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CARBON MONOXIDE - ITS EFFECTS ON HUMAN BEINGS, ITS OCCURRENCE AND MONITORING IN BUILDING NO. 2 OF THE CANMET BELLS CORNERS COMPLEX.

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CARBON MONOXIDE - ITS EFFECTS ON HUMAN BEINGS, ITS OCCURRENCE AND MONITORING IN BUILDING NO. 2 OF THE CANMET BELLS CORNERS COMPLEX

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W.R. Leeder* and J.T. Price*

REPORT OBJECTIVES

The objectives of this report are to review the dangers of CO and to outline its occurrence and monitoring in Building No. 2 of the CANMET Bells Corners Complex. This report was prepared at the request of the Building No. 2 Safety Committee who discussed possible CO hazards in Building No. 2 at their November 17, 1975 meeting.

THE EFFECT OF CO ON HUMAN BEINGS

Carbon monoxide has an affinity for haemoglobin 300 times that of oxygen. CO renders haemoglobin incapable of carrying oxygen to the body and can asphyxiate the body (suffocation). Carbon monoxide is slowly eliminated from the body when air, free from CO, is inhaled. Over half the CO is eliminated in the first hour if the exposure has been moderate[1,2].

Some appreciation of the effect of CO concentration and exposure time with the level of human activity is summarized in Figure 1[3]. For example at work a CO concentration of 400 to 500 ppm in air can be inhaled without appreciable effect for 1 hour. An hour's exposure to 600 to 700 ppm will cause barely appreciable effects and a similar exposure to 1000 to 1200 ppm is dangerous; concentrations of 4000 ppm and over are fatal in less than an hour. Repeated exposure to low concentrations (100 ppm) is generally believed to cause no signs of poisoning or permanent damage. However, long and repeated exposures (> 100 ppm) may cause long lasting brain and nervous damage.

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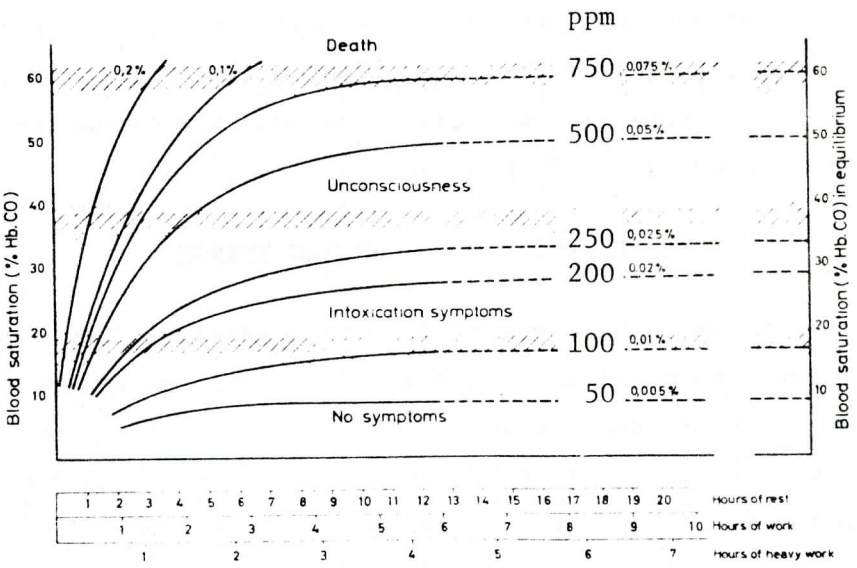
FIGURE 1

Diagram of the Effects of Carbon Monoxide on Human Beings (3)



CO PRODUCTION USE AND MONITORING IN BUILDING NO. 2

CO is used or produced in several locations in Building No. 2 and represents a potential hazard. A summary of the affected areas, equipment, estimated hazard level and CO monitoring system are outlined in Table 1. Details of several of the potential hazard areas will be discussed in the remaining part of this section.

TABLE 1

CO Source	Room	Hazard Potential	Method of CO Monitoring
Laboratory Experiments	149 (Lab)	Low (Low Flow Rates)	Continuous Dräger 2315E Model AK CO-Meter
Rist (Counter-Current Reactor)	119 (Pilot Plant)	Low (Low Flow Rates)	Continuous Dräger 2315E Model AK CO-Meter (sampled from 2 areas)
ISO Equipment	119 (Pilot Plant)	Medium (Higher Flow Rates)	-as above-
6" Cupola	125 (Pilot Plant)	Medium (Large production of CO)	Non-continuous; Dräger Detector Tube with hand pump
18" Cupola	125 (Pilot Plant)	High (Extremely large production of CO)	Non-continuous, as above.
Coke Ovens	123 (Pilot Plant)	Unknown probably medium	None to date
Fork Lift Truck	(Pilot Plant Areas)	Medium to high (large production of CO)	None to date (sets off CO alarms in 119 if rotoclones off)

Room 149

Several experiments in this laboratory involve the use or generation of carbon monoxide. The reduction of iron oxides and chromites involve single pellets and requires small flows of carbon monoxide (0.025-0.100 1/min). The reactivity of coke with carbon dioxide generates up to 0.8 1/min of carbon monoxide. The off-gases from these experiments are vented to a fume hood. The carbon monoxide levels in the room are monitored by a continuous Dräger

2315E Model AK CO-Meter and is set so an alarm will ring when the CO level in the room exceeds 50 ppm. Under these conditions this laboratory is considered safe.

Room 119

The experiments performed in this pilot-plant area are on a pilot-plant scale and require greater flows of carbon monoxide. The room is equipped with a continuous Dräger 2315E Model AK CO-Meter which continuously monitors the CO level in both the pilot-plant area and enclosed control room. It has been set to ring an alarm when the CO level is in excess of 50 ppm. The ISO test procedures for the reduction and physical testing of iron ores require flows of carbon monoxide from 8 to 33 1/min. These tests require the use of carbon monoxide for periods up to two hours.

The counter-current reactor involves the reduction of iron oxide pellets by carbon monoxide. These experiments require two to four 1/min of carbon monoxide and extend for periods of about six hours. A typical measurement of the CO level (using a Dräger tube) in the control room indicated CO levels of 2 ppm. The equipment is electronically connected to the Dräger system so that if the CO level exceeds 50 ppm a solenoid valve shuts off the carbon monoxide at the source.

Except for severe CO hazards of a very localized nature (caused by unsafe operating practices) this room can be considered safe under normal operating conditions.

Room 125

Two cupolas (18-inch and 6-inch hearth) generate carbon monoxide in their off-gases. The off-gas contains about 28% carbon monoxide which is burned to carbon dioxide before being removed by a rotoclone. During operation the CO levels are monitored periodically using Dräger tubes capable of measuring CO levels up to 700 ppm. During operation of the 6-inch cupola the CO level was 30 ppm in the atmosphere a few feet from the cupola. During the initial run of the 18-inch cupola the exhausting system proved to be inadequate and consequently high levels of CO were detected at the charging door at the top of the cupola. The cupola exhaust system is presently being reconstructed to remove this hazard.

Room 123

Two technical-scale coke ovens, a 30-pound coke oven and the sole-heated oven are potential sources of CO in Room 123. Presently, off gases from these facilities are vented to the outside of the building. In the case of the coke oven, the oven off-gases are combusted to remove the significant quantities of CO that are produced in the ovens. However, inadequate sealing of the ovens, poor combustion and/or operating practices could cause a potential CO hazard in Room 123. No detection system presently exists in this area and the authors are unaware of CO levels during normal coke oven operation.

REFERENCES

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