

SAN BERNARDINO VALLEY COLLEGE

SAN BERNARDINO COMMUNITY COLLEGE DISTRICT

FORMALDEHYDE, PHENOL, AND GLUTARALDEHYDE PROGRAM

EFFECTIVE: JUNE 2015



EMERGENCY TELEPHONE NUMBERS

Local Emergency Dispatch for Fire, Personal Injury or Local Police 911

<u>University Police Department</u> 909-384-4491 (Campus Extension 4491)

<u>Chemical Spill or Accident</u> Chemical Hygiene Officer Dean, Science Division Dr. Susan Bangasser 909-384-8650 <u>sbangasser@sbccd.cc.ca.us</u>

<u>Site Safety Officer</u> Vice President of Administrative Services Scott Stark 909-384-8958 <u>sstark@sbccd.cc.ca.us</u>

<u>Hazardous Waste Disposal Coordinator</u> Maintenance & Grounds, Supervisor Chris Hylton 909-387-1608 <u>chylton@sbccd.cc.ca.us</u>

<u>District Environmental Health & Safety</u> Environmental Health & Safety Administrator Whitney Fields 909-382-4070 <u>wfields@sbccd.cc.ca.us</u>



Table of Contents

1.0	INTRODUCTION	. 1
2.0	SCOPE	. 1
3.0	RESPONSIBILITIES	. 1
3.1	CHEMICAL HYGIENE OFFICER	. 1
3.2	DEANS, DIRECTORS AND DEPARTMENT HEADS	. 1
3.3	INSTRUCTORS	. 1
3.4	LAB TECHNICIANS/EMPLOYEES	. 2
3.5	STUDENTS	. 2
4.0	FORMALDEHYDE HAZARD DATA	. 2
4.1	ACUTE HEALTH EFFECTS	. 3
4.2	CHRONIC HEALTH EFFECTS	. 3
4.3	PHYSICAL HAZARDS	. 4
4.4	PERMISSIBLE EXPOSURE LIMITS (PELS)	. 4
5.0	PHENOL HAZARD DATA	. 5
5.1	ACUTE HEALTH EFFECTS	. 5
5.2	CHRONIC HEALTH EFFECTS	. 5
5.3	PHYSICAL HAZARDS	. 6
5.4	PERSONAL EXPOSURE LIMITS (PELS)	. 6
6.0	GLUTARALDEHYDE HAZARD DATA	. 6
6.1	ACUTE HEALTH EFFECTS	. 7
6.2	CHRONIC HEALTH EFFECTS	. 7
6.3	PHYSICAL HAZARDS	. 7
6.4	PERSONAL EXPOSURE LIMITS (PELS)	. 7
7.0	EXPOSURE ASSESSMENTS	. 8
7.1	EMPLOYEE EXPOSURE ASSESSMENTS	. 8
7.2	STUDENT EXPOSURE ASSESSMENTS	. 9
8.0	METHODS OF REDUCING EMPLOYEE/STUDENT EXPOSURE TO FORMALDEHYDE & PHENOL	9
8.1	SUBSTITUTION	. 9
8.2	ENGINEERING CONTROLS	. 9
8.3	ADMINISTRATIVE CONTROLS	. 9
8.4	PERSONAL PROTECTIVE EQUIPMENT (PPE)	10
8	B.4.1 HAND PROTECTION	10
8	3.4.2 EYE PROTECTION	10
8	3.4.3 RESPIRATORY PROTECTION	10
8	3.4.4 PROTECTIVE CLOTHING	10
8.5	HYGIENE	11
8.6	EMERGENCY EYEWASH AND SHOWER	11
9.0	SIGNAGE AND LABELING	11
9.1	REGULATED AREAS	11
9.2	CONTAINER LABELS	12
10.0	STANDARD OPERATING PROCEDURES	13
11.0	INFORMATION AND TRAINING	14
11.1	1 EMPLOYEE AND STUDENT INFORMATION AND TRAINING	14
12.0	MEDICAL SURVEILLANCE (EMPLOYEES ONLY)	14
12.1	1 FORMALDEHYDE	15
12.2	2 PHENOL AND GLUTARALDEHYDE	15
1	2.2.1 MEDICAL SCREENING	15
1	2.2.2 PREPLACEMENT MEDICAL EVALUATION	15



1	2.2.3	PERIODIC MEDICAL EVALUATIONS	
1	2.2.4	BIOLOGICAL MONITORING – PHENOL	
12.3	3 N	IEDICAL REMOVAL	
13.0	SPILLS		
13.1	1 SI	MALL SPILLS	
13.	2 L	ARGE SPILLS	17
14.0	DISPO	SAL	
15.0	STORA	\GE	
16.0	REGUI	ATORY REQUIREMENTS AND GUIDELINES (REFER TO APPENDIX A)	

APPENDIX A: Regulatory Requirements and Guidelines

APPENDIX B: Standard Operating Procedure - Formaldehyde

APPENDIX C: Standard Operating Procedure - Phenol

APPENDIX D: Standard Operating Procedure - Glutaraldehyde

Appendix E: Standard Operating Procedure - Laboratory Exhaust Ventilation Systems

APPENDIX F: Safety Data Sheets



1.0 INTRODUCTION

The purpose of this program is to protect San Bernardino Valley College (SBVC) employees and students from the hazards associated with the use of formaldehyde, phenol, and glutaraldehyde, and to maintain formaldehyde, phenol, and glutaraldehyde exposures below the regulatory limits.

2.0 SCOPE

This program applies to all SBVC employees and students who use formaldehyde, formalin, other formaldehyde-containing solutions and/or specimens preserved in such solutions, phenol, other phenol-containing solutions and/or specimens preserved in such solutions, glutaraldehyde and other glutaraldehyde-containing solutions and/or specimens preserved in such solutions.

3.0 **RESPONSIBILITIES**

3.1 CHEMICAL HYGIENE OFFICER

- Develop and implement the SBVC Formaldehyde, Phenol, and Glutaraldehyde Program;
- monitor compliance with the Occupational Health & Safety Administration (OSHA) Standard for Formaldehyde, 29 CFR 1910.1048;
- provide general formaldehyde, phenol, and glutaraldehyde safety training;
- conducting exposure assessments and evaluation of exposure control measures in collaboration with the Site Safety Officer, as necessary;
- coordinate emergency response for chemical spills;
- investigate accidents;
- maintain employee and student exposure records;
- ensure compliance with site-specific Standard Operating Procedures (SOP) that address the specific safety measures to be implemented when using formaldehyde, phenol, and/or glutaraldehyde, and revise as necessary (see Appendix B, C, D);
- ensure compliance with site-specific Standard Operating Procedures (SOP) for Laboratory Exhaust Ventilation Systems, and revise as necessary (see Appendix E); and
- coordinate the provision of medical examinations, exposure monitoring and record keeping in collaboration with the Site Safety Officer and Laboratory Technicians, as required.

3.2 DEANS, DIRECTORS AND DEPARTMENT HEADS

Deans, Directors and Department Heads are responsible for ensuring departmental compliance with all the procedures outlined in this program.

3.3 INSTRUCTORS

• ensure compliance with this program in their work area(s);



- review site-specific Standard Operating Procedures (SOP) that address the specific safety measures to be implemented when using formaldehyde, phenol, and/or glutaraldehyde, and revise as necessary (see Appendix B, C, D);
- ensure employees with potential exposure to formaldehyde, phenol, or glutaraldehyde receives the appropriate training before working with it;
- arrange for immediate emergency response, if necessary, for chemical spills, injuries and overexposures; and
- notify the Chemical Hygiene Officer when there is a change in equipment, processes or controls which may result in additional exposure to formaldehyde, phenol, or glutaraldehyde.

3.4 LAB TECHNICIANS/EMPLOYEES

- know the provisions of the SBVC Formaldehyde, Phenol, and Glutaraldehyde Program;
- maintain their work area(s) daily;
- maintain an SDS for the formaldehyde, phenol, and glutaraldehyde products used, and all other hazardous chemicals in the work area;
- report accidents, possible overexposures or unsafe conditions to the instructors;
- wear/utilize personal protective equipment (PPE) and engineering controls when recommended and provided; and
- schedule medical examinations and exposure monitoring in collaboration with the Chemical Hygiene Officer and Site Safety Officer, as required.

3.5 STUDENTS

- know the provisions of the SBVC Formaldehyde, Phenol, and Glutaraldehyde Program;
- report accidents, possible overexposures or unsafe conditions to the instructors; and
- wear/utilize personal protective equipment (PPE) and engineering controls when recommended and provided.

4.0 FORMALDEHYDE HAZARD DATA

Formaldehyde exposure has been associated with irritation to the human respiratory tract, cancers of the nose and lung, and loss of vision. Formaldehyde may affect the body through inhalation, skin/eye contact or accidental ingestion. One's sense of smell and eye irritation become less sensitive with time as one adapts to formaldehyde exposure; therefore, one cannot rely on formaldehyde's warning properties to alert oneself to the potential for overexposure. The dose, or amount of exposure, determines the type and degree of beneficial or adverse health effects.



4.1 ACUTE HEALTH EFFECTS

Acute Health Effects are symptoms that occur at very high concentrations of exposure. Table 1.0 below describes of the health effects correlated to the various routes of formaldehyde exposure.

Routes of	Health Effects		
Exposure			
Inhalation	 Formaldehyde is highly irritating to the eyes, nose and throat. Affects the nasal cavity. Severity of the symptoms depends upon the concentration in air coupled with the length of the exposure. Wheezing, nausea, bronchitis, teary eyes, watery nose, headache, sinus fullness, sore throat, throat hoarseness, severe coughing, chest pains, chest tightness, swelling of the throat, and spasms in the throat. Concentrations of 100 ppm are immediately dangerous to life and health (IDLH). 		
Skin Absorption	 Formaldehyde is a severe skin irritant and sensitizer. Contact with formaldehyde causes white discoloration, drying, cracking and scaling of the skin. Prolonged or repeated contact can cause numbness or hardening/tanning of the skin. 		
Eye Contact	 Formaldehyde solutions splashed in the eyes can cause injuries ranging from mild discomfort (such as watery eyes, itchy eyes) to severe, permanent corneal clouding and loss of vision. The eyes can become itchy, tear, and can eventually close. The severity of the effects depends on the concentration of formaldehyde, length of contact, and whether or not the eyes were flushed with water immediately after the accident. 		
Ingestion	 Severe irritation of the mouth, throat, and stomach. Nausea, vomiting, abdominal pain, diarrhea, hypertension, hypothermia, lethargy, dizziness, convulsions, coma, acidosis, kidney inflammation, and liver toxicity. Corrosion of the gastrointestinal tract. Inflammation and ulceration of the mouth, esophagus, and stomach. Severe stomach pains will follow ingestion with possible loss of consciousness and death. 		

Table 1.0 – Acute Health Effects, Formaldehyde

4.2 CHRONIC HEALTH EFFECTS

Formaldehyde has the potential to cause various respiratory impairments, such as bronchitis and nasal cancer that may appear over a relatively long period of time after repeated and prolonged exposures above the OSHA permissible exposure limits (PEL). In humans, formaldehyde exposure has been associated with cancers of the lung, nasopharynx and oropharynx, and nasal passages.



4.3 PHYSICAL HAZARDS

Formaldehyde poses a moderate fire and explosion hazard when exposed to heat or flame. The flash point for 37% formaldehyde is 185°F with an explosion range of 7 to 73% by volume in air. Avoid contact with strong oxidizing agents, caustics, strong alkalies, isocyanates, anhydrides, oxides, and inorganic acids. Formaldehyde reacts with nitrogen dioxide, nitromethane, peroxyformic acid, perchloric acid and aniline to yield explosive compounds. Formaldehyde reacts with hydrochloric acid to form the potent carcinogen, bischloromethyl ether. A violent reaction occurs when formaldehyde is mixed with strong oxidizers. Oxygen from the air can oxidize formaldehyde to formic acid, especially when heated; formic acid is corrosive.

4.4 PERMISSIBLE EXPOSURE LIMITS (PELs)

CAL-OSHA has issued several types of limits for employee exposures to trigger various regulated requirements.

Limit Types	Limits	Required Actions		
Exposure	0.1 part formaldehyde per	*	Annual formaldehyde training	
Threshold	million parts of air (0.1 ppm)			
Action Level (AL)	0.5 ppm (calculated as an 8-hour time- weighted average)	*	 If at or above the AL, CAL-OSHA mandates that employers initiate certain required activities such as exposure monitoring and medical surveillance for employees. 	
Permissible Exposure Limit (PEL)	0.75 ppm (calculated as an 8-hour time- weighted average)	*	If at or above the PEL, CAL-OSHA requires employers to do the following: • Provide personal protective equipment (PPE) such as respirators; • Establish administrative controls, to study and install engineering controls (if feasible); and • Establish regulated areas, and perform other OSHA- required procedures and duties.	
Short Term Exposure Limit (STEL)	2 ppm (averaged over any one 15-minute period)	*	If at or above the STEL, CAL-OSHA requires employers to do the following:	



Limit Types	Limits	Required Actions		
		controls, to study and install engineering contro (if feasible); and o Establish regulated areas and perform other OSHA required procedures and duties.	ols s, A-	

5.0 PHENOL HAZARD DATA

Phenol exposure has been associated with irritation to the skin, eyes, and mucous membranes. The skin is the primary route of entry into the human body. Phenol may affect the body through inhalation, skin/eye contact or accidental ingestion. Acute exposure in humans can result in irregular breathing, muscle weakness, muscle tremors, loss of coordination, convulsions, coma, respiratory arrest, and death. The dose, or amount of exposure, determines the type and degree of beneficial or adverse health effects.

5.1 ACUTE HEALTH EFFECTS

Acute Health Effects are symptoms that occur at very high concentrations of exposure and short term exposures. Table 3.0 below describes the health effects correlated to the various routes of phenol exposure.

Routes of	Health Effects			
Exposure				
Inhalation	 Phenol is extremely irritating to the skin, eyes, and mucous membrane. 			
Skin	 Phenol is extremely irritating to the skin. 			
Absorption	 Chemical burns, redness, edema, tissue necrosis, and gangrene. 			
Eye	Irritation			
Contact	Conjunctival swelling where the cornea becomes white and loses			
	sensation.			
	Loss of vision, blindness.			
Ingestion	 Shock, collapsing, coma, convulsions, cyanosis, muscular weakness, 			
	and death			
	 Severe burns in the mouth and throat, abdominal pain, cyanosis, muscular weakness 			

Table 3.0 – Acute Health Effects, Phenol

5.2 CHRONIC HEALTH EFFECTS

Phenol has the potential to cause anorexia, progressive weight loss, diarrhea, vertigo, salivation and dark coloration of the urine in those after repeated and prolonged exposures above the OSHA permissible exposure limits (PEL). In humans, phenol exposure has been associated with gastrointestinal irritation and respiratory, eyes, skin, blood, liver, and kidney effects, and systemic disorders such as digestive disturbances and nervous system effects. The Agency for Toxic Substances and Disease Registry



(ATSDR)¹ indicated that application of phenol to the skin resulted in dermal inflammation and necrosis, and exposure in high phenol concentration resulted in cardiac arrhythmias in humans.

5.3 PHYSICAL HAZARDS

Phenol poses a moderate fire and explosion hazard when exposed to heat, flames, or sparks. The flash point for 30-60% phenol is 175°F. Avoid phenol contact with strong oxidizing agents (especially calcium hypochlorite), acids, and halogens as they yield explosive compounds. Liquid phenol attacks rubber, coatings, and some forms of plastic. Hot liquid phenol attacks aluminum, magnesium, lead, and zinc metals.

5.4 PERSONAL EXPOSURE LIMITS (PELs)

CAL-OSHA and NIOSH have issued several types of limits for employee exposures to trigger various regulated requirements.

Limit Types	Limits	Recommended Actions
Cal-OSHA Permissible Exposure Limit (PEL)	5 ppm [skin] ² (calculated as an 8-hour time- weighted average)	 If at or above the limit, OSHA requires employers to do the following: Annual phenol training; Provide personal
NIOSH Short Term Exposure Limit (STEL)	15.6 ppm [skin] ² (averaged over any one 15-minute period)	 protective equipment (PPE) such as respirators; Establish administrative controls, to study and install engineering controls (if feasible); and Establish regulated areas, and perform other OSHA- required procedures and duties.

