PROGRAM DIRECTIVE

Program Directive **A-203**
Issued May 30, 1980
Revised September 14, 2000

SUBJECT: Wood Preservatives Containing Chlorinated Phenols

AFFECTED CODES/ DIRECTIVES: Division 2/I, Personal Protective Equipment, 437-002-0161(5) Safety Showers and Eyewashes, Division 2/Z, OAR 437-002-0382, Air Contaminants, Division 2/Z, 1910.1200, Hazard Communications

PURPOSE: This directive provides information and guidelines for evaluating personal protective measures and safe handling practices for employees exposed to wood preservatives containing chlorinated phenols.

BACKGROUND: Chlorinated phenols are chemical derivatives of phenol which contain from one to five chlorine atoms. Pentachlorophenol, tetrachlorophenol, and trichlorophenol have been used as fungicides and herbicides since the 1930's.

Pentachlorophenol (which typically contains 5 - 10 percent tetrachlorophenol as a contaminant) is in worldwide use as a wood preservative to control mold, mildew, and termites. Tetrachlorophenol is also commonly used in the Pacific Northwest and has, in many cases, replaced pentachlorophenol.

A. Health Effects

1. Mode of Exposure: Acute toxicity of chlorophenols is influenced by the route of exposure and the dose. They are rapidly absorbed through the skin and the gastrointestinal tract. Inhalation of fumes and aerosols can produce systemic toxicity as well as local irritation. Toxicity is also influenced by the formulation or solvents used as a carrier. Oil based formulations are more rapidly absorbed through the skin or gastrointestinal tract than water based formulations.

   Inhalation and skin absorption are the most likely workplace exposure modes. Toxicity per applied dose is

highest for exposure by inhalation. Significant exposures to airborne chlorophenols can result from spraying operations (for lumber sapstain control), and from wood dust due to handling or working with treated lumber. Because oral exposure from contaminated hands may also be an important route for chemical absorption, users are warned against eating and smoking at work stations.

2. Acute toxicity: Symptoms include weakness, loss of appetite, profuse sweating, difficult or labored breathing, fever, dizziness, nausea, vomiting, and chest pain. Acute toxic reactions may result in death from elevated body temperature (hyperpyrexia) or cardiac failure.

3. Chronic toxicity: Chronic toxicity of the chlorophenols in humans is not well-defined. After pro- longed, higher exposures, severe dermititis (chloracne) may be experienced. Chronic low level exposures to pentachlorophenol seem to be associated with occasional signs of minor chloracne and with minor disturbances of lipid (fat) metabolism. Commonly reported symptoms among workers with chronic exposure include night sweats, neurological disturbances, bronchitis, weight loss, headache, and fatigue. Liver and kidney damage and a depressed immune response may be associated with high levels of chronic exposure. Evidence reported by the EPA suggests that commercial preparations of chlorophenols may be oncogenic (tumor producing), toxic to fetuses and related to birth defects (teratogenic). It was the reproductive effects which originally led to EPA action to restrict the use of pentachlorophenol.

4. Contaminants in chlorophenols: The highly chlorinated phenols contain biologically active impurities. Chlorinated debenzodioxins (dioxins) and chlorinated dibenzofurans (furans) have been identified in commercial grades of penta and tetrachlorophenol. The quantity and proportions of these impurities vary with each industrial batch. The most toxic dioxin, 2,3,7,8-tetrachlorodibenzodioxin (TCDD) has not been detected in pentachlorophenol manufactured in the U.S. Hexachlorobenzene has also been reported as a possible contaminant of commercial pentachlorophenol. In the past, lack of awareness of toxic contaminants confounded the understanding of chlorophenol toxicity. While the acute lethality is primarily attributable to the chlorophenols themselves, chronic toxicity is influenced by the degree of contamination by dioxins, furans, and

hexachlorobenzene. In particular, the acnegenic response, liver pathology, immune depression, fetotoxicity/ teratogenicity, and oncogenicity are attributable to the contaminants.

5. The commercially important biocidal effects of the chlorophenols is due to their action on the metabolic pathways by which organisms derive energy from the oxidation of food. The chlorophenols have been shown to be potent uncouplers of oxidative phosphorylation. The resultant effect on cell metabolism leads to an increased metabolic rate in the whole organism. A resulting body temperature increase and eventual heart failure are described in animal lethality studies and in accidental acute poisonings.

B. Exposure Standards: The only hygienic standard for chlorophenols applies to pentachlorophenol. The American Conference of Governmental Industrial Hygienists (ACGIH) set a threshold limit value (TLV) of 0.5 mg/m^3 for pentachlorophenol in air. This is the same level adopted by federal OSHA and Oregon OSHA. This value has also been adopted in many European countries. Finland has used this value for tetrachlorophenol and has also adopted a short-term exposure limit (STEL) of 1.5 mg/m^3. It is important to note that current information indicates that workplace air levels rarely approach the TLV and are usually much lower. Certain exposures associated with chlorophenol use can lead to peak concentrations at or above the TLV. For example, opening pressure cylinders, drying kilns, and in the preparation of treatment solutions from pelletized or flaked forms of the chemical.

Recent studies suggest that urine levels of chlorinated phenols are an appropriate measure of employee exposure. High urine levels of penta and tetrachlorophenol have been found in workers exposed to airborne levels at or below the TLV. This implies a significant dermal and/or oral route of exposure.

