Carbon Monoxide – Technical Information – Health Hazards

Why is Carbon Monoxide a priority chemical?	The NSW Work Health and Safety (WHS) Roadmap states a target of a 50% reduction in serious injuries and illnesses by 2022, including a reduction in exposures to the priority hazardous chemicals and materials by 30%. An initial list of 100 priority chemicals was developed based on national and international sources. This list was further refined using the following criteria: toxicity rating, exposure potential, estimated quantities used and potential number of workers using these chemicals. Carbon Monoxide ranked fifth based on these criteria. Carbon monoxide is an odourless gas produced as a result of incomplete combustion processes. Exposure to carbon monoxide results in a deficiency of oxygen reaching the body, causing tissue damage to a range of organs including the brain and heart. Appropriate controls for the emission, use, handling and storage of carbon monoxide gas will reduce the risk of hazardous exposures and illness in the workplace. These include, proper ventilation during combustion activities and regular maintenance of plant that produces carbon monoxide.
Sources of exposure	Carbon monoxide is released as a combustion product during the burning of compounds containing carbon such as fossil fuels, charcoal, wood and plastics. It is produced during the running of some plant (such as generators), vehicles (including fork lifts), gas appliances (such as stoves, space heaters, water heaters, furnaces) and from the burning of charcoal (including coal barbeques/pits), plastics and wood. Some of the industry sectors most at risk of exposure to carbon monoxide include cooks and bakers, blast furnace and boiler room workers, diesel engine operators, garage mechanics, brewery workers, pulp and paper workers, fire fighters, glass manufacturers and coal miners. Any work conducted in enclosed or restricted spaces poses a higher risk of exposure to carbon monoxide as the chemical will accumulate in the area. Work in such spaces as trenches, garages and plant rooms should only be conducted after assessing the risk of carbon monoxide exposure. Use of plant powered by combustion engines should be minimised in such restricted areas where ventilation is not adequate. Exposure to carbon monoxide is through inhalation. Carbon monoxide is then carried through the body in the blood. As carbon monoxide is taken up in the blood more easily than oxygen, it reduces the amount of oxygen available in the blood stream and causes oxygen depletion in the tissues.
Health effects	The presence of symptoms from carbon monoxide exposure is related to the length and extent of exposure, in addition to the health and overall condition of the worker exposed. The most affected organs are those that use the highest levels of oxygen, such as the brain and heart.

	The most commonly reported symptoms of acute (short term) exposure to high levels of carbon monoxide include: • headaches, dizziness, nausea • metallic taste • darkened vision • muscular weakness, incoordination and impaired judgement • numbed reflexes and reaction times • sleepiness, collapse and unconsciousness • increased pulse and breathing • convulsions • heart attack or stroke When a worker is removed from the carbon monoxide–rich atmosphere, the majority will have a complete recovery. However, as prolonged exposures result in impaired judgement and reflexes, workers conducting activities while experiencing carbon monoxide exposure symptoms may be at higher risk of other workplace injuries. Acute exposures to high levels of carbon monoxide may result in death, even after a single exposure. Cause of death is through oxygen depletion to vital organs. Underlying medical conditions may increase the chances of serious illness or injury from carbon monoxide exposure. Delayed neurological effects may also be seen days to months after exposure, characterised by personality and behavioural changes, dementia, depression and muscular shakes. The majority of delayed neurological symptoms normally go away within a year of onset. Ongoing chronic exposure to high levels of carbon monoxide may result in: • recurring headaches • irritability • insomnia • foetal changes in pregnant women (including miscarriage) • personality changes • decreased exercise tolerance • impaired judgement
Labelling and Safety Data Sheets	Manufacturers and importers of chemicals need to ensure that hazardous chemicals are labelled and that safety data sheets are prepared and provided (cl.330 and 335 Work Health and Safety WHS Regulation 2017). Suppliers of a hazardous chemical to a workplace must provide current safety data sheets (cl. 339). Persons conducting a business or undertaking (PCBUs) must correctly label hazardous chemicals used, handled or stored at the workplace, including materials, containers and pipework (cl. 341,342,343). The PCBU must also

