sessions

- The employer will maintain a record of:
  - » Fit test results and worker instruction
  - » Maintenance and repairs for each self-contained breathing apparatus and all air cylinders in accordance with the requirements of CSA Standard CAN.CSA-Z94.4-02, Selection Use and Care of Respirators.

Annual review

- The employer will review the Exposure Control Plan at least annually, and update as necessary in consultation with the Joint Occupational Health and Safety Committee or the Worker Health and Safety Representative.

REFERENCE MATERIAL

Earnest, G. S., Mickelsen, R. L., McCammon, J. B., & O'Brien, D. M. (1997). Carbon Monoxide Poisonings From Small, Gasoline-Powered, Internal Combustion Engines: Just What Is a "Well-ventilated Area"? American Industrial Hygiene Association Journal, 58(11), 787–791
https://doi.org/10.1080/15428119791012289

Fairfax, R. (2000). Carbon Monoxide Exposure from a Propane-Fired Concrete Cutter. Applied Occupational and Environmental Hygiene, 15(5), 400-401.
https://doi.org/10.1080/104732200301331

Haflidson, W. O., & Figueira, C. S. (1997). Carbon Monoxide Exposure of Concrete Finishers. Applied Occupational and Environmental Hygiene, 12(2), 126–131.
https://doi.org/10.1080/1047322X.1997.10389472

Health Canada. Carbon monoxide poisoning.
https://www.canada.ca/en/health-canada/services/air-quality/indoor-air-contaminants/keep-carbon-monoxide-out-your-home.html

Mccammon, J. B., Mckenzie, L. E., & Heinzman, M. (1996). Carbon Monoxide Poisoning Related to the Indoor Use of Propane-Fueled Forklifts in Colorado Workplaces. Applied Occupational and Environmental Hygiene, 11(3), 192–198.
https://doi.org/10.1080/1047322X.1996.10390604

Roberge, B. (1998). Evaluation and Control of Carbon Monoxide Exposure from Propane-Fueled Forklifts. Applied Occupational and Environmental Hygiene, 13(3), 183–191.
https://doi.org/10.1080/1047322X.1998.10390060

Roberge, B., & Goyer, N. (1993). Evaluation of Personal Carbon Monoxide Monitors. Applied Occupational and Environmental Hygiene, 8(4), 275–278.
https://doi.org/10.1080/1047322X.1993.10389206

Tharr, D. (1995). Case Studies: Simulated Carbon Monoxide Exposure in an Enclosed Structure from a Gasoline-Powered Pressure Washer. Applied Occupational and Environmental Hygiene, 10(7), 581–584
https://doi.org/10.1080/1047322X.1995.10387647

BCCSA
BC Construction Safety Alliance

APPENDIX A
TEMPLATE FOR CARBON MONOXIDE EXPOSURE CONTROL PLAN (ECP)

COMPANY INFORMATION	
COMPANY NAME	
ADDRESS	

CONTACT INFORMATION *(at minimum include Prime Contractor and company completing work)*					
NAME		**TITLE**		**TELEPHONE #**	
NAME		**TITLE**		**TELEPHONE #**	

WORKSITE INFORMATION	
PROJECT NAME	
ADDRESS	

PURPOSE

Copy and paste section – add info about specific exposure scenario, if applicable.

RESPONSIBILITIES - INCLUDING WORKSAFEBC EXPECTATIONS

Copy and paste this section to the ECP – delete any sections that do not apply to your work.

- Coordination at multiple-employer workplaces
- Owner
- Employer
- Supervisor
- Workers
- Joint Occupational Health and Safety Committee

RISK IDENTIFICATION, ASSESSMENT AND CONTROL

- Background on Carbon Monoxide *(copy and paste section)*
- Health Hazards *(copy and paste section)*
- Exposure Limits *(copy and paste section)*
- *Identify make/model, location, and maintenance records for internal combustion engine operated equipment*
- *Identify jobs and workers that are at risk of carbon monoxide exposure.*
- *Report measured carbon monoxide exposure levels associated with jobs & equipment from exposure monitoring with direct reading carbon monoxide monitor*

CONTROL METHODS FOR EXPOSURE TO CARBON MONOXIDE

(companies to copy and paste the work activities and associated controls that they are doing at the worksite)

These control procedures are the "Written Work Procedures" required by the Regulation

- Control Methods for Exposure to Carbon Monoxide
- Identify make/model, location, calibration records, and alarm settings for carbon monoxide alarms
- Respirators
- Other PPE and Hygiene
- Safe work planning

EDUCATION AND TRAINING

(copy and paste section)

DOCUMENTATION AND ANNUAL REVIEW

(copy and paste section)