



## INTEROFFICE MEMORANDUM Oregon Occupational Safety & Health Division

*Reference IM-94-11, issued March 21, 1991.*

**DATE:** May 14, 2015  
**TO:** All Oregon OSHA  
**FROM:** Peggy Munsell, Standards and Appeals manager  
**SUBJECT:** Carbon Monoxide Gas Formation in Closed Dairy Equipment

### AFFECTED

**CODES:** *Division 4/J – 437-04-1250 and Division 2/J – 437-002-0146*

**PURPOSE:** To inform compliance officers of carbon monoxide (CO) build up in closed dairy equipment during certain cleaning operations.

### BACKGROUND:

Federal OSHA reported that a death occurred during the cleaning of closed dairy equipment, which was attributed to the formation of CO from the reaction of certain reducing sugars and oxygen in the presence of hydroxide ions. Alkaline solutions used for cleaning (such as sodium hydroxide, sodium orthosilicate, and sodium metasilicate at concentrations of 5% and higher), when heated to 1562°F (850°C) and higher, may react with reducing sugars (2% and higher solutions of fructose, galactose, arabinose, levulose, lactose maltose, as well as dry whey solids) in the presence of air to produce CO.

These reactions will occur at lower temperatures, but they are slower. This reaction does not occur in the presence of sucrose. Furthermore, no CO is formed with lactose or whey when other agents, such as sodium hypochlorite, calcium hypochlorite, phosphoric acid, or nitric acid are used in place of the alkaline solutions.

**ACTION:** While it is **rarely** necessary to enter enclosed or semi-enclosed equipment, compliance officers should carefully evaluate this situation as with any confined space entry. Before entry, take these minimum precautions:

- Ventilate the equipment interior.
- Measure equipment atmospheres for carbon monoxide, carbon dioxide, and oxygen.
- Follow other required and customary tank and equipment entry and occupancy procedures designed to ensure the safety of personnel involved (see Chapter 3, Section III of the FIRM).

Similar precautions should be taken in any operation involving potential entry into enclosed or semi-enclosed equipment that has contained reducing sugars (or possibly other carbohydrates) and any alkaline solution.