 Table 4.0 - Phenol Exposure Limits and Recommended Actions

6.0 GLUTARALDEHYDE HAZARD DATA

Glutaraldehyde exposure has been associated with irritation to the eyes, skin, and respiratory system. Other symptoms include dermatitis, sensitization, cough, asthma, nausea, and vomiting. Glutaraldehyde may affect the body through inhalation, skin absorption, ingestion, and skin and/or eye contact. The dose, or amount of exposure, determines the type and degree of beneficial or adverse health effects.

¹ Agency for Toxic Substances and Disease Registry (ATSDR). *Toxicological Profile for Phenol (Update)*. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA. 1998.

² "Skin" notation, indicates that the cutaneous route of exposure (including mucous membranes and eyes) contributes to overall exposure.



6.1 ACUTE HEALTH EFFECTS

Acute Health Effects are symptoms that occur at very high concentrations of exposure and short term exposures. Table 5.0 below describes the health effects correlated to the various routes of glutaraldehyde exposure.

Routes of	Health Effects			
Exposure				
Inhalation	 Irritates nose, throat, and respiratory tract 			
	 Causes coughing and wheezing, nausea, headaches, drowsiness, 			
	nosebleeds, and dizziness			
Skin	 Irritates skin and can cause dermatitis (skin rash), with dryness, redness, 			
Absorption	flaking, and cracking of the skin			
	 At higher concentrations can burn skin 			
Eye	 Severely irritates eyes 			
Contact	 Can cause permanent eye damage 			
Ingestion	 Severe irritation of digestive tract with burning sensation in chest, 			
_	abdominal pain, cramping, vomiting, diarrhea, vascular collapse, and			
	coma			
	May also affect liver, spleen, blood, metabolism, behavior, urinary			
	system			

Table 5.0 - Acute Health Effects, Glutaraldehyde

6.2 CHRONIC HEALTH EFFECTS

Glutaraldehyde is a sensitizer. This means some workers will become very sensitive to glutaraldehyde and have strong reactions if they are exposed to even small amounts. Workers may get sudden asthma attacks with difficulty breathing, wheezing, coughing, and tightness in the chest. Prolonged exposure can cause a skin allergy and chronic eczema, and afterwards, exposure to small amounts produces severe itching and skin rashes. It has been implicated as a possible cause of occupational asthma.

6.3 PHYSICAL HAZARDS

Glutaraldehyde is a combustible liquid. When heated to decomposition, it emits acid smoke and irritating fumes. Avoid glutaraldehyde contact with strong oxidizers and strong bases. Alkaline solutions of glutaraldehyde (i.e. activated glutaraldehyde) reach with alcohol, ketones, amines, hydrazines, and proteins.

6.4 PERSONAL EXPOSURE LIMITS (PELs)

CAL-OSHA and NIOSH have issued several types of limits for employee exposures to trigger various regulated requirements.



Limit Types	Limits	Recommended Actions			
Cal-OSHA Permissible Exposure Limit (PEL)	None	N/A			
Cal-OSHA	0.05 ppm (0.2 mg/m³)	 If at or above the ceiling limit, 			
Ceiling Limit	(maximum concentration employee	Citadel recommends employers			
(C)	may be exposed at any time)	to do the following:			
NIOSH	0.2 ppm (0.8 mg/m³)	 Annual glutaraldehyde 			
Ceiling Limit	(maximum concentration employee	training;			
(C)	may be exposed at any time)	 Provide personal protective equipment (PPE) such as respirators; Establish administrative controls, to study and install engineering controls (if feasible); and Establish regulated areas, and perform other OSHA- required procedures and 			

Table 6.0 - Glutaralde	nvde Exposure	e Limits and Rec	ommended Actions
	Jao Enpodare		

7.0 EXPOSURE ASSESSMENTS

Whenever formaldehyde, phenol, or glutaraldehyde is used in a work area, the College will coordinate with an industrial hygienist to conduct air monitoring to determine employee exposures. Measurements of employee exposures will be representative of a full shift or STEL and will be taken for each job classification in each work area.

The industrial hygienist will utilize special sampling equipment to collect representative air samples for laboratory analysis of formaldehyde, phenol or glutaraldehyde. Exposure records and determinations shall be kept for at least 30 years.

7.1 EMPLOYEE EXPOSURE ASSESSMENTS

If employee exposures are found to be at or above the action level or STEL for formaldehyde, or at or above the PEL for Phenol, the College will repeat air monitoring every six (6) months. If exposures are above the STEL, or at or above the Ceiling Limit for glutaraldehyde, air monitoring will be conducted at least once per year. Monitoring will continue until exposures can be reduced below these levels by engineering or administrative controls.

Air monitoring will be conducted promptly in a work area if employees are experiencing signs or symptoms of formaldehyde, phenol, or glutaraldehyde exposure. Air monitoring will be repeated in an area each time there is a change in equipment, processes or controls which may result in additional exposure to formaldehyde, phenol, or glutaraldehyde.



Periodic monitoring of the employees may be discontinued if the results from two (2) consecutive sampling periods taken at least seven (7) days apart show that employee exposure is below the AL and the STEL for formaldehyde, below the PEL for Phenol, and below the Ceiling Limit for glutaraldehyde.

Affected employees shall be notified of the monitoring results within fifteen (15) days of receiving the results.

Exposure records shall be kept for 30 years. Access to exposure records must be allowed to current and former employees or their designated representatives upon request.

7.2 STUDENT EXPOSURE ASSESSMENTS

Student exposure assessments are currently not conducted by SBVC. Students are to report to the health center and their instructors if students are experiencing signs or symptoms of formaldehyde, phenol, or glutaraldehyde exposure.

8.0 METHODS OF REDUCING EMPLOYEE/STUDENT EXPOSURE TO FORMALDEHYDE & PHENOL

8.1 SUBSTITUTION

When possible, substitution of a less hazardous chemical or process will be used to reduce or eliminate formaldehyde, phenol, and/or glutaraldehyde use and exposures.

8.2 ENGINEERING CONTROLS

When possible, chemical fume hoods and/or local exhaust ventilation will be used to reduce exposures to formaldehyde, phenol, and glutaraldehyde. Local exhaust is used to capture and exhaust formaldehyde, phenol, and glutaraldehyde vapors, preventing the accumulation of high exposures in a person's breathing zone. General dilution ventilation will also be used, which involves continuous introduction of fresh air into the laboratory/workroom to mix with the contaminated air and lower the breathing zone concentration of formaldehyde, phenol and glutaraldehyde. Effectiveness of general dilution ventilation will depend on the number of air changes per hour and where sources emitting formaldehyde, phenol and glutaraldehyde are located in the area.

8.3 ADMINISTRATIVE CONTROLS

If engineering controls cannot be implemented, alteration of work practices will be used to reduce exposures to formaldehyde, phenol, and glutaraldehyde. This could include limiting the amount of time employees spend working in high exposure areas, such as by reassigning or rotating personnel among various job duties. Reassignment may continue for up to six (6) months until the employee is determined to be able to return to the original job or to be unable to return to work – whichever comes first.



8.4 PERSONAL PROTECTIVE EQUIPMENT (PPE)

Prevent liquids with eyes skin with direct contact the or containing formaldehyde, phenol and/or glutaraldehyde, by the use of protective garments and equipment which are resistant to formaldehyde, phenol, and glutaraldehyde. The type of PPE necessary will vary on the concentration, amount used and the potential for splashing. The DISTRICT EH&S OFFICE can provide you with guidance regarding the appropriate PPE for your area.

8.4.1 HAND PROTECTION

Butyl or polyethylene gloves are recommended when handling phenol. Butyl gloves are recommended when handling 37% or greater concentrations of formaldehyde. Nitrile gloves (8-mil) may be used when solely handling formaldehyde/formalin solutions. Butyl rubber, neoprene, polyvinyl chloride, or Viton gloves should be used when handling glutaraldehyde.

8.4.2 EYE PROTECTION

Goggles must be worn during formaldehyde, phenol, or glutaraldehyde use, when there is potential for splashing/disturbance. Face shields may be used to supplement the protection provided by goggles, but must never be used without other eye protection.

8.4.3 RESPIRATORY PROTECTION

If employee/student exposures are found to exceed the PEL, STEL or C, respirators will be provided until feasible engineering or administrative controls can be implemented.

Respirator use and type will be based on air monitoring results in accordance with SBVC's Respiratory Protection Plan.

If respirator use is necessary, employees/students must comply with *SBVC's Respiratory Protection Program* and be medically cleared to wear a respirator and fit-tested and trained by the DISTRICT EH&S OFFICE or appropriate alternate before using a respirator. Be sure to replace the cartridges after three (3) hours of use, or at the end of the work-shift, whichever is sooner. Or, if equipped with a NIOSH approved end-of-service indicator, replace the cartridge as indicated. Respirators must be inspected by employees/students prior to each use and must be stored in a clean and sanitary manner. Respirators should be inspected by instructors each month to ensure they are being used, stored, and cleaned properly.

8.4.4 PROTECTIVE CLOTHING

Protective (impervious) gowns, lab coats, aprons and arm sleeves are provided for use. Closed toe shoes should be worn at all times in areas where formaldehyde, phenol and/or glutaraldehyde contact is expected.

In areas where the formaldehyde, phenol, or glutaraldehyde concentrations are expected to be greater than 100ppm, each area/task should be evaluated by DISTRICT EH&S and/or industrial hygienist for appropriate PPE. This concentration may be encountered during a large quantity spill of formaldehyde, phenol, or glutaraldehyde in a confined or small enclosed area. Contact the SITE SAFETY OFFICER or District Police (after hours) in these situations.



8.5 HYGIENE

To prevent the accidental ingestion of formaldehyde, phenol, or glutaraldehyde, eating, drinking and smoking are prohibited in areas where formaldehyde, phenol, or glutaraldehyde are used. In addition, employees/students must wash their hands after formaldehyde, phenol, and/or glutaraldehyde use.

Protective clothing contaminated with formaldehyde, phenol, or glutaraldehyde must be decontaminated prior to reuse and no contaminated clothing may be taken home. Disposable clothing may not be reused.

Containers for contaminated clothing and equipment shall have the following labels and signage:

DANGER: FORMALDEHYDE CONTAMINATED CLOTHING AND EQUIPMENT AVOID INHALATION AND SKIN CONTACT

OR

DANGER: PHENOL CONTAMINATED CLOTHING AND EQUIPMENT AVOID INHALATION AND SKIN CONTACT

OR

DANGER: GLUTARALDEHYDE CONTAMINATED CLOTHING AND EQUIPMENT AVOID INHALATION AND SKIN CONTACT

8.6 EMERGENCY EYEWASH AND SHOWER

If there is a possibility that employee's/students' skin may be splashed by formaldehyde, phenol, or glutaraldehyde-containing solutions, an emergency shower will be provided in the work area. If there is a possibility that employee's/students' eyes may be splashed by formaldehyde, phenol, or glutaraldehyde-containing solutions, a plumbed eyewash station will be provided in the work area. Both emergency showers and eyewash stations have to be within ten (10) seconds of unobstructed travel.

Employee/students must be instructed on the proper use of the eyewash and emergency showers. If an employee's/students' eyes or skin are splashed by formaldehyde, phenol, or glutaraldehyde-containing solutions, the employee/student must flush them immediately and continue for 15 minutes. The employee/student should then seek medical attention.

9.0 SIGNAGE AND LABELING

9.1 Regulated Areas

Areas where the airborne levels of formaldehyde, phenol, or glutaraldehyde are found to exceed the PEL, STE: and/or C will be designated as regulated areas. Access



to these areas will be limited to persons trained to recognize the hazards of formaldehyde, phenol, or glutaraldehyde. All entrances and access ways will be posted with signs bearing the following information:

DANGER Formaldehyde Exposure Area Irritant and Potential Cancer Hazard Authorized Personnel Only

OR

DANGER Phenol Exposure Area Avoid any contact with skin or eyes Avoid breathing vapor or aerosol

OR

DANGER Glutaraldehyde Exposure Area Causes severe skin burns and eye damage Harmful if swallowed or if inhaled

9.2 Container Labels

The OSHA Hazard Communication Standard (HCS) and Global Harmonized System of Classification and Labeling of Chemicals (GHS) require that all containers must be labeled with the name of the product and the most significant hazards(s) associated with the contents. Label all mixtures or solutions composed of greater than 0.1% formaldehyde and materials capable of releasing formaldehyde into the air at concentrations reaching or exceeding 0.1 ppm with the following information:





Label all containers of phenol at concentration of 1% phenol or greater with the following information:



DANGER Contains Phenol Harmful if swallowed Toxic in contact with skin Fatal if inhaled May cause allergy or asthma symptoms or breathing difficulties if inhaled Causes damage to organs

Label all containers of glutaraldehyde at concentration of 25% glutaraldehyde or greater with the following information:



Contains Glutaraldehyde Causes severe skin burns and eye damage May cause an allergic skin reaction Harmful if swallowed or if inhaled May cause allergy or asthma symptoms or breathing difficulties if inhaled Do not breathe dust/fume/gas/mist/vapors/spray

*CHEMICAL HYGIENE OFFICER will provide these labels upon request.

10.0 STANDARD OPERATING PROCEDURES

Work with formaldehyde, phenol, or glutaraldehyde requires a written Standard Operating Procedure (SOP) that addresses the following:

- the hazards of formaldehyde, phenol, and glutaraldehyde;
- what containment devices (i.e., chemical fume hoods, local exhaust ventilation) will be used when working with formaldehyde, phenol, or glutaraldehyde;
- what PPE is required;
- designated storage and use areas;
- how to dispose of waste formaldehyde, phenol, or glutaraldehyde solutions; and
- decontamination and spill clean-up procedures.



The SBVC Chemical Hygiene Plan serves as a general guideline. A SBVC Formaldehyde, Phenol, and Glutaraldehyde template is provided in Appendix B, C, and D respectively of this program. Certain applications may require the development of additional, site-specific formaldehyde, phenol, and glutaraldehyde SOPs.

11.0 INFORMATION AND TRAINING

11.1 Employee and Student Information and Training

Every employee/student working with formaldehyde, phenol, and glutaraldehyde must receive training regarding the hazards. A training module will be provided to instructors with lab technicians and students working with formaldehyde, phenol and/or glutaraldehyde. Instructors should review this information with lab technicians annually and with students at the start of each semester. It will cover the following:

- requirements of the Cal-OSHA formaldehyde, phenol, and glutaraldehyde regulations;
- explanation of the formaldehyde, phenol, and glutaraldehyde Safety Data Sheets (SDSs);
- explanation of the SBVC Formaldehyde, Phenol, & Glutaraldehyde Program in its entirety;
- description of the medical surveillance program (applicable to employees and students);
- description of the health hazards associated with exposure;
- instructions to report any signs or symptoms that may be attributable to formaldehyde, phenol, or glutaraldehyde exposure;
- description of the operations in the work area where formaldehyde, phenol, or glutaraldehyde is present;
- explanation of the work practices to reduce exposure, including engineering and administrative controls and PPE required; and
- instructions for handling spills and emergency procedures.

This training must be conducted whenever a new hazard is introduced into the work area, when the employee transfers to another job, at the beginning of each semester, and whenever the employee/student demonstrates behavior that indicates a lack of understanding of the basic rules for the safe handling of chemicals.

Instructors are responsible for ensuring that employees and students with potential exposure to formaldehyde, phenol, or glutaraldehyde receive the appropriate training before working with it. All training must be documented by the individual presenting the training session and a copy of the training records will be submitted to the CHEMICAL HYGIENE OFFICER.

12.0 MEDICAL SURVEILLANCE (EMPLOYEES ONLY)

Employees exposed to formaldehyde, phenol, or glutaraldehyde will be provided with the opportunity to receive medical attention under the following circumstances:

- Whenever exposure monitoring indicates exposures above the AL, STEL or C;
- whenever an employee has developed disease signs or symptoms associated with exposure to formaldehyde, phenol, or glutaraldehyde; and/or



• when an employee is involved in a spill, leak or other occurrence resulting in a possible overexposure to formaldehyde, phenol, or glutaraldehyde.