	obtain a copy of the safety data sheet and make it readily accessible to workers involved in using, handling or storing the hazardous chemical at the workplace (cl. 344)
Workplace exposure standards and air monitoring – WHS Regulation 2017	A business must ensure that a worker is not exposed to airborne chemicals above the workplace exposure standard. Carbon monoxide has a workplace exposure standard of 30 ppm averaged over 8 hours. However, short term exposures above this are permittable to 60 ppm where total exposure at this level is less than 60 minutes in an 8-hour shift; 100 ppm where total exposure at this level is less than 30 minutes in an 8-hour shift; and 200 ppm where total exposure at this level is less than 15 minutes in an 8-hour shift. Short-term exposures should never exceed 400 ppm for any duration. Risks to health and safety from exposures to hazardous chemicals must, so far as is reasonably practicable, be eliminated (cl. 35). Where elimination is not practicable, PCBUs must ensure that no person at the workplace is exposed to a substance above its exposure standard (cl. 49) and must reduce exposures so far as is reasonably practicable. Where it is uncertain (on reasonable grounds) as to whether or not the exposure standard is exceeded, PCBUs must undertake exposure (air) monitoring for substances with an exposure standard (cl. 50). Adjustments to the exposure standards are made for extended work shifts, taking into account the longer daily exposure. The air monitoring results must be readily available to workers and records of results must be kept for 30 years (cl. 50). A PCBU must review control measures (cl. 352): • when the workplace exposure standard for a hazardous chemical has been exceeded • if a health monitoring report contains advice that a worker may have developed an illness/disease, or a recommendation for remedial measures including whether a worker can continue to work with the hazardous chemical • the SDS for the hazardous chemical changes

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Health monitoring – WHS Regulation 2017	PCBUs are required to provide health monitoring to workers if there is a significant risk to the worker's health because of exposure to a hazardous chemical listed in schedule 14 of the WHS Regulation 2017. Carbon Monoxide is not listed in Schedule 14, however there remains a requirement to provide health monitoring if there is a significant risk to the worker, and there are valid techniques to detect effects on workers' health (cl. 368). In relation to health monitoring, PCBU (cl. 369 to 378) duties include: • informing workers of the requirements for health monitoring • using a registered medical practitioner with experience in health monitoring • providing details to the medical practitioner • obtaining a copy of the health monitoring report • providing a copy of the health monitoring report to SafeWork NSW if the worker has developed a disease or injury and/or the report contains any recommendations on remedial measures at the workplace • keeping records of health monitoring for 30 years
Control Measures	Where risks to health and safety cannot be eliminated the hierarchy of controls must be applied in accordance with cl. 36 of the WHS Regulation 2017 to minimise risks. For instance: • where practicable, substitute carbon monoxide–emitting plant with electrically powered plant • ensure adequate engineering controls including adequate ventilation and/or isolation of the carbon monoxide source from the worker are implemented • install gas detectors on plant, in work areas, or as personal alarmed monitors, where carbon monoxide exposure may be a risk • conduct regular maintenance on plant that are a source of carbon monoxide gas • follow manufacturers specifications as to the maintenance and use of plant • where required, use well maintained and appropriate supplied air respirator (SCBA) • instruct and train workers in the correct fitting, use and maintenance of SCBA Ensure that instructions and controls outlined in safety data sheets, manufacturers specifications and product labels are followed and that workers are provided with suitable information, training, instruction and supervision when using, storing and handling hazardous chemicals (cl. 39 and 379).
Where to find more information	Safety Data Sheets NSW Codes of Practice:

	a) Managing the Risks of Hazardous Chemicals in the Workplace b) Preparation of Safety Data Sheets for Hazardous Chemicals c) Labelling of Workplace Hazardous Chemicals Safe Work Australia Guidance Material: a) Workplace Exposure Standards for Airborne Contaminants b) Guidance on the Interpretation of Workplace Exposure Standards for Airborne Contaminants c) Health Monitoring for Exposure to Hazardous Chemicals – Guide for persons conducting a business or undertaking d) Health Monitoring for Exposure to Hazardous Chemicals – Guide for workers Australian Standards a) AS/NZS 1715;2009 Selection, Use and Maintenance of Respiratory Protection In the event of suspected exposure, call the Poisons Information Centre on 131 126.