Clorinated phenols appear to be common in human urine. There is a relatively wide range of urine chlorinated phenol levels in the general population and there are difficulties in collecting and analyzing a representative, uncontaminated urine sample. The ACGIH in 1984 proposed the first Biological Exposure Indices for six substances. Chlorinated phenols were not included. Consequently, at this time, biological monitoring for the chlorinated phenols is considered supplementary to airborne PELS. Employee urine levels of chlorinated phenols can, however, provide employers with an additional tool to monitor the adequacy of worker protection. While an elevated urine level is indicative of

exposure, urinalysis cannot distinguish between occupational and nonoccupational exposure. Regardless, elevated urine chlorinated phenol levels should be considered as occupational exposure until further evidence contraindicates.

C. Usage of Chlorinated Wood Preservatives: These preservatives are generally applied by two basic methods: 1) pressure/vacuum process to ensure long term lumber preservation; or 2) surface application by spraying, dipping, or brushing for less permanent preservation or sapstain (surface discoloration) control. Solubility and method of application dictates one of two formulations: 1) oil or solvent based solutions of the neutral phenolic form; or 2) basic aqueous solution of the chlorophenate salts. The product is obtained as either a pelletized or flaked solid or a liquid concentrate. It is mixed and/or diluted prior to use and application. Typically the material is used in the range of 5 - 10 percent in oil or solvent for pressure treatment of posts and poles, lumber, etc., and 0.5 - 2 percent for sapstain control on lumber and plywood.

Pressure treatment involves large sealed pressure vessels which may employ vacuum and/or heating of the product as well. Surface treatment of lumber and wood products is achieved by passing it through a spraying tunnel, dipping bundles in dip tanks, or individual treatment of boards. Other uses include brush application of fresh cut surfaces on construction sites, groundline control in field applications, dipping of fence posts or butt end treatment of posts and poles on job sites.

ACTION: Evaluation of the health hazard and necessary controls must take into account the concentration of chlorinated phenols, the carrier used, the quantity of material handled and the ventilation provided at the work station:

A. Guidelines for work practices and personal protective equipment:

Area/Operation/ Concentration	Work Practice and/or Personal Protective Equipment (PPE)
(A) Mixing/diluting solids or	Impermeable gloves, footwear, and aprons[1]

	concentrations greater than or equal to 5 percent	or impermeable protective clothing,[1,2] and eye protection should be used when diluting or handling concentrate or solids. Local exhaust systems and particulate respirators should be used for operations using solid, flaked, or pelleted preservative where bags are opened or dumped. These operations should be connected to a closed process where possible. Eyewash and deluge shower shall be readily available.
(B)	Pressure Treatment Emergency spills maintenance, pump leaks, entering cylinder, cylinder repairs, tank cleaning, waste sludge removal.	Impermeable gloves, garments[2] and footwear.[1] Eye protection and respirator with organic cartridges. Emergency shower and eyewash. Hygiene cleanup facilities for general hand and face cleaning.
(C)	Spray or Dip area using 0.1 to 5 percent solutions.	Respirator with organic cartridges may be necessary if mist or aerosol exposure occurs above the PEL.
(D)	Topical treatment by dipping or brush application using 0.1 to 5 percent solutions	Protective coveralls or garments where treated lumber is handled.[2] Eye protection where splashing or misting are possible. Impermeable clothing if handling solution or exposed to spray or mist. Washing facilities.
(E)	Stacking and handling of wet or dry treated lumber.	Impermeable gloves,[1] protective clothing,[2] precautions against contaminating shoes or clothing. Ready access to washing facilities.
(F)	Cutting or working treated wood.	Impermeable gloves,[1] protective aprons or clothing.[2]
(G)	All areas where chlorophenol products are used.	Impermeable gloves,[1] toxic particle dust respirators may be needed if dust is generated.
		No Smoking, or food or beverage consumption should be allowed. All tanks and vessels of treatment chemical must be properly labeled. Hand washing facilities must be provided and daily showers are

recommended on completion of shift. Employees should not be allowed to wear work clothing home or into lunchroom areas. In no case should permeable leather gloves be allowed for handling even dry wood. Proper disposal of all hazardous waste must meet Department of Environmental Quality rules.

Notes: [1] The industrial hygienist or safety professional should verify impermeability and chemical resistance of PPE to both chlorinated phenols and to the carrier or solvent in use.

[2] Where permeable protective clothing is used, disposable coveralls or clothing which can be laundered should be used with extras readily available, and changed on a scheduled basis. Change of clothing and washing of affected skin is required when clothing and/or skin are contaminated.

References for further information on hazards of chlorophenols:

NIOSH Technical Report: Industrial Hygiene Surveys of Occupational Exposure to Wood Preservative Chemicals, February 1983, U.S. Department Health and Human Services (NIOSH) Publ. No. 83-106.

"Pentachlorophenol, An Assessment of the Occupational Hazard," Williams, P.L., AIHA Jour. Vol 43(11):799-810(1982).

Ahlborg, U.G. & Thunberg, T.M.; "Chlorinated Phenols: Occurrence, Toxicity, Metabolism and Environmental Impact, CRC Critical Reviews in Toxicology. V.7 #1 pp 1-35, July 1980.

EFFECTIVE DATE: This directive is effective immediately and will remain in effect until cancelled or superseded.