It is the intent of SBVC to provide a work environment which does not compromise the reproductive health of any employee or student, regardless of gender, or the health of a fetus.

SBVC employees may obtain free medical consultation or counseling regarding concerns about formaldehyde and/or exposures by contacting District Human Resources at 909-382-4042.

If respirator use is necessary, employees/students will consult and comply with the SBVC's, Respiratory Protection Program, which can be accessed at <u>www.sbccd.org/ehs</u>, under SAFETY PROGRAMS.

12.1 FORMALDEHYDE

Employees found to have exposures that exceed the action level or the STEL of formaldehyde will be included in a medical surveillance program. These employees will fill out a medical questionnaire form annually and receive a physical examination if SBVC's designated medical personnel determine it is necessary based on a review of the employee's responses on the questionnaire. Required medical surveillance should be provided at the time of initial assignment and once a year afterward for as long as the exposure continues.

Medical records shall be kept for the duration of employment plus 30 years. Access to medical records must be allowed to current and former employees or their designated representatives upon request.

12.2 PHENOL AND GLUTARALDEHYDE

OSHA is developing requirements for phenol and glutaraldehyde medical surveillance. When these requirements are promulgated, it should be referred to for additional information and to determine whether employers whose employees are exposed to phenol and glutaraldehyde are required to implement medical surveillance procedures.

Medical records shall be kept for the duration of employment plus 30 years. Access to medical records must be allowed to current and former employees or their designated representatives upon request.

12.2.1 MEDICAL SCREENING

Workers who may be exposed to phenol and/or glutaraldehyde should be monitored in a systematic program of medical surveillance that is intended to prevent occupational injury and disease. To detect and control work-related health effects, medical evaluations should be performed (1) before job placement, (2) periodically during the term of employment, and (3) at the time of job transfer or termination.

12.2.2 PREPLACEMENT MEDICAL EVALUATION



A preplacement medical evaluation is recommended to assess medical conditions that may be aggravated or may result in increased risk when a worker is exposed to phenol and/or glutaraldehyde at or below the prescribed exposure limit. The health care professional should consider the probable frequency, intensity, and duration of exposure as well as the nature and degree of any applicable medical condition. Before a worker is placed in a job with a potential for exposure to phenol and/or glutaraldehyde, a licensed health care professional should evaluate and document the worker's baseline health status with thorough medical, environmental, and occupational histories, a physical examination, and physiologic and laboratory tests appropriate for the anticipated occupational risks. These should concentrate on the function and integrity of the skin, central nervous system, respiratory system, liver, and kidneys. Medical surveillance for respiratory disease should be conducted using the principles and methods recommended by the American Thoracic Society.

12.2.3 PERIODIC MEDICAL EVALUATIONS

Occupational health interviews and physical examinations should be performed at regular intervals during the employment period. Evaluations should be conducted every 3 to 5 years or as frequently as recommended by an experienced occupational health physician if hazard is minimal. Current health status should be compared with the baseline health status of the individual worker or with expected values for a suitable reference population.

Additional examinations may be necessary if a worker develops symptoms attributable to phenol exposure. The interviews, examinations, and medical screening tests should focus on identifying the adverse effects of phenol and/or glutaraldehyde on the skin, central nervous system, respiratory system, liver, or kidneys.

The medical, environmental, and occupational history interviews, the physical examination, and selected physiologic or laboratory tests that were conducted at the time of placement should be repeated at the time of job transfer or termination to determine the worker's medical status at the end of his or her employment. Any changes in the worker's health status should be compared with those expected for a suitable reference population.

12.2.4 BIOLOGICAL MONITORING – PHENOL

Biological monitoring involves sampling and analyzing body tissues or fluids to provide an index of exposure to a toxic substance or metabolite. A worker's exposure to phenol can be determined by analyzing a urine sample taken at the end of the shift for total phenol. A 250 mg total phenol per gram creatinine level corresponds to an airborne phenol exposure at the TLV (5 ppm). It should be noted that dermal absorption of phenol may also contribute to the urinary levels found.

12.3 MEDICAL REMOVAL

Employees experiencing significant irritation of the eyes, central nervous system, respiratory system, liver, kidneys or skin, respiratory sensitization or dermal sensitization attributed to formaldehyde, phenol, or glutaraldehyde exposure will be seen by SBVC's designated medical provider. If SBVC's designated medical provider determines that the symptoms may be the result of a possible overexposure, the CHEMICAL HYGIENE



OFFICER will evaluate the work area to determine if the symptoms are the result of an over-exposure. If exposures are at or above the OSHA PEL, STEL, or C, the CHEMICAL HYGIENE OFFICER or designated industrial hygienist will determine which further administration and/or engineering control measures are necessary. If the employee's symptoms have not subsided within a two-week period and SBVC's designated medical personnel has determined that the employee was sensitized, restrictions or transfer from the work area may be recommended.

13.0 SPILLS

Laboratory personnel can clean up the vast majority of chemical spills that occur in the lab. The individual(s) who caused the spill is (are) responsible for prompt and proper cleanup. It is the responsibility of the instructor and/or lab technician to have spill control cleanup materials and PPE, which are appropriate for the chemicals being handled, readily available. Instructors are also responsible for ensuring that spills are cleaned up as soon as possible. Notify the CHEMICAL HYGIENE OFFICER, SITE SAFETY OFFICER or District Police (after hours) of a spill.

The types and quantities of hazardous chemical substances used on the SBVC campus require preplanning in order for accidental chemical releases to be handled in a safe manner. Additionally, formaldehyde-, phenol-, and glutaraldehyde-contaminated waste and debris from a spill must be disposed of as hazardous waste. Two categories of chemical spills and response procedures are identified for this purpose.

13.1 SMALL SPILLS

Small spills (<100 milliliters) can be cleaned up with absorbent material. The appropriate PPE, such as safety glasses and chemical-resistant gloves, must be used to prevent skin contact with the formaldehyde, phenol, or glutaraldehyde material. The spill clean-up materials must be double-bagged, tightly closed, labeled and picked up by SBVC's designated hazardous waste contractor (EMT) for disposal. If you experience any eye or upper respiratory irritation while cleaning up the spill, stop immediately and call CHEMICAL HYGIENE OFFICER, SITE SAFETY OFFICE or District Police (after hours) for assistance.

13.2 LARGE SPILLS

Employees should not attempt to clean up large quantity (>100 milliliters) spills of formaldehyde, phenol, or glutaraldehyde, particularly in confined or restricted spaces, unless training has been received, appropriate spill clean-up materials, and PPE are readily available. In the event of a large spill for which you are not properly trained or prepared:

- do not touch the spilled material; stop the leak if it is possible to do so without risk;
- evacuate the area;
- close doors;
- alert others not to enter the area;
- remove all sources of heat and ignition;
- contact the CHEMICAL HYGIENE OFFICER, SITE SAFETY OFFICER or District Police (after hours) to coordinate clean-up of the spill. If a spill is larger than 1 liter, the Campus Police must be notified.



- ✤ do not reenter the area until the area has been monitored.
- read the Standard Operating Procedures for formaldehyde, phenol, or glutaraldehyde in that area.

14.0 DISPOSAL

All chemical waste must be disposed of according to *SBVC's Chemical Hygiene Plan*. Formaldehyde-, phenol-, or glutaraldehyde-containing wastes should be placed in a labeled waste container in a flammable storage cabinet. Call SBVC, Administrative Services at 909-384-8965 or 909-382-8906 to coordinate a pick-up of waste materials and surplus chemicals, via the designated hazardous waste contractor (EMT).

15.0 STORAGE

Ideally, formaldehyde, phenol, and glutaraldehyde should be stored in a cool, dry, wellventilated cabinet in an unbreakable, chemically resistant secondary container to contain spills. Containers of formaldehyde, phenol, and glutaraldehyde should be protected from physical damage and ignition sources. Phenol should be stored separately from strong oxidizers, acids, and halogens; Formaldehyde should not be stored with inorganic acids, caustics, strong alkalies, isocyanates, anhydrides or oxidizing agents; and glutaraldehyde should be stored away from incompatibles such as oxidizing agents, alkalis. The storage area should exhibit a sign warning of the presence and hazards of formaldehyde, phenol and/or glutaraldehyde. Refer to SBVC's Chemical Hygiene Plan.

16.0 REGULATORY REQUIREMENTS AND GUIDELINES (REFER TO APPENDIX A)

California Code of Regulations, Title 8, Section 5217 Formaldehyde

Occupational Health & Safety Administration, 29 CFR, Part 1910, Subpart Z, Standard 1910.1048 Formaldehyde

Occupational Safety & Health Guideline for Phenol

Occupational Safety & Health Administration – Best Practices for the Safe Use of Glutaraldehyde in Health Care

Occupational Safety & Health Administration – Healthcare Wide Hazards – Glutaraldehyde

Department of Health Services, Hazard Evaluation System and Information Service – Glutaraldehyde Fact Sheet (dated November 1995



Appendix A Regulatory Requirements and Guidelines This information is provided free of charge by the Department of Industrial Relations from its web site at <u>www.dir.ca.gov</u>. These regulations are for the convenience of the user and no representation or warranty is made that the information is current or accurate. See full disclaimer at <u>http://www.dir.ca.gov/od_pub/disclaimer.html</u>.

Subchapter 7. General Industry Safety Orders Group 16. Control of Hazardous Substances Article 110. Regulated Carcinogens

Return to index New query

§5217. Formaldehyde.

(a) Scope and application. This standard applies to all occupational exposures to formaldehyde, i.e. from formaldehyde gas, its solutions, and materials that release formaldehyde.

(b) Definitions. For purposes of this standard, the following definitions shall apply:

Action level. Action level means a concentration of 0.5 part formaldehyde per million parts of air (0.5 ppm) calculated as an eight (8)-hour time-weighted average (TWA) concentration.

Authorized Person. Authorized person means any person required by work duties to be present in regulated areas, or authorized to do so by the employer, by this section, or by the California Occupational Safety and Health Act of 1973.

Chief. The Chief of the Division of Occupational Safety and Health, or designee.

Director. Director means the Director of the National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services, or designee.

Emergency. An emergency is any occurrence, such as but not limited to equipment failure, rupture of containers, or failure of control equipment that results in an uncontrolled release of a significant amount of formaldehyde.

Employee exposure. Employee exposure means the exposure to airborne formaldehyde which would occur without corrections for protection provided by any respirator that is in use.

Formaldehyde. Formaldehyde means the chemical substance, HCHO, Chemical Abstracts Service Registry No. 50-00-0.

(c) Permissible Exposure Limit (PEL)

(1) Time Weighted Average (TWA): The employer shall assure that no employee is exposed to a concentration www.dir.ca.gov/title8/5217.html

of airborne formaldehyde which exceeds 0.75 parts formaldehyde per million parts of air (0.75 ppm) as an 8-hour TWA.

(2) Short Term Exposure Limit (STEL): The employer shall assure that no employee is exposed to a concentration of airborne formaldehyde which exceeds two parts formaldehyde per million parts of air (2 ppm) as a 15 minute STEL.

(d) Exposure monitoring

(1) General.

(A) Each employer who has a workplace covered by this standard shall monitor employees to determine their exposure to formaldehyde.

(B) Exceptions.

Where the employer documents, using objective data, that the presence of formaldehyde or formaldehydereleasing products in the workplace cannot result in concentrations of airborne formaldehyde that would cause any employee to be exposed at or above the action level or at or above the STEL under foreseeable conditions of use, the employer will not be required to measure employee exposure to formaldehyde.

(C) When an employee's exposure is determined from representative sampling, the measurements used shall be representative of the employee's full shift or short-term exposure to formaldehyde, as appropriate.

(D) Representative samples for each job classification in each work area shall be taken for each shift unless the employer can document with objective data that exposure levels for a given job classification are equivalent for different work shifts.

(2) Initial monitoring. The employer shall identify all employees who may be exposed at or above the action level or at or above the STEL and accurately determine the exposure of each employee so identified.

(A) Unless the employer chooses to measure the exposure of each employee potentially exposed to formaldehyde, the employer shall develop a representative sampling strategy and measure sufficient exposures within each job classification for each workshift to correctly characterize and not underestimate the exposure of any employee within each exposure group.

(B) The initial monitoring process shall be repeated each time there is a change in production, equipment, process, personnel, or control measures which may result in new or additional exposure to formaldehyde.

(C) If the employer receives reports of signs or symptoms of respiratory or dermal conditions associated with formaldehyde exposure, the employer shall promptly monitor the affected employee's exposure.

(3) Periodic monitoring.

(A) The employer shall periodically measure and accurately determine exposure to formaldehyde for employees shown by the initial monitoring to be exposed at or above the action level or at or above the STEL.

(B) If the last monitoring results reveal employee exposure at or above the action level, the employer shall repeat

monitoring of the employees at least every 6 months.

(C) If the last monitoring results reveal employee exposure at or above the STEL, the employer shall repeat monitoring of the employees at least once a year under worst conditions.

(4) Termination of monitoring. The employer may discontinue periodic monitoring of employees if results from two consecutive sampling periods taken at least 7 days apart show that employee exposure is below the action level and the STEL. The results must be statistically representative and consistent with the employer's knowledge of the job and work operation.

(5) Accuracy of monitoring. Monitoring shall be accurate, at the 95 percent confident level, to within plus or minus 25 percent for concentrations of airborne formaldehyde at the TWA and the STEL, and to within plus or minus 35 percent for concentrations of airborne formaldehyde at the action level.

(6) Employee notification of monitoring results. Within 15 days of receiving the results of exposure monitoring conducted under this standard, the employer shall notify the affected employees of these results. Notification shall be in writing, either by distributing copies of the results to the employees or by posting the results. If the employee exposure is over either PEL, the employer shall develop and implement a written plan to reduce employee exposure to or below both PELs, and give written notice to employees. The written notice shall contain a description of the corrective action being taken by the employer to decrease exposure.

(7) Observation of monitoring.

(A) The employer shall provide affected employees or their designated representatives an opportunity to observe any monitoring of employee exposure to formaldehyde required by this standard.

(B) When observation of the monitoring of employee exposure to formaldehyde requires entry into an area where the use of protective clothing or equipment is required, the employer shall provide the clothing and equipment to the observer, require the observer to use such clothing and equipment, and assure that the observer complies with all other applicable safety and health procedures.

(e) Regulated areas

(1) The employer shall establish regulated areas where the concentration of airborne formaldehyde exceeds either the TWA or the STEL, and post all entrances and accessways with signs bearing the following information:

DANGER FORMALDEHYDE IRRITANT AND POTENTIAL CANCER HAZARD AUTHORIZED PERSONNEL ONLY

(2) The employer shall limit access to regulated areas to authorized persons who have been trained to recognize the hazards of formaldehyde.

(3) An employer at a multi-employer worksite who establishes a regulated area shall communicate the access restrictions and locations of these areas to other employers with work operations at that worksite.

(f) Methods of compliance

(1) Engineering controls and work practices. The employer shall institute engineering and work practice controls

to reduce and maintain employee exposures to formaldehyde at or below the TWA and the STEL.

(2) Exception. Whenever the employer has established that feasible engineering and work practice controls cannot reduce employee exposure to or below either of the PELs, the employer shall apply these controls to reduce employee exposures to the extent feasible and shall supplement them with respirators which satisfy this standard.

(g) Respiratory protection

(1) General. For employees who are required to use respirators by this section, the employer must provide respirators that comply with the requirements of this subsection. Respirators must be used during:

(A) Periods necessary to install or implement feasible engineering and work practice controls;

(B) Work operations, such as maintenance and repair activities or vessel cleaning, for which the employer establishes that engineering and work practice controls are not feasible;

(C) Work operations for which feasible engineering and work practice controls are not yet sufficient to reduce exposure to or below the PELS; and

(D) Emergencies.

(2) Respirator program.

(A) The employer must implement a respiratory protection program in accordance with section 5144 (b) through (d) (except (d)(1)(C)), and (f) through (m).

(B) When employees use air-purifying respirators with chemical-cartridges or canisters that do not contain endof-service-life indicators approved by the National Institute for Occupational Safety and Health, employers shall replace these cartridges or canisters as specified by subsection (d)(3)(C)(2)(b) of Section 5144, or at the end of the workshift, whichever condition occurs first.

(3) Respirator selection.

(A) The employer must select, and provide to employees, the appropriate respirators specified in Section 5144(d)(3)(A)1.

(B) The employer shall make available a powered air purifying respirator, adequate to protect against formaldehyde exposure to any employee who experiences difficulty wearing a negative pressure respirator to reduce exposure to formaldehyde.

(C) The employer shall equip each air-purifying, full facepiece respirator with a canister or cartridge approved for protection against formaldehyde.

(D) For escape, the employer shall provide employees with one of the following respirator options: A selfcontained breathing apparatus operated in the demand or pressure-demand mode; or a full facepiece respirator having a chin-style, or a front- or back-mounted industrial-size, canister or cartridge approved for protection against formaldehyde.

(E) Employers may substitute an air-purifying, half mask respirator for an air-purifying, full facepiece respirator when they equip the half mask respirator with a cartridge approved for protection against formaldehyde and provide the affected employee with effective gas-proof goggles.

(h) Protective equipment and clothing. Employers shall comply with the provisions of Sections 3380, 3382, 3383 and 3384. When protective equipment or clothing is provided under these provisions, the employer shall provide these protective devices at no cost to the employee and assure that the employee wears them.

(1) Selection. The employer shall select protective clothing and equipment based upon the form of formaldehyde to be encountered, the conditions of use, and the hazard to be prevented.

(A) All contact of the eyes and skin with liquids containing 1 percent or more formaldehyde shall be prevented by the use of chemical protective clothing made of material impervious to formaldehyde and the use of other personal protective equipment, such as goggles and face shields, as appropriate to the operation.

(B) Contact with irritating or sensitizing materials shall be prevented to the extent necessary to eliminate the hazard.

(C) Where a face shield is worn, chemical safety goggles are also required if there is a danger of formaldehyde reaching the area of the eye.

(D) Full body protection shall be worn for entry into areas where concentrations exceed 100 ppm and for emergency reentry into areas of unknown concentration.

(2) Maintenance of protective equipment and clothing.

(A) The employer shall assure that protective equipment and clothing that has become contaminated with formaldehyde is cleaned or laundered before its reuse.

(B) When ventilating formaldehyde contaminated clothing and equipment, the employer shall establish a storage area so that employee exposure is minimized. Containers for contaminated clothing, equipment, and storage areas shall have labels and signs containing the following information:

DANGER

FORMALDEHYDE-CONTAMINATED

(CLOTHING) EQUIPMENT

AVOID INHALATION AND SKIN CONTACT

(C) The employer shall assure that only persons trained to recognize the hazards of formaldehyde remove the contaminated material from the storage area for purposes of cleaning, laundering, or disposal.

(D) The employer shall assure that no employee takes home equipment or clothing that is contaminated with formaldehyde.

(E) The employer shall repair or replace all required protective clothing and equipment for each affected employee as necessary to assure its effectiveness.

(F) The employer shall inform any person who launders, cleans, or repairs such clothing or equipment of formaldehyde's potentially harmful effects and of procedures to safely handle the clothing and equipment.

(i) Hygiene protection.

(1) The employer shall provide change rooms, as described in Section 3367 for employees who are required to change from work clothing into protective clothing to prevent skin contact with formaldehyde.

(2) If employee's skin may become splashed with solutions containing 1 percent or greater formaldehyde, for example because of equipment failure or improper work practices, the employer shall provide conveniently located quick drench showers and assure that affected employees use these facilities immediately.

(3) If there is any possibility that an employee's eyes may be splashed with solutions containing 0.1 percent or greater formaldehyde, the employer shall provide acceptable eyewash facilities within the immediate work area for emergency use.

(j) Housekeeping. For operations involving formaldehyde liquids or gas, the employer shall conduct a program to detect leaks and spills, including regular visual inspections.

(1) Preventative maintenance of equipment, including surveys for leaks, shall be undertaken at regular intervals.

(2) In work areas where spillage may occur, the employer shall make provisions to contain the spill, to decontaminate the work area, and to dispose of the waste.

(3) The employer shall assure that all leaks are repaired and spills are cleaned promptly by employees wearing suitable protective equipment and trained in proper methods for cleanup and decontamination.

(4) Formaldehyde contaminated waste and debris resulting from leaks or spills shall be placed for disposal in sealed containers bearing a label warning of formaldehyde's presence and of the hazards associated with formaldehyde.

(k) Emergencies. For each workplace where there is the possibility of an emergency involving formaldehyde, the employer shall assure appropriate procedures are adopted to minimize injury and loss of life. Appropriate procedures shall be implemented in the event of an emergency.

(l) Medical surveillance

(1) Employees covered.

(A) The employer shall institute medical surveillance programs for all employees exposed to formaldehyde at concentrations at or exceeding the action level or exceeding the STEL.

(B) The employer shall make medical surveillance available for employees who develop signs and symptoms of overexposure to formaldehyde and for all employees exposed to formaldehyde in emergencies. When determining whether an employee may be experiencing signs and symptoms of possible overexposure to formaldehyde, the employer may rely on the evidence that signs and symptoms associated with formaldehyde exposure will occur only in exceptional circumstances when airborne exposure is less than 0.1 ppm and when formaldehyde is present in materials in concentrations less than 0.1 percent.

(2) Examination by a physician. All medical procedures, including administration of medical disease questionnaires, shall be performed by or under the supervision of a licensed physician and shall be provided without cost to the employee, without loss of pay, and at a reasonable time and place.

(3) Medical disease questionnaire. The employer shall make the following medical surveillance available to employees prior to assignment to a job where formaldehyde exposure is at or above the action level or above the STEL, and annually thereafter. The employer shall also make the following medical surveillance available promptly upon determining that an employee is experiencing signs and symptoms indicative of possible overexposure to formaldehyde.

(A) Administration of a medical disease questionnaire, such as in Appendix D, which is designed to elicit information on work history, smoking history, any evidence of eye, nose, or throat irritation; chronic airway problems or hyperactive airway disease; allergic skin conditions or dermatitis; and upper or lower respiratory problems.

(B) A determination by the physician based on evaluation of the medical disease questionnaire, of whether a medical examination is necessary for employees not required to wear respirators to reduce exposure to formaldehyde.

(4) Medical examinations. Medical examinations shall be given to any employee who the physician feels, based on information in the medical disease questionnaire, may be of increased risk from exposure to formaldehyde and at the time of initial assignment and at least annually thereafter to all employees required to wear a respirator to reduce exposure to formaldehyde. The medical examination shall include:

(A) A physical examination with emphasis on evidence of irritation or sensitization of the skin and respiratory system, shortness of breath, or irritation of the eyes.

(B) Laboratory examinations for respirator wearers consisting of baseline and annual pulmonary function tests. As a minimum, these tests shall consist of forced vital capacity (FVC), forced expiratory volume in one second (FEVI), and forced expiratory flow (FEF).

(C) Any other test which the examining physician deems necessary to complete the written opinion.

(D) Counseling of employees having medical conditions that would be directly or indirectly aggravated by exposure to formaldehyde on the increased risk of impairment of their health.

(5) Examinations for employees exposed in an emergency. The employer shall make medical examinations available as soon as possible to all employees who have been exposed to formaldehyde in an emergency.

(A) The examination shall include a medical and work history with emphasis on any evidence of upper or lower respiratory problems, allergic conditions, skin reaction or hypersensitivity, and any evidence of eye, nose, or throat irritation.

(B) Other examinations shall consist of those elements considered appropriate by the examining physician.

(6) Information provided to the physician. The employer shall provide the following information to the examining physician:

(A) A copy of this standard and Appendices A, C, D, and E;

(B) A description of the affected employee's job duties as they relate to the employee's exposure to formaldehyde;

(C) The representative exposure level for the employee's job assignment;

(D) Information concerning any personal protective equipment and respiratory protection used or to be used by the employee;

(E) Information from previous medical examinations of the affected employee within the control of the employer; and

(F) In the event of a non-routine examination because of an emergency, the employer shall provide to the physician as soon as possible a description of how the emergency occurred and the exposure the victim may have received.

(7) Physician's written opinion.

(A) For each examination required under this standard, the employer shall obtain a written opinion from the examining physician. This written opinion shall contain the results of the medical examination except that it shall not reveal specific findings or diagnoses unrelated to occupational exposure to formaldehyde. The written opinion shall include:

1. The physician's opinion as to whether the employee has any medical condition that would place the employee at an increased risk of material impairment of health from exposure to formaldehyde;

2. Any recommended limitations on the employee's exposure or changes in the use of personal protective equipment, including respirators; and

3. A statement that the employee has been informed by the physician of any medical conditions which would be aggravated by exposure to formaldehyde, whether these conditions may have resulted from past formaldehyde exposure or from exposure in an emergency, and whether there is a need for further examination or treatment.

(B) The employer shall provide for retention of the results of the medical examination and tests conducted by the physician.

(C) The employer shall provide a copy of the physician's written opinion to the affected employee within 15 days of its receipt.

(8) Medical removal.

(A) The provisions of subsection (l)(8) apply when an employee reports significant irritation of the mucosa of the eyes or of the upper airways, respiratory sensitization, dermal irritation, or dermal sensitization attributed to workplace formaldehyde exposure. Medical removal provisions do not apply in the case of dermal irritation or dermal sensitization when the product suspected of causing the dermal condition contains less than 0.05% formaldehyde.

(B) An employee's report of signs or symptoms of possible overexposure to formaldehyde shall be evaluated by a physician, selected by the employer pursuant to subsection (1)(3). If the physician determines that a medical examination is not necessary under subsection (1)(3)(B), there shall be a two-week evaluation and remediation period to permit the employer to ascertain whether the signs or symptoms subside untreated or with the use of creams, gloves, first aid treatment or personal protective equipment. Industrial hygiene measures that limit the employee's exposure to formaldehyde may also be implemented during this period. The employee shall be referred immediately to a physician prior to expiration of the two-week period if the signs or symptoms worsen. Earnings, seniority and benefits may not be altered during the two-week period by virtue of the report.

(C) If the signs or symptoms have not subsided or been remedied by the end of the two-week period, or earlier if signs or symptoms warrant, the employee shall be examined by a physician selected by the employer. The physician shall presume, absent contrary evidence, that observed dermal irritation or dermal sensitization are not attributable to formaldehyde when products to which the affected employee is exposed contain less than 0.1% formaldehyde.

(D) Medical examinations shall be conducted in compliance with the requirements of subsection (l)(5)(A) and (B). Additional guidelines for conducting medical exams are contained in Appendix C.

(E) If the physician finds that significant irritation of the mucosa of the eyes or of the upper airways, respiratory sensitization, dermal irritation, or dermal sensitization result from workplace formaldehyde exposure and recommends restrictions or removal, the employer shall promptly comply with the restrictions or recommendation of removal. In the event of a recommendation of removal, the employee shall remove the affected employee from the current formaldehyde exposure and if possible, transfer the employee to work having no or significantly less exposure to formaldehyde.

(F) When an employee is removed pursuant to subsection (I)(8)(E), the employer shall transfer the employee to comparable work for which the employee is qualified or can be trained in a short period (up to 6 months), where the formaldehyde exposures are as low as possible, but not higher than the action level. The employer shall maintain the employee's current earnings, seniority, and other benefits. If there is no such work available, the employer shall maintain the employee's current earnings, seniority and other benefits until such work becomes available, until the employee is determined to be unable to return to workplace formaldehyde exposure, until the employee is determined to the original job status, or for six months, whichever comes first.

(G) The employer shall arrange for a follow-up medical examination to take place within six months after the employee is removed pursuant to this subsection. This examination shall determine if the employee can return to the original job status, or if the removal is to be permanent. The physician shall make a decision within six months of the date the employee was removed as to whether the employee can be returned to the original job status, or if the removal is to be permanent.

(H) An employer's obligation to provide earnings, seniority and other benefits to a removed employee may be reduced to the extent that the employee receives compensation for earnings lost during the period of removal either from a publicly or employer-funded compensation program or from employment with another employer made possible by virtue of the employee's removal.

(I) In making determinations of the formaldehyde content of materials under this subsection the employer may rely on objective data.

(9) Multiple physician review.

(A) After the employer selects the initial physician who conducts any medical examination or consultation to determine whether medical removal or restriction is appropriate, the employee may designate a second physician to review any findings, determinations or recommendations of the initial physician and to conduct such examinations, consultations, and laboratory tests as the second physician deems necessary and appropriate to evaluate the effects of formaldehyde exposure and to facilitate this review.

(B) The employer shall promptly notify an employee of the right to seek a second medical opinion after each occasion that an initial physician conducts a medical examination or consultation for the purpose of medical removal or restriction.

(C) The employer may condition its participation in, and payment for, the multiple physician review mechanism upon the employee doing the following within fifteen (15) days after receipt of the notification of the right to seek a second medical opinion, or receipt of the initial physician's written opinion, whichever is later;

1. The employee informs the employer of the intention to seek a second medical opinion, and

2. The employee initiates steps to make an appointment with a second physician.

(D) If the findings, determinations or recommendations of the second physician differ from those of the initial physician, then the employer and the employee shall assure that efforts are made for the two physicians to resolve the disagreement. If the two physicians are unable to quickly resolve their disagreement, then the employer and the employee through their respective physicians shall designate a third physician who shall be a specialist in the field at issue:

1. To review the findings, determinations or recommendations of the prior physicians; and

2. To conduct such examinations, consultations, laboratory tests and discussions with the prior physicians as the third physician deems necessary to resolve the disagreement of the prior physicians.

(E) In the alternative, the employer and the employee or authorized employee representative may jointly designate such third physician.

(F) The employer shall act consistent with the findings, determinations and recommendations of the third physician, unless the employer and the employee reach an agreement which is otherwise consistent with the recommendations of at least one of the three physicians.

(m) Hazard communication

(1) General. Communication of the hazards associated with formaldehyde in the workplace shall be governed by the requirements of this subsection. The definitions of Section 5194(c) shall apply under this subsection.

(A) The following shall be subject to the hazard communication requirements of this subsection: formaldehyde gas, all mixtures or solutions composed of greater than 0.1 percent formaldehyde, and materials capable of releasing formaldehyde into the air, under reasonably foreseeable conditions of use, at concentrations reaching or exceeding 0.1 ppm.

(B) As a minimum, specific health hazards that the employer shall address are: cancer, irritation and sensitization of the skin and respiratory system, eye and throat irritation, and acute toxicity.

(2) Manufacturers and importers who produce or import formaldehyde or formaldehyde-containing products shall provide downstream employers using or handling these products with an objective determination through the required labels and MSDSs if these items may constitute a health hazard within the meaning of Section 5194(d) under normal conditions of use.

(3) Labels.

(A) The employer shall assure that hazard warning labels complying with the requirements of Section 5194(f) are affixed to all containers of materials listed in subsection (m)(1)(A), except to the extent that Section 5194(f) is inconsistent with this subsection.

(B) Information on labels. As a minimum, for all materials listed in subsection (m)(1)(A) capable of releasing formaldehyde at levels of 0.1 ppm to 0.5 ppm, labels shall identify that the product contains formaldehyde; list the name and address of the responsible party; and state that physical and health hazard information is readily available from the employer and from material safety data sheets.

(C) For materials listed in subsection (m)(1)(A) capable of releasing formaldehyde at levels above 0.5 ppm, labels shall appropriately address all hazards as defined in Section 5194(d) and Section 5194 Appendices A and B, including respiratory sensitization, and shall contain the words "Potential Cancer Hazard."

(D) In making the determinations of anticipated levels of formaldehyde release, the employer may rely on objective data indicating the extent of potential formaldehyde release under reasonably foreseeable conditions of use.

(E) Substitute warning labels. The employer may use warning labels required by other statutes, regulations, or ordinances which impart the same information as the warning statements required by this subsection.

(4) Material safety data sheets.

(A) Any employer who uses formaldehyde-containing materials listed in subsection (m)(1)(A) shall comply with the requirements in Section 5194(g) with regard to the development and updating of material safety data sheets

(B) Manufacturers, importers, and distributors of formaldehyde-containing materials listed in subsection (m)(1)(A) shall assure that material safety data sheets and updated information are provided to all employers purchasing such materials at the time of the initial shipment and at the time of the first shipment after a material safety data sheet is updated.

(5) Written hazard communication program. The employer shall develop, implement, and maintain at the workplace, a written hazard communication program for formaldehyde exposures in the workplace, which at a minimum describes how the requirements specified in this subsection for labels and other forms of warning and material safety data sheets, and subsection (n) for employee information and training, will be met. Employers in multi-employer workplaces shall comply with the requirements of Section 5194(e)(2).

(n) Employee information and training

(1) Participation. The employer shall assure that all employees who are assigned to workplaces where there is exposure to formaldehyde participate in a training program, except that where the employer can show, using objective data, that employees are not exposed to formaldehyde at or above 0.1 ppm, the employer is not required to provide training.

(2) Frequency.

Employers shall provide such information and training to employees at the time of initial assignment and whenever a new exposure to formaldehyde is introduced into their work area. The training shall be repeated at least annually.

(3) Training program. The training program shall be conducted in a manner which the employee is able to understand and shall include:

(A) A discussion of the contents of this regulation and the contents of the Material Safety Data Sheet;

(B) The purpose for and a description of the medical surveillance program required by this standard, including:

1. A description of the potential health hazards associated with exposure to formaldehyde and a description of the signs and symptoms of exposure to formaldehyde.

2. Instructions to immediately report to the employer the development of any adverse signs or symptoms that the employee suspects is attributable to formaldehyde exposure.

(C) Description of operations in the work area where formaldehyde is present and an explanation of the safe work practices appropriate for limiting exposure to formaldehyde to each job;

(D) The purpose for, proper use of, and limitations of personal protective clothing and equipment;

(E) Instructions for the handling of spills, emergencies, and clean-up procedures;

(F) An explanation of the importance of engineering and work practice controls for employee protection and any necessary instruction in the use of these controls; and

(G) A review of emergency procedures including the specific duties or assignments of each employee in the event of an emergency.

(4) Access to training materials.

(A) The employer shall inform all affected employees of the location of written training materials and shall make these materials readily available, without cost, to the affected employees.

(B) The employer shall provide, upon request, all training materials relating to the employee training program to the Chief and the Director.

(o) Recordkeeping

(1) Exposure measurements. The employer shall establish and maintain an accurate record of all measurements taken to monitor employee exposure to formaldehyde. This record shall include:

(A) The date of measurement;

(B) The operation being monitored;

(C) The methods of sampling and analysis and evidence of their accuracy and precision;

(D) The number, durations, time, and results of samples taken;

(E) The types of protective devices worn; and

(F) The names, job classifications, social security numbers, and exposure estimates of the employees whose exposures are represented by the actual monitoring results.

(2) Exposure determinations. Where the employer has determined that no monitoring is required under this standard, the employer shall maintain a record of the objective data relied upon to support the determination that no employee is exposed to formaldehyde at or above the action level.

(3) Medical surveillance. The employer shall establish and maintain an accurate record for each employee subject to medical surveillance under this standard. This record shall include:

(A) The name and social security number of the employee;

(B) The physician's written opinion;

(C) A list of any employee health complaints that may be related to exposure to formaldehyde; and

(D) A copy of the medical examination results, including medical disease questionnaires and results of any medical tests required by the standard or mandated by the examining physician.

(4) Respirator fit testing.

(A) The employer shall establish and maintain accurate records for employees subject to negative pressure respirator fit testing required by this standard.

(B) This record shall include:

1. A copy of the protocol selected for respirator fit testing.

2. A copy of the results of any fit testing performed.

3. The size and manufacturer of the types of respirator available for selection.

4. The date of the most recent fit testing, the name and social security number of each tested employee, and the respirator type and facepiece selected.

(5) Record retention. The employer shall retain records required by this standard for at least the following periods:

(A) Exposure records and determinations shall be kept for at least 30 years.
California Code of Regulations, Title 8, Section 5217. Formaldehyde.

(B) Medical records shall be kept for the duration of employment plus 30 years.

(C) Respirator fit testing records shall be kept until replaced by a more recent record.

(6) Availability of records.

(A) Upon request, the employer shall make all records maintained as a requirement of this standard available for examination and copying to the Chief and the Director.

(B) The employer shall make employee exposure records, including estimates made from representative monitoring and available upon request for examination, and copying to the subject employee, or former employee, and employee representative in accordance with section 3204.

(C) Employee medical records required by this standard shall be provided upon request for examination and copying, to the subject employee or former employee or to anyone having the specific written consent of the subject employee or former employee in accordance with Section 3204(a)-(e) and (g)-(i).

(p) Reporting requirements See section 5203.

(q) Delayed Effective Dates. The amendments to the following subsections have a delayed effective date:

(1) Respiratory protection. Respiratory protection required to meet the amended PEL of 0.75 ppm TWA shall be provided as soon as possible but no later than March 24, 1993.

(2) Engineering and work practice controls. Engineering and work practice controls required to meet the amended PEL of 0.75 ppm TWA shall be implemented as soon as possible, but no later than December 26, 1993.

(3) Medical removal protection. The medical removal protection provisions including the multiple physician review mechanism shall be implemented no later than June 28, 1993.

(4) Hazard communication. The labeling provisions contained in amended subsection (m) of this standard shall be implemented no later than June 28, 1993. Labeling of containers of formaldehyde products shall continue to comply with the provisions of Section 5194(e)-(j) until that time.

(5) Training. The periodic training mandated for all employees exposed to formaldehyde between 0.1 ppm and 0.5 ppm shall begin no later than February 25, 1993.

(r) Appendices. The information contained in Appendices A, B, C, and D is not intended, by itself, to create any additional obligations not otherwise imposed or to detract from any existing obligations. The protocols on respiratory fit testing in Appendix E are mandatory.

Note: Authority cited: Sections 142.3, 9020, 9030 and 9040, Labor Code. Reference: Sections 142.3, 9004(d), 9009, 9020, 9030, 9031 and 9040, Labor Code.

HISTORY 1. New section and Appendices A-E filed 3-5-90; operative 4-4-90 (Register 90, No. 11). For history of former section 5217, see Registers 87, No. 51 and 86, No. 47.

2. Change without regulatory effect amending section filed 11-21-90 pursuant to section 100, title 1, California www.dir.ca.gov/title8/5217.html

14/15

California Code of Regulations, Title 8, Section 5217. Formaldehyde.

Code of Regulations (Register 91, No. 2).

3. Amendment of subsection (c)(1), table 1, subsections (g)(3)(D), (n)(1)-(2) and Appendix 1, repeal of subsections (d)(1)(B)1., (m)(1) and (n)(2)(B) and new subsections (d)(2)(C), (l)(8)(A)-(m)(5) and (q)-(q)(5) and relettering filed 12-9-92; operative 1-8-93 (Register 92, No. 50).

4. Change without regulatory effect amending subsection (o)(6)(C) filed 3-30-93 pursuant to section 100, title 1, California Code of Regulations (Register 93, No. 14).

5. Editorial corrections (Register 95, No. 24).

6. Amendment of former subsections (g)(1)-(g)(3)(E) including subsection renumbering and relettering resulting in newly designated subsections (g)(1)-(g)(3)(B), and amendment repealing appendix E and adding editorial reference filed 8-25-98; operative 11-23-98 (Register 98, No. 35).

7. Editorial correction moving Noteand Histories1-6 from following Appendix E to preceding Appendix A (Register 99, No. 28).

8. Amendment of subsection (p) and repealer of subsections (p)(1)-(3) filed 7- 6-99; operative 8-5-99 (Register 99, No. 28).

9. Editorial correction of subsections (0)(2) and (0)(3) (Register 2007, No. 6).

10. Amendment of subsections (g)(2)(A)-(B), repealer of subsections (g)(2)(B)1.-2., amendment of subsections (h)(3)(A)-(B) and new subsections (h)(3)(C)-(h)(3)(E) filed 3-6-2007; operative 3-6-2007. Submitted to OAL for printing only pursuant to Labor Code section 142.3(a)(3) (Register 2007, No. 10).

Go Back to Article 110 Table of Contents



SEARCH

OSHA		OSHA Quic	A to Z Index	RSS Feeds	Contact Us FAQs	About OSHA
Occupational Safety & Healt	h Administration	We Can Help			What's New	Offices
Home Workers Regulations	Enforcement Data & Si	itatistics Training	Publications	Newsroom	Small Business	O SHA
Regulations (Standards - 29 CFR) - Table o	<u>f Contents</u>					
 Part Number: Part Title: Subpart: Subpart Title: Standard Number: Title: Appendix: 	1910 Occupational Safety and Hea Z Toxic and Hazardous Substa <u>1910.1048</u> Formaldehyde. <u>A</u> , <u>B</u> , <u>C</u> , <u>D</u> , <u>E</u>	alth Standards ances				
1910.1048(a)						
Scope and application. This standard solutions, and materials that release	applies to all occupational exposi formaldehyde.	ures to formaldehyde, i.e	. from formaldehyd	le gas, its		
1910.1048(b)						
Definitions. For purposes of this stand	lard, the following definitions sha	all apply:				
"Action level" means a concentration hour time-weighted average (TWA) c	of 0.5 part formaldehyde per mill oncentration.	lion parts of air (0.5 ppm) calculated as an e	eight (8)-		
"Assistant Secretary" means the Assi: Department of Labor, or designee.	stant Secretary of Labor for the C	Occupational Safety and H	lealth Administratio	on, U.S.		
"Authorized Person" means any person the employer, by this section, or by the	on required by work duties to be page OSH Act of 1970.	present in regulated area	is, or authorized to	do so by		
"Director" means the Director of the I Human Services, or designee.	lational Institute for Occupational	I Safety and Health, U.S.	Department of Hea	lth and		
"Emergency" is any occurrence, such equipment that results in an uncontro	as but not limited to equipment f Iled release of a significant amou	failure, rupture of contain unt of formaldehyde.	ers, or failure of co	ontrol		
"Employee exposure" means the expo provided by any respirator that is in u	osure to airborne formaldehyde w Ise.	vhich would occur withou	t corrections for pr	otection		
"Formaldehyde" means the chemical	substance, HCHO, Chemical Abst	tracts Service Registry No	. 50-00-0.			
<u>1910.1048(c)</u>						
Permissible Exposure Limit (PEL) -						
1910.1048(c)(1)						
TWA: The employer shall assure that	no employee is exposed to an ai	irborne concentration of f	formaldehyde whic	h exceeds		
0.75 parts formaldehyde per million p	arts of air (0.75 ppm) as an 8-hc	our TWA.				
<u>1910.1048(c)(2)</u>						
Short Term Exposure Limit (STEL): T formaldehyde which exceeds two par	he employer shall assure that no ts formaldehyde per million parts	employee is exposed to s of air (2 ppm) as a 15-n	an airborne concer ninute STEL.	itration of		
<u>1910.1048(d)</u>						
Exposure monitoring -						
1910.1048(d)(1)						
General.						
1910.1048(d)(1)(i)						
Each employer who has a workplace formaldehyde.	covered by this standard shall mo	onitor employees to deter	rmine their exposu	re to		
1910.1048(d)(1)(ii)						
Exception. Where the employer docur releasing products in the workplace of to be exposed at or above the action to measure employee exposure to for	nents, using objective data, that annot result in airborne concentra level or the STEL under foreseea maldehyde.	the presence of formalde ations of formaldehyde the able conditions of use, the	ehyde or formaldeh nat would cause an e employer will not	yde- y employee be required		
1010 10/9(d)(1)(iii)						

Formaldehyde. - 1910.1048

of the employee's full shift or short-term exposure to formaldehyde, as appropriate.

1910.1048(d)(1)(iv)

Representative samples for each job classification in each work area shall be taken for each shift unless the employer can document with objective data that exposure levels for a given job classification are equivalent for different work shifts.

1910.1048(d)(2)

Initial monitoring. The employer shall identify all employees who may be exposed at or above the action level or at or above the STEL and accurately determine the exposure of each employee so identified.

l910.1048(d)(2)(i)

Unless the employer chooses to measure the exposure of each employee potentially exposed to formaldehyde, the employer shall develop a representative sampling strategy and measure sufficient exposures within each job classification for each workshift to correctly characterize and not underestimate the exposure of any employee within each exposure group.

1910.1048(d)(2)(ii)

The initial monitoring process shall be repeated each time there is a change in production, equipment, process, personnel, or control measures which may result in new or additional exposure to formaldehyde.

L910.1048(d)(2)(iii)

If the employer receives reports of signs or symptoms of respiratory or dermal conditions associated with formaldehyde exposure, the employer shall promptly monitor the affected employee's exposure.

1910.1048(d)(3)

Periodic monitoring.

1910.1048(d)(3)(i)

The employer shall periodically measure and accurately determine exposure to formaldehyde for employees shown by the initial monitoring to be exposed at or above the action level or at or above the STEL.

L910.1048(d)(3)(ii)

If the last monitoring results reveal employee exposure at or above the action level, the employer shall repeat monitoring of the employees at least every 6 months.

1910.1048(d)(3)(iii)

If the last monitoring results reveal employee exposure at or above the STEL, the employer shall repeat monitoring of the employees at least once a year under worst conditions.

1910.1048(d)(4)

Termination of monitoring. The employer may discontinue periodic monitoring for employees if results from two consecutive sampling periods taken at least 7 days apart show that employee exposure is below the action level and the STEL. The results must be statistically representative and consistent with the employer's knowledge of the job and work operation.

1910.1048(d)(5

Accuracy of monitoring. Monitoring shall be accurate, at the 95 percent confidence level, to within plus or minus 25 percent for airborne concentrations of formaldehyde at the TWA and the STEL and to within plus or minus 35 percent for airborne concentrations of formaldehyde at the action level.

1910.1048(d)(6)

Employee notification of monitoring results. The employer must, within 15 working days after the receipt of the results of any monitoring performed under this section, notify each affected employee of these results either individually in writing or by posting the results in an appropriate location that is accessible to employees. If employee exposure is above the PEL, affected employees shall be provided with a description of the corrective actions being taken by the employer to decrease exposure.

1910.1048(d)(7)

Observation of monitoring.

910.1048(d)(7)(i

The employer shall provide affected employees or their designated representatives an opportunity to observe any monitoring of employee exposure to formaldehyde required by this standard.

1910.1048(d)(7)(ii)

When observation of the monitoring of employee exposure to formaldehyde requires entry into an area where the use of protective clothing or equipment is required, the employer shall provide the clothing and equipment to the observer, require the observer to use such clothing and equipment, and assure that the observer complies with all other applicable safety and health procedures.

1910.1048(e)

Regulated areas.

1910.1048(e)(1)

The employer shall establish regulated areas where the concentration of airborne formaldehyde exceeds either the TWA or the STEL and post all entrances and accessways with signs bearing the following information:

DANGER FORMALDEHYDE IRRITANT AND POTENTIAL CANCER HAZARD

Formaldehyde. - 1910.1048

AUTHORIZED PERSONNEL ONLY

1910.1048(e)(2)

The employer shall limit access to regulated areas to authorized persons who have been trained to recognize the hazards of formaldehyde.

1910.1048(e)(3)

An employer at a multiemployer worksite who establishes a regulated area shall communicate the access restrictions and locations of these areas to other employers with work operations at that worksite.

1910.1048(f)

Methods of compliance -

1910.1048(f)(1)

Engineering controls and work practices. The employer shall institute engineering and work practice controls to reduce and maintain employee exposures to formaldehyde at or below the TWA and the STEL.

L910.1048(f)(2)

Exception. Whenever the employer has established that feasible engineering and work practice controls cannot reduce employee exposure to or below either of the PELs, the employer shall apply these controls to reduce employee exposures to the extent feasible and shall supplement them with respirators which satisfy this standard.

1910.1048(g)

Respiratory protection.

1910.1048(g)(1)

General. For employees who use respirators required by this section, the employer must provide each employee an appropriate respirator that complies with the requirements of this paragraph. Respirators must be used during:

1910.1048(g)(1)(i)

Periods necessary to install or implement feasible engineering and work-practice controls.

1910.1048(g)(1)(ii)

Work operations, such as maintenance and repair activities or vessel cleaning, for which the employer establishes that engineering and work-practice controls are not feasible.

1910.1048(g)(1)(iii)

Work operations for which feasible engineering and work- practice controls are not yet sufficient to reduce employee exposure to or below the PELs.

1910.1048(g)(1)(iv)

Emergencies.

1910.1048(g)(2)

Respirator program.

l910.1048(g)(2)(i)

The employer must implement a respiratory protection program in accordance with § 1910.134(b) through (d) (except (d)(1) (iii), (d)(3)(iii)(b)(1), and (2)), and (f) through (m), which covers each employee required by this section to use a respirator.

1910.1048(g)(2)(ii)

When employees use air-purifying respirators with chemical cartridges or canisters that do not contain end-of-service-life indicators approved by the National Institute for Occupational Safety and Health, employers must replace these cartridges or canisters as specified by paragraphs (d)(3)(iii)(B)(1) and (B)(2) of 29 CFR 1910.134, or at the end of the workshift, whichever condition occurs first.

1910.1048(g)(2)(ii)(A)

Replace the cartridge after three (3) hours of use or at the end of the workshift, whichever occurs first, unless the cartridge contains a NIOSH-approved end-of-service-life indicator (ESLI) to show when breakthrough occurs.

1910.1048(g)(2)(ii)(B)

Unless the canister contains a NIOSH-approved ESLI to show when breakthrough occurs, replace canisters used in atmospheres up to 7.5 ppm (10xPEL) every four (4) hours and industrial-sized canisters used in atmospheres up to 75 ppm (100xPEL) every two (2) hours, or at the end of the workshift, whichever occurs first.

1910.1048(g)(3)

Respirator selection.

1910.1048(g)(3)(i)

Employers must:

1910.1048(g)(3)(i)(A)

Select, and provide to employees, the appropriate respirators specified in paragraph (d)(3)(i)(A) of 29 CFR 1910.134.

1910.1048(g)(3)(i)(B)

Equip each air-purifying, full facepiece respirator with a canister or cartridge approved for protection against formaldehyde.

1910.1048(g)(3)(i)(C)

Formaldehyde. - 1910.1048

For escape, provide employees with one of the following respirator options: A self-contained breathing apparatus operated in the demand or pressure-demand mode; or a full facepiece respirator having a chin-style, or a front-or back-mounted industrial-size, canister or cartridge approved for protection against formaldehyde.

1910.1048(g)(3)(ii)

Employers may substitute an air-purifying, half mask respirator for an air-purifying, full facepiece respirator when they equip the half mask respirator with a cartridge approved for protection against formaldehyde and provide the affected employee with effective gas-proof goggles.

1910.1048(g)(3)(iii)

Employers must provide employees who have difficulty using negative pressure respirators with powered air-purifying respirators permitted for use under paragraph (g)(3)(i)(A) of this standard and that affords adequate protection against formaldehyde exposures.

1910.1048(h)

Protective equipment and clothing. Employers shall comply with the provisions of 29 CFR 1910.132 and 29 CFR 1910.133. When protective equipment or clothing is provided under these provisions, the employer shall provide these protective devices at no cost to the employee and assure that the employee wears them.

1910.1048(h)(1)

Selection. The employer shall select protective clothing and equipment based upon the form of formaldehyde to be encountered, the conditions of use, and the hazard to be prevented.

1910.1048(h)(1)(i)

All contact of the eyes and skin with liquids containing 1 percent or more formaldehyde shall be prevented by the use of chemical protective clothing made of material impervious to formaldehyde and the use of other personal protective equipment, such as goggles and face shields, as appropriate to the operation.

1910.1048(h)(1)(ii)

Contact with irritating or sensitizing materials shall be prevented to the extent necessary to eliminate the hazard.

1910.1048(h)(1)(iii)

Where a face shield is worn, chemical safety goggles are also required if there is a danger of formaldehyde reaching the area of the eye.

1910.1048(h)(1)(iv)

Full body protection shall be worn for entry into areas where concentrations exceed 100 ppm and for emergency reentry into areas of unknown concentration.

1910.1048(h)(2)

Maintenance of protective equipment and clothing.

1910.1048(h)(2)(i)

The employer shall assure that protective equipment and clothing that has become contaminated with formaldehyde is cleaned or laundered before its reuse.

1910.1048(h)(2)(ii)

When ventilating formaldehyde-contaminated clothing and equipment, the employer shall establish a storage area so that employee exposure is minimized. Containers for contaminated clothing and equipment and storage areas shall have labels and signs containing the following information:

DANGER FORMALDEHYDE-CONTAMINATED [CLOTHING] EQUIPMENT AVOID INHALATION AND SKIN CONTACT

1910.1048(h)(2)(iii)

The employer shall assure that only persons trained to recognize the hazards of formaldehyde remove the contaminated material from the storage area for purposes of cleaning, laundering, or disposal.

L910.1048(h)(2)(iv)

The employer shall assure that no employee takes home equipment or clothing that is contaminated with formaldehyde.

1910.1048(h)(2)(v)

The employer shall repair or replace all required protective clothing and equipment for each affected employee as necessary to assure its effectiveness.

910.1048(h)(2)(vi)

The employer shall inform any person who launders, cleans, or repairs such clothing or equipment of formaldehyde's potentially harmful effects and of procedures to safely handle the clothing and equipment.

l910.1048(i)

Hygiene protection.

1910.1048(i)(1)

The employer shall provide change rooms, as described in 29 CFR 1910.141 for employees who are required to change from work clothing into protective clothing to prevent skin contact with formaldehyde.

1910.1048(i)(2)

Formaldehyde - 1910.1048

If employees skin may become splashed with solutions containing 1 percent or greater formaldenyde, for example, because of equipment failure or improper work practices, the employer shall provide conveniently located quick drench showers and assure that affected employees use these facilities immediately.

1910.1048(i)(3

If there is any possibility that an employee's eyes may be splashed with solutions containing 0.1 percent or greater formaldehyde, the employer shall provide acceptable eyewash facilities within the immediate work area for emergency use.

1910.1048(j)

Housekeeping. For operations involving formaldehyde liquids or gas, the employer shall conduct a program to detect leaks and spills, including regular visual inspections.

1910.1048(j)(1)

Preventative maintenance of equipment, including surveys for leaks, shall be undertaken at regular intervals.

1910.1048(j)(2)

In work areas where spillage may occur, the employer shall make provisions to contain the spill, to decontaminate the work area, and to dispose of the waste.

1910.1048(j)(3)

The employer shall assure that all leaks are repaired and spills are cleaned promptly by employees wearing suitable protective equipment and trained in proper methods for cleanup and decontamination.

1910.1048(j)(4)

Formaldehyde-contaminated waste and debris resulting from leaks or spills shall be placed for disposal in sealed containers bearing a label warning of formaldehyde's presence and of the hazards associated with formaldehyde.

1910.1048(k)

Emergencies. For each workplace where there is the possibility of an emergency involving formaldehyde, the employer shall assure appropriate procedures are adopted to minimize injury and loss of life. Appropriate procedures shall be implemented in the event of an emergency.

<u>1910.1048(l)</u>

Medical surveillance -

1910.1048(l)(1)

Employees covered.

1910.1048(l)(1)(i)

The employer shall institute medical surveillance programs for all employees exposed to formaldehyde at concentrations at or exceeding the action level or exceeding the STEL.

1910.1048(l)(1)(ii)

The employer shall make medical surveillance available for employees who develop signs and symptoms of overexposure to formaldehyde and for all employees exposed to formaldehyde in emergencies. When determining whether an employee may be experiencing signs and symptoms of possible overexposure to formaldehyde, the employer may rely on the evidence that signs and symptoms associated with formaldehyde exposure will occur only in exceptional circumstances when airborne exposure is less than 0.1 ppm and when formaldehyde is present in material in concentrations less than 0.1 percent.

1910.1048(l)(2)

Examination by a physician. All medical procedures, including administration of medical disease questionnaires, shall be performed by or under the supervision of a licensed physician and shall be provided without cost to the employee, without loss of pay, and at a reasonable time and place.

1910.1048(l)(3)

Medical disease questionnaire. The employer shall make the following medical surveillance available to employees prior to assignment to a job where formaldehyde exposure is at or above the action level or above the STEL and annually thereafter. The employer shall also make the following medical surveillance available promptly upon determining that an employee is experiencing signs and symptoms indicative of possible overexposure to formaldehyde.

1910.1048(l)(3)(i)

Administration of a medical disease questionnaire, such as in Appendix D, which is designed to elicit information on work history, smoking history, any evidence of eye, nose, or throat irritation; chronic airway problems or hyperreactive airway disease: allergic skin conditions or dermatitis; and upper or lower respiratory problems.

1910.1048(l)(3)(ii)

A determination by the physician, based on evaluation of the medical disease questionnaire, of whether a medical examination is necessary for employees not required to wear respirators to reduce exposure to formaldehyde.

1910.1048(l)(4)

Medical examinations. Medical examinations shall be given to any employee who the physician feels, based on information in the medical disease questionnaire, may be at increased risk from exposure to formaldehyde and at the time of initial assignment and at least annually thereafter to all employees required to wear a respirator to reduce exposure to formaldehyde. The medical examination shall include:

1910.1048(l)(4)(i)

A physical examination with emphasis on evidence of irritation or sensitization of the skin and respiratory system, shortness of breath, or irritation of the eyes.

Formaldehyde. - 1910.1048

1910.1048(l)(4)(ii)

Laboratory examinations for respirator wearers consisting of baseline and annual pulmonary function tests. As a minimum, these tests shall consist of forced vital capacity (FVC), forced expiratory volume in one second (FEV(1)), and forced expiratory flow (FEF).

1910.1048(İ)(4)(iii)

Any other test which the examining physician deems necessary to complete the written opinion.

1910.1048(l)(4)(iv)

Counseling of employees having medical conditions that would be directly or indirectly aggravated by exposure to formaldehyde on the increased risk of impairment of their health.

1910.1048(l)(5)

Examinations for employees exposed in an emergency. The employer shall make medical examinations available as soon as possible to all employees who have been exposed to formaldehyde in an emergency.

1910.1048(l)(5)(i)

The examination shall include a medical and work history with emphasis on any evidence of upper or lower respiratory problems, allergic conditions, skin reaction or hypersensitivity, and any evidence of eye, nose, or throat irritation.

1910.1048(l)(5)(ii)

Other examinations shall consist of those elements considered appropriate by the examining physician.

1910.1048(l)(6)

Information provided to the physician. The employer shall provide the following information to the examining physician:

010.1048(l)(6)(i)

A copy of this standard and Appendix A, C, D, and E;

l910.1048(l)(6)(ii)

A description of the affected employee's job duties as they relate to the employee's exposure to formaldehyde;

l910.1048(l)(6)(iii)

The representative exposure level for the employee's job assignment;

1910.1048(l)(6)(iv)

Information concerning any personal protective equipment and respiratory protection used or to be used by the employee;

and 1910.1048(l)(6)(v)

Information from previous medical examinations of the affected employee within the control of the employer.

L910.1048(İ)(6)(vi)

In the event of a nonroutine examination because of an emergency, the employer shall provide to the physician as soon as possible: a description of how the emergency occurred and the exposure the victim may have received.

l910.1048(l)(7)

Physician's written opinion.

1910.1048(l)(7)(i)

For each examination required under this standard, the employer shall obtain a written opinion from the examining physician. This written opinion shall contain the results of the medical examination except that it shall not reveal specific findings or diagnoses unrelated to occupational exposure to formaldehyde. The written opinion shall include:

1910.1048(l)(7)(i)(A)

The physician's opinion as to whether the employee has any medical condition that would place the employee at an increased risk of material impairment of health from exposure to formaldehyde;

1910.1048(İ)(7)(i)(B)

Any recommended limitations on the employee's exposure or changes in the use of personal protective equipment, including respirators;

1910.1048(l)(7)(i)(C)

A statement that the employee has been informed by the physician of any medical conditions which would be aggravated by exposure to formaldehyde, whether these conditions may have resulted from past formaldehyde exposure or from exposure in an emergency, and whether there is a need for further examination or treatment.

1910.1048(l)(7)(ii)

The employer shall provide for retention of the results of the medical examination and tests conducted by the physician.

1910.1048(İ)(7)(iii)

The employer shall provide a copy of the physician's written opinion to the affected employee within 15 days of its receipt.

1910.1048(l)(8)

Medical removal.

1910.1048(l)(8)(i)

Formaldehyde. - 1910.1048

The provisions of paragraph (I)(8) apply when an employee reports significant irritation of the mucosa of the eyes or of the upper airways, respiratory sensitization, dermal irritation, or dermal sensitization attributed to workplace formaldehyde exposure. Medical removal provisions do not apply in the case of dermal irritation or dermal sensitization when the product suspected of causing the dermal condition contains less than 0.05 percent formaldehyde.

1910.1048(l)(8)(ii)

An employee's report of signs or symptoms of possible overexposure to formaldehyde shall be evaluated by a physician selected by the employer pursuant to paragraph (I)(3). If the physician determines that a medical examination is not necessary under paragraph (I)(3)(ii), there shall be a two-week evaluation and remediation period to permit the employer to ascertain whether the signs or symptoms subside untreated or with the use of creams, gloves, first aid treatment or personal protective equipment. Industrial hygiene measures that limit the employee's exposure to formaldehyde may also be implemented during this period. The employee shall be referred immediately to a physician prior to expiration of the two-week period if the signs or symptoms worsen. Earnings, seniority and benefits may not be altered during the two-week period by virtue of the report.

1910.1048(l)(8)(iii)

If the signs or symptoms have not subsided or been remedied by the end of the two-week period, or earlier if signs or symptoms warrant, the employee shall be examined by a physician selected by the employer. The physician shall presume, absent contrary evidence, that observed dermal irritation or dermal sensitization are not attributable to formaldehyde when products to which the affected employee is exposed contain less than 0.1 percent formaldehyde.

1910.1048(l)(8)(iv)

Medical examinations shall be conducted in compliance with the requirements of paragraph (I)(5)(i) and (ii). Additional guidelines for conducting medical exams are contained in Appendix C.

1910.1048(l)(8)(v)

If the physician finds that significant irritation of the mucosa of the eyes or of the upper airways, respiratory sensitization, dermal irritation, or dermal sensitization result from workplace formaldehyde exposure and recommends restrictions or removal, the employer shall promptly comply with the restrictions or recommendation of removal. In the event of a recommendation of removal, the employer shall remove the affected employee from the current formaldehyde exposure and if possible, transfer the employee to work having no or significantly less exposure to formaldehyde.

1910.1048(l)(8)(vi)

When an employee is removed pursuant to paragraph (I)(8)(v), the employer shall transfer the employee to comparable work for which the employee is qualified or can be trained in a short period (up to 6 months), where the formaldehyde exposures are as low as possible, but not higher than the action level. The employer shall maintain the employee's current earnings, seniority, and other benefits. If there is no such work available, the employer shall maintain the employee's current earnings, seniority and other benefits until such work becomes available, until the employee is determined to be unable to return to workplace formaldehyde exposure, until the employee is determined to be able to return to the original job status, or for six months, whichever comes first.

1910.1048(l)(8)(vii)

The employer shall arrange for a follow-up medical examination to take place within six months after the employee is removed pursuant to this paragraph. This examination shall determine if the employee can return to the original job status, or if the removal is to be permanent. The physician shall make a decision within six months of the date the employee was removed as to whether the employee can be returned to the original job status, or if the removal is to be permanent.

1910.1048(l)(8)(viii)

An employer's obligation to provide earnings, seniority and other benefits to a removed employee may be reduced to the extent that the employee receives compensation for earnings lost during the period of removal either from a publicly or employer-funded compensation program or from employment with another employer made possible by virtue of the employee's removal.

1910.1048(l)(8)(ix)

In making determinations of the formaldehyde content of materials under this paragraph the employer may rely on objective data.

1910.1048(l)(9)

Multiple physician review.

1910.1048(l)(9)(i)

After the employer selects the initial physician who conducts any medical examination or consultation to determine whether medical removal or restriction is appropriate, the employee may designate a second physician to review any findings, determinations or recommendations of the initial physician and to conduct such examinations, consultations, and laboratory tests as the second physician deems necessary and appropriate to evaluate the effects of formaldehyde exposure and to facilitate this review.

1910.1048(l)(9)(ii)

The employer shall promptly notify an employee of the right to seek a second medical opinion after each occasion that an initial physician conducts a medical examination or consultation for the purpose of medical removal or restriction.

1910.1048(l)(9)(iii)

The employer may condition its participation in, and payment for, the multiple physician review mechanism upon the employee doing the following within fifteen (15) days after receipt of the notification of the right to seek a second medical opinion, or receipt of the initial physician's written opinion, whichever is later;

1910.1048(l)(9)(iii)(A)

The employee informs the employer of the intention to seek a second medical opinion, and

1910.1048(l)(9)(iii)(B)

The employee initiates steps to make an appointment with a second physician.

1910.1048(l)(9)(iv)

If the findings, determinations or recommendations of the second physician differ from those of the initial physician, then the employer and the employee shall assure that efforts are made for the two physicians to resolve the disagreement. If the two physicians are unable to quickly resolve their disagreement, then the employer and the employee through their respective physicians shall designate a third physician who shall be a specialist in the field at issue:

1910.1048(l)(9)(iv)(A)

To review the findings, determinations or recommendations of the prior physicians; and

1910.1048(l)(9)(iv)(B)

To conduct such examinations, consultations, laboratory tests and discussions with the prior physicians as the third physician deems necessary to resolve the disagreement of the prior physicians.

1910.1048(l)(9)(v)

In the alternative, the employer and the employee or authorized employee representative may jointly designate such third physician.

1910.1048(l)(9)(vi)

The employer shall act consistent with the findings, determinations and recommendations of the third physician, unless the employer and the employee reach an agreement which is otherwise consistent with the recommendations of at least one of the three physicians.

1910.1048(m

Hazard communication -

1910.1048(m)(1)

General. Communication of the hazards associated with formaldehyde in the workplace shall be governed by the requirements of paragraph (m). The definitions of 29 CFR 1910.1200 (c) shall apply under this paragraph.

1910.1048(m)(1)(i)

The following shall be subject to the hazard communication requirements of this paragraph: formaldehyde gas, all mixtures or solutions composed of greater than 0.1 percent formaldehyde, and materials capable of releasing formaldehyde into the air, under reasonably foreseeable conditions of use, at concentrations reaching or exceeding 0.1 ppm.

1910.1048(m)(1)(ii)

As a minimum, specific health hazards that the employer shall address are: cancer, irritation and sensitization of the skin and respiratory system, eye and throat irritation, and acute toxicity.

1910.1048(m)(2)

Manufacturers and importers who produce or import formaldehyde or formaldehyde-containing products shall provide downstream employers using or handling these products with an objective determination through the required labels and MSDSs if these items may constitute a health hazard within the meaning of 29 CFR 1910.1200(d) under normal conditions of use.

1910.1048(m)(3)

Labels.

1910.1048(m)(3)(i)

The employer shall assure that hazard warning labels complying with the requirements of 29 CFR 1910.1200(f) are affixed to all containers of materials listed in paragraph (m)(1)(i), except to the extent that 29 CFR 1910.1200(f) is inconsistent with this paragraph.

1910.1048(m)(3)(ii)

Information on labels. As a minimum, for all materials listed in paragraph (m)(1)(i) capable of releasing formaldehyde at levels of 0.1 ppm to 0.5 ppm, labels shall identify that the product contains formaldehyde; list the name and address of the responsible party; and state that physical and health hazard information is readily available from the employer and from material safety data sheets.

.910.1048(m)(3)(iii)

For materials listed in paragraph (m)(1)(i) capable of releasing formaldehyde at levels above 0.5 ppm, labels shall appropriately address all hazards as defined in 29 CFR 1910.1200 (d) and 29 CFR 1910.1200 Appendices A and B, including respiratory sensitization, and shall contain the words "Potential Cancer Hazard."

1910.1048(m)(3)(iv)

In making the determinations of anticipated levels of formaldehyde release, the employer may rely on objective data indicating the extent of potential formaldehyde release under reasonably foreseeable conditions of use.

1910.1048(m)(3)(v)

Substitute warning labels. The employer may use warning labels required by other statutes, regulations, or ordinances which impart the same information as the warning statements required by this paragraph.

1910.1048(m)(4)

Material safety data sheets.

1910.1048(m)(4)(i)

Formaldehyde. - 1910.1048

Any employer who uses formaldehyde-containing materials listed in paragraph (m)(1)(i) shall comply with the requirements of 29 CFR 1910.1200(g) with regard to the development and updating of material safety data sheets.

910.1048(m)(4)(ii)

Manufacturers, importers, and distributors of formaldehyde-containing materials listed in paragraph (m)(1)(i) shall assure that material safety data sheets and updated information are provided to all employers purchasing such materials at the time of the initial shipment and at the time of the first shipment after a material safety data sheet is updated.

1910.1048(m)(5)

Written hazard communication program. The employer shall develop, implement, and maintain at the workplace, a written hazard communication program for formaldehyde exposures in the workplace, which at a minimum describes how the requirements specified in this paragraph for labels and other forms of warning and material safety data sheets, and paragraph (n) for employee information and training, will be met. Employers in multi-employer workplaces shall comply with the requirements of 29 CFR 1910.1200(e)(2).

1910.1048(n)

Employee information and training -

1910.1048(n)(1)

Participation. The employer shall assure that all employees who are assigned to workplaces where there is exposure to formaldehyde participate in a training program, except that where the employer can show, using objective data, that employees are not exposed to formaldehyde at or above 0.1 ppm, the employer is not required to provide training.

1910.1048(n)(2)

Frequency. Employers shall provide such information and training to employees at the time of initial assignment, and whenever a new exposure to formaldehyde is introduced into the work area. The training shall be repeated at least annually.

1910.1048(n)(3)

Training program. The training program shall be conducted in a manner which the employee is able to understand and shall include:

1910.1048(n)(3)(i

A discussion of the contents of this regulation and the contents of the Material Safety Data Sheet.

1910.1048(n)(3)(ii)

The purpose for and a description of the medical surveillance program required by this standard, including:

1910.1048(n)(3)(ii)(A)

A description of the potential health hazards associated with exposure to formaldehyde and a description of the signs and symptoms of exposure to formaldehyde.

1910.1048(n)(3)(ii)(B)

Instructions to immediately report to the employer the development of any adverse signs or symptoms that the employee suspects is attributable to formaldehyde exposure.

1910.1048(n)(3)(iii)

Description of operations in the work area where formaldehyde is present and an explanation of the safe work practices appropriate for limiting exposure to formaldehyde in each job;

1910.1048(n)(3)(iv)

The purpose for, proper use of, and limitations of personal protective clothing and equipment;

1910.1048(n)(3)(v)

Instructions for the handling of spills, emergencies, and clean-up procedures;

1910.1048(n)(3)(vi)

An explanation of the importance of engineering and work practice controls for employee protection and any necessary instruction in the use of these controls; and

L910.1048(n)(3)(vii)

A review of emergency procedures including the specific duties or assignments of each employee in the event of an emergency.

1910.1048(n)(4)

Access to training materials.

1910.1048(n)(4)(i)

The employer shall inform all affected employees of the location of written training materials and shall make these materials readily available, without cost, to the affected employees.

1910.1048(n)(4)(ii)

The employer shall provide, upon request, all training materials relating to the employee training program to the Assistant Secretary and the Director.

1910.1048(o)

Recordkeeping -

1910.1048(o)(1)

Formaldehyde. - 1910.1048

Exposure measurements. The employer shall establish and maintain an accurate record of all measurements taken to monitor employee exposure to formaldehyde. This record shall include:

1910.1048(o)(1)(i)

The date of measurement;

1910.1048(o)(1)(ii)

The operation being monitored;

1910.1048(o)(1)(iii)

The methods of sampling and analysis and evidence of their accuracy and precision;

1910.1048(o)(1)(iv)

The number, durations, time, and results of samples taken;

1910.1048(o)(1)(v)

The types of protective devices worn; and

1910.1048(o)(1)(vi)

The names, job classifications, social security numbers, and exposure estimates of the employees whose exposures are represented by the actual monitoring results.

1910.1048(o)(2)

Exposure determinations. Where the employer has determined that no monitoring is required under this standard, the employer shall maintain a record of the objective data relied upon to support the determination that no employee is exposed to formaldehyde at or above the action level.

1910.1048(o)(3)

Medical surveillance. The employer shall establish and maintain an accurate record for each employee subject to medical surveillance under this standard. This record shall include:

.910.1048(o)(3)(i)

The name and social security number of the employee;

1910.1048(o)(3)(ii)

The physician's written opinion;

1910.1048(o)(3)(iii)

A list of any employee health complaints that may be related to exposure to formaldehyde; and

L910.1048(o)(3)(iv)

A copy of the medical examination results, including medical disease questionnaires and results of any medical tests required by the standard or mandated by the examining physician.

1910.1048(o)(4)

Respirator fit testing.

1910.1048(o)(4)(i)

The employer shall establish and maintain accurate records for employees subject to negative pressure respirator fit testing required by this standard.

1910.1048(o)(4)(ii)

This record shall include:

1910.1048(o)(4)(ii)(A)

A copy of the protocol selected for respirator fit testing.

1910.1048(o)(4)(ii)(B)

A copy of the results of any fit testing performed.

1910.1048(o)(4)(ii)(C)

The size and manufacturer of the types of respirators available for selection.

1910.1048(o)(4)(ii)(D)

The date of the most recent fit testing, the name and social security number of each tested employee, and the respirator type and facepiece selected.

1910.1048(o)(5)

Record retention. The employer shall retain records required by this standard for at least the following periods:

1910.1048(o)(5)(i)

Exposure records and determinations shall be kept for at least 30 years.

1910.1048(o)(5)(ii)

Medical records shall be kept for the duration of employment plus 30 years.

1910.1048(o)(5)(iii)

Respirator fit testing records shall be kept until replaced by a more recent record.

1910.1048(o)(6)

Availability of records.

1910.1048(o)(6)(i)

Upon request, the employer shall make all records maintained as a requirement of this standard available for examination and copying to the Assistant Secretary and the Director.

1910.1048(o)(6)(ii)

The employer shall make employee exposure records, including estimates made from representative monitoring and available upon request for examination, and copying to the subject employee, or former employee, and employee representatives in accordance with 29 CFR 1910.1020 (a)-(e) and (g)-(i).

1910.1048(o)(6)(iii)

Employee medical records required by this standard shall be provided upon request for examination and copying, to the subject employee or former employee or to anyone having the specific written consent of the subject employee or former employee in accordance with 29 CFR 1910.1020 (a)-(e) and (g)-(i).

[56 FR 10378, Mar. 12, 1991; 56 FR 26909, June 12, 1991; 56 FR 37651, Aug. 8, 1991; 56 FR 57593, Nov. 13, 1991; 57 FR 2682, Jan. 23, 1992; 57 FR 19262, May 5, 1992; 57 FR 22290, May 27, 1992; 61 FR 5507, Feb. 13, 1996; 63 FR 1152, Jan. 8, 1998; 63 FR 20098, April 23, 1998; 70 FR 1143, Jan. 5, 2005; 71 FR 16672 and 16673, April 3, 2006; 71 FR 50190, August 24, 2006; 73 FR 75586, Dec. 12, 2008]

👍 <u>Next Standard (1910.1048 App A)</u>

👍 <u>Regulations (Standards - 29 CFR) - Table of Contents</u>

Freedom of Information Act | Privacy & Security Statement | Disclaimers | Customer Survey | Important Web Site Notices | International | Contact Us

U.S. Department of Labor | Occupational Safety & Health Administration | 200 Constitution Ave., NW, Washington, DC 20210 Telephone: 800-321-OSHA (6742) | TTY: 877-889-5627 www.OSHA.gov

www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=10075&p_table=STANDARDS



- 4 Vapor density: 3.24
- 5. Melting point: 43 degrees C (109.4 degrees F)
- Vapor pressure at 25 degrees C (77 degrees F): 0.35 mm Hg 6.
- Solubility: Soluble in water and benzene; very soluble in alcohol, chloroform, ether, glycerol, carbon disulfide, petrolatum, volatile and fixed oils, and aqueous 7. alkali hydroxides; almost insoluble in petroleum ether.
- 8. Evaporation rate: Data not available.

* Reactivity

- 1. Conditions contributing to instability: Heat, flames, or sparks.
- 2. Incompatibilities: Contact between phenol and strong oxidizers (especially calcium hypochlorite), acids, and halogens should be avoided.
- 3. Hazardous decomposition products: Toxic cases (such as carbon monoxide) may be released in a fire involving phenol.

Occupational Safety and Health Guideline for Phenol

4. Special precautions: Liquid phenol attacks rubber, coatings, and some forms of plastic. Hot liquid phenol attacks aluminum, magnesium, lead, and zinc metals.

* Flammability

The National Fire Protection Association has assigned a flammability rating of 2 (moderate fire hazard) to phenol.

- 1. Flash point: 79 degrees C (175 degrees F) (closed cup)
- 2. Autoignition temperature: 715 degrees C (1319 degrees F)
- 3. Flammable limits in air (percent by volume): Lower, 1,7; upper, 8.6
- 4. Extinguishant: For small fires use dry chemical, water spray, or regular foam. Use water spray, fog, or regular foam to fight large fires involving phenol. Fires involving phenol should be fought upwind from the maximum distance possible. Keep unnecessary people away; isolate the hazard area and deny entry. Emergency personnel should stay out of low areas and ventilate closed spaces before entering. Containers of phenol may explode in the heat of the fire and should be moved from the fire area if it is possible to do so safely. If this is not possible, cool fire exposed containers from the sides with water until well after the fire is out. Dike fire control water for later disposal; do not scatter this material. Stay away from the ends of containers. Firefighters should wear a full set of protective clothing and self-contained breathing apparatus when fighting fires involving phenol.

EXPOSURE LIMITS

* OSHA PEL

The current Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) for phenol is 5 ppm (19 milligrams per cubic meter (mg/m(3))) as an 8-hour time-weighted average (TWA) concentration. The OSHA PEL also bears a "Skin" notation, which indicates that the cutaneous route of exposure (including mucous membranes and eyes) contributes to overall exposure [29 CFR 1910.1000, Table Z-1].

* NIOSH REL

The National Institute for Occupational Safety and Health (NIOSH) has established a recommended exposure limit (REL) for phenol of 5 ppm (19 mg/m(3)) as a TWA for up to a 10-hour workday and a 40-hour workweek and a short-term exposure limit (STEL) of 15.6 ppm (60 mg/m(3)) for periods not to exceed 15 minutes. NIOSH also assigns a "Skin" notation to phenol [NIOSH 1992].

* ACGIH TLV

The American Conference of Governmental Industrial Hygienists (ACGIH) has assigned phenol a threshold limit value (TLV) of 5 ppm (19 mg/m(3)) as a TWA for a normal 8-hour workday and a 40-hour workweek. The ACGIH also assigns a "Skin" notation to phenol [ACGIH 1994, p. 29].

* Rationale for Limits

The NIOSH limits are based on the risk of skin, eyes, central nervous system, liver, kidneys [NIOSH 1992]. The ACGIH limit is based on the risk of irritation and systemic effects [ACGIH 1991, p. 1206].

Evaluation

HEALTH HAZARD INFORMATION

* Routes of Exposure

Exposure to phenol can occur through inhalation, ingestion, eye or skin contact, and absorption through the skin [Sittig 1991, p. 1284].

* Summary of toxicology

1. Effects on Animals: Phenol is an irritant of the eyes, mucous membranes, and skin; absorption causes convulsions as well as liver, kidney, and other systemic damage [Hathaway et al. 1991]. In animals, the predominant effects of acute toxicity are exerted on motor centers in the spinal cord, which induces marked twitching and severe convulsions. Following absorption of a toxic dose, the heart rate first increases and then becomes slow and irregular; the blood pressure initially rises slightly and then falls markedly. There may be salivation and marked dyspnea, and the body temperature usually decreases [Clayton and Clayton 1982]. The mean lethal concentration for rats inhaling phenol vapors is 316 mg/m(3), and for mice it is 177 mg/m(3). The oral LD(50) values are 317 mg/kg and 270 mg/kg for rats and mice, respectively. In rabbits, the dermal LD(50) is 850 mg/kg [NIOSH 1991]. Prolonged oral or subcutaneous administration of phenol to animals can cause damage to the lungs, liver, kidneys, heart, and genitourinary tract. Prolonged inhalation of vapor concentrations in the range of 30 to 60 ppm causes respiratory difficulties, lung damage, loss of weight, and paralysis [Clayton and Clayton 1982]. In contact with rabbit eyes, crystalline or concentrated aqueous phenol causes almost instantaneous white opacification of the corneal epithelium; 8 hours after application, the cornea is anesthetic, the surface ulcerated, and the stroma opaque. Five weeks later, scarring of the conjunctiva and opacity of the cornea occur. In addition, glaucoma has been induced experimentally in rabbits by injected 5-percent phenol subconjunctivally [Grant 1986]. Phenol administered by gavage has produced fetotoxic effects in rats and mice. An increased incidence of leukemia and lymphomas has been reported in rats receiving 2,500 ppm of phenol in drinking water for 103 weeks, although phenol was not considered to be carcinogenic. In mice treated twice weekly for 41 weeks by application of one drop of a 10-percent solution of phenol in b

2. Effects on Humans: The effects of phenol exposure in humans are similar to those produced in animals: systemic absorption causes central nervous system impairment and liver and kidney damage; local effects include irritation of the eyes, skin and mucous membranes [Hathaway et al. 1991]. Because of its low volatility, phenol does not pose a serious inhalation hazard in the occupational setting; the skin is a primary route of entry [Hathaway et al. 1991; Parmeggiani 1983]. A 32-year-old man died 10 minutes after spilling a strong solution of phenol over his scalp, face, neck, shoulders, and back. There was coagulation necrosis of the skin and left eye, acute dermatitis, and acute passive congestion of the lungs, liver, spleen, and kidneys [NLM 1992]. An oral dose of 1 gram of phenol many be lethal to humans; however, in exceptional cases, patients have survived the ingestion of 65 grams of pure phenol or 120 grams of the crude product. Roughly 50 percent of all reported cases have been fatal. Death may be rapid and usually results from respiratory failure [Clayton and Clayton 1982]. Chronic phenol poisoning is characterized by systemic disorders such as digestive disturbances, nervous system effects, and possibly by skin discoloration and eruptions; the prognosis is grave when there is extensive damage to the liver and kidneys [Parmeggiani 1983]. Concentrated phenol solutions are severely irritating to the human eye and cause conjunctival swelling; the cornea becomes white and loses sensation. Loss of vision has occurred in some cases. In addition to systemic effects, contact with the solid or liquid can produce chemical burns. Erythema, edema, tissue necrosis, and gangrene have been reported [Hathaway et al. 1991].

- * Signs and symptoms of exposure
 - 1. Acute exposure: Acute phenol intoxication causes shock, collapse, coma, convulsions, cyanosis, and death. Ingestion of lethal amounts causes severe burns of the mouth and throat, marked abdominal pain, cyanosis, muscular weakness, collapse, coma, and death. Tremors, convulsions, and muscle twitching have also occurred. Contact of the skin with the solid or liquid can produce chemical burns, redness, edema, tissue percosis, and gangrene: contact with the even

Occupational Safety and Health Guideline for Phenol

- and occurred. Contact of the shift with the solid of righted carrier produce chemical parties, reariese, eaching, assue necrosis, and gangrene, contact with the eye amy result in irritation, conjunctival swelling, whitened cornea, and blindness.
- Chronic exposure: Chronic phenol poisoning is characterized by vomiting, difficult swallowing, excessive salivation, diarrhea, anorexia, headache, fainting, vertigo, mental disturbances, and possibly skin eruptions. Prolonged cutaneous exposure may result in deposition of dark pigment in the skin.

EMERGENCY MEDICAL PROCEDURES

- * Emergency medical procedures: [NIOSH to supply]
 - 1. Rescue: Remove an incapacitated worker from further exposure and implement appropriate emergency procedures (e.g., those listed on the Material Safety Data Sheet required by OSHA's Hazard Communication Standard [29 CFR 1910.1200]). All workers should be familiar with emergency procedures, the location and proper use of emergency equipment, and methods of protecting themselves during rescue operations.

EXPOSURE SOURCES AND CONTROL METHODS

The following operations may involve phenol and lead to worker exposures to this substance:

- The manufacture and transportation of phenol
- Use as bonding resin in plywood manufacture and of molding resins in manufacture of molded articles, such as electrical appliances, automotive parts, foundry sand molds, and utensil handles; and during manufacture of friction materials, bonded adhesives, coated abrasives, wood particle board, and insulation materials
- Use as a peptizing agent in glue, as a blocking agent for blocked isocyanate monomers, and in the synthesis of stabilizers and preservatives for dyes, perfumes, and fungicides
- Use in synthesis of thermosetting phenolic resins, epoxy, polycarbonate, phenoxy, and polysulfone; and in synthesis of caprolactam for use in nylon 6 fibers, plastics, and films
- Use in synthesis of bisphenol-a, adipic acid, alkyphenols, agricultural chemicals, and intermediates; in synthesis of pharmaceuticals, rubber and plastic plasticizers and antioxidants, and curing agents
- Use during solvent refining of lubrication il and wax and in synthesis of additives for gasoline and lubricating fluids and intermediates
- Use in medicine as a preservative for pneumococcal polysaccharide vaccine, as an agent for relieving itching, as a disinfectant for septic wounds, as a cauterizing agent, and for the treatment of severe disability (muscle spasms, paralysis, and related disorders) resulting from multiple sclerosis
- Use in synthesis of intermediates in polyester production; in synthesis of corrosion-resistant polyester and polyester polyols; and in synthesis of dye
 intermediates
- Use in synthesis of disinfectants, surface-active agents, detergent intermediates, explosives, and synthetic cresols and xylenols
- Use in the production or manufacture of fertilizer, coke, illuminating gas, lampblack, paints, paint removers, and asbestos goods
- Use in veterinary medicine as an internal antiseptic and gastric anesthetic

Methods that are effective in controlling worker exposures to phenol, depending on the feasibility of implementation, are as follows:

- Process enclosure
- Local exhaust ventilation
- General dilution ventilation
- Personal protective equipment

Workers responding to a release or potential release of a hazardous substance must be protected as required by paragraph (q) of OSHA's Hazardous Waste Operations and Emergency Response Standard [29 CFR 1910.120].

Good sources of information about control methods are as follows:

- 1. ACGIH [1992]. Industrial ventilation--a manual of recommended practice. 21st ed. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.
- 2. Burton DJ [1986]. Industrial ventilation--a self study companion. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.
- 3. Alden JL, Kane JM [1982]. Design of industrial ventilation systems. New York, NY: Industrial Press, Inc.
- 4. Wadden RA, Scheff PA [1987]. Engineering design for control of workplace hazards. New York, NY: McGraw-Hill.
- 5. Plog BA [1988]. Fundamentals of industrial hygiene. Chicago, IL: National Safety Council.

MEDICAL SURVEILLANCE

OSHA is currently developing requirements for medical surveillance. When these requirements are promulgated, readers should refer to them for additional information and to determine whether employers whose employees are exposed to phenol are required to implement medical surveillance procedures.

* Medical Screening

Workers who may be exposed to chemical hazards should be monitored in a systematic program of medical surveillance that is intended to prevent occupational injury and disease. The program should include education of employers and workers about work-related hazards, early detection of adverse health effects, and referral of workers for diagnosis and treatment. The occurrence of disease or other work-related adverse health effects should prompt immediate evaluation of primary preventive measures (e.g., industrial hygiene monitoring, engineering controls, and personal protective equipment). A medical surveillance program is intended to supplement, not replace, such measures. To detect and control work-related health effects, medical evaluations should be performed (1) before job

placement, (2) periodically during the term of employment, and (3) at the time of job transfer or termination.

* Preplacement medical evaluation

Before a worker is placed in a job with a potential for exposure to phenol, a licensed health care professional should evaluate and document the worker's baseline health status with thorough medical, environmental, and occupational histories, a physical examination, and physiologic and laboratory tests appropriate for the anticipated occupational risks. These should concentrate on the function and integrity of the skin, central nervous system, respiratory system, liver, and kidneys. Medical surveillance for respiratory disease should be conducted using the principles and methods recommended by the American Thoracic Society. A preplacement medical evaluation is recommended to assess medical conditions that may be aggravated or may result in increased risk when a worker is exposed to phenol at or below the prescribed exposure limit. The health care professional should consider the probable frequency, intensity, and duration of exposure as well as the nature and degree of any applicable medical condition. Such conditions (which should not be regarded as absolute contraindications to job placement) include a history and other findings consistent with diseases of the skin, central nervous system, respiratory system, liver, and kidneys.

* Periodic medical evaluations

Occupational health interviews and physical examinations should be performed at regular intervals during the employment period, as mandated by any applicable Federal, State, or local standard. Where no standard exists and the hazard is minimal, evaluations should be conducted every 3 to 5 years or as frequently as recommended by an experienced occupational health physician. Additional examinations may be necessary if a worker develops symptoms attributable to phenol exposure. The interviews, examinations, and medical screening tests should focus on identifying the adverse effects of phenol on the skin, central nervous system,

Occupational Safety and Health Guideline for Phenol

respiratory system, liver, or kianeys. Current health status should be compared with the baseline health status of the individual worker or with expected values for a suitable reference population.

* Termination medical evaluations

The medical, environmental, and occupational history interviews, the physical examination, and selected physiologic or laboratory tests that were conducted at the time of placement should be repeated at the time of job transfer or termination to determine the worker's medical status at the end of his or her employment. Any changes in the worker's health status should be compared with those expected for a suitable reference population.

* Biological monitoring

Biological monitoring involves sampling and analyzing body tissues or fluids to provide an index of exposure to a toxic substance or metabolite. A worker's exposure to phenol can be determined by analyzing a urine sample taken at the end of the shift for total phenol. A 250 mg total phenol per gram creatinine level corresponds to an airborne phenol exposure at the TLV (5 ppm). It should be noted that dermal absorption of phenol may also contribute to the urinary levels found.

WORKPLACE MONITORING AND MEASUREMENT

Determination of a worker's exposure to airborne phenol is made using an XAD-7 tube (100/50 mg sections, 15/50 mesh). Samples are collected at a maximum flow rate of 0.1 liter/minute until a maximum collection volume of 24 liters is reached. The sample is then treated with methanol. Analysis is conducted by gas chromatography using a flame ionization detector (GC/FID). This method is fully validated and is described in the OSHA Computerized Information System [OSHA 1994] and in NIOSH Method No. 2546 [NIOSH 1994b].

Controls

PERSONAL HYGIENE PROCEDURES

If phenol contacts the skin, workers should immediately wash the affected areas with soap and water. Clothing contaminated with phenol should be removed immediately, and provisions should be made for the safe removal of the chemical from the clothing. Persons laundering the clothes should be informed of the hazardous properties of phenol, particularly its potential for causing irritation and tissue corrosion.

A worker who handles phenol should thoroughly wash hands, forearms, and face with soap and water before eating, using tobacco products, using toilet facilities, applying cosmetics, or taking medication.

Workers should not eat, drink, use tobacco products, apply cosmetics, or take medication in areas where phenol or a solution containing phenol is handled, processed, or stored.

STORA GE

Phenol should be stored in a cool, dry, well-ventilated area in tightly sealed containers that are labeled in accordance with OSHA's Hazard Communication Standard [29 CFR 1910.1200]. Containers of phenol should be protected from physical damage and ignition sources, and should be stored separately from strong oxidizers (especially calcium hypochlorite), acids, and halogens.

SPILLS AND LEAKS

In the event of a spill or leak involving phenol, persons not wearing protective equipment and clothing should be restricted from contaminated areas until cleanup has been completed. The following steps should be undertaken following a spill or leak:

- 1. Do not touch the spilled material; stop the leak if it is possible to do so without risk.
- 2. Notify safety personnel.
- 3. Remove all sources of heat and ignition.
- 4. Use non-sparking tools.
- 5. Water spray may be used to reduce vapors.
- 6. For small dry spills, use a clean shovel and place the material into a clean, dry container; cover and remove the container from the spill area.
- 7. For small liquid spills, take up with sand or other noncombustible absorbent material and place into closed containers for later disposal.
- 8. For large liquid spills, build dikes far ahead of the spill to contain the phenol for later reclamation or disposal.

SPECIAL REQUIREMENTS

U.S. Environmental Protection Agency (EPA) requirements for emergency planning, reportable quantities of hazardous releases, community right-to-know, and hazardous waste management may change over time. Users are therefore advised to determine periodically whether new information is available.

* Emergency planning requirements

Employers owning or operating a facility at which there are 10,000 pounds or more of phenol must comply with EPA's emergency planning requirements [40 CFR Part 355.30]. (If phenol is in the form of a finely divided powder or is handled in solution or in molten form, the employer must comply with these requirements if 500 pounds or more of phenol are present at the facility.)

* Reportable quantity requirements for hazardous releases

A hazardous substance release is defined by EPA as any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment (including the abandonment or discarding of contaminated containers) of hazardous substances. In the event of a release that is above the reportable quantity for that chemical, employers are required to notify the proper Federal, State, and local authorities [40 CFR 355.40].

The reportable quantity of phenol is 1,000 pounds. If an amount equal to or greater than this quantity is released within a 24-hour period in a manner that will expose persons outside the facility, employers are required to do the following:

- Notify the National Response Center immediately at (800) 424-8802 or at (202) 426-2675 in Washington, D.C. [40 CFR 302.6].
- Notify the emergency response commission of the State likely to be affected by the release [40 CFR 355.40].
- Notify the community emergency coordinator to the local emergency planning committee (or relevant local emergency response personnel) of any area likely to be affected by the release [40 CFR 355.40].

Occupational Safety and Health Guideline for Phenol

Employers who own or operate facilities in SIC codes 20 to 39 that employ 10 or more workers and that manufacture 25,000 pounds or more of phenol per calendar year or otherwise use 10,000 pounds or more of phenol per calendar year are required by EPA [40 CFR Part 372.30] to submit a Toxic Chemical Release Inventory form (Form R) to EPA reporting the amount of phenol emitted or released from their facility annually.

* Hazardous waste management requirements

EPA considers a waste to be hazardous if it exhibits any of the following characteristics: ignitability, corrosivity, reactivity, or toxicity as defined in 40 CFR 261.21-261.24. Under the Resource Conservation and Recovery Act (RCRA) [40 USC 6901 et seq.], EPA has specifically listed many chemical wastes as hazardous. Phenol is listed as a hazardous waste under RCRA and has been assigned EPA Hazardous Waste No. U188. It is approved for land disposal after treatment and only if the concentration of phenol in the waste or treatment residual does not exceed 6.2 mg/kg.

Providing detailed information about the removal and disposal of specific chemicals is beyond the scope of this guideline. The U.S. Department of Transportation, EPA, and State and local regulations should be followed to ensure that removal, transport, and disposal of this substance are conducted in accordance with existing regulations. To be certain that chemical waste disposal meets EPA regulatory requirements, employers should address any questions to the RCRA hotline at (703) 412-9810 (in the Washington, D.C. area) or toll-free at (800) 424-9346 (outside Washington, D.C.). In addition, relevant State and local authorities should be contacted for information on any requirements they may have for the waste removal and disposal of this substance.

RESPIRATORY PROTECTION

* Conditions for respirator use

Good industrial hygiene practice requires that engineering controls be used where feasible to reduce workplace concentrations of hazardous materials to the prescribed exposure limit. However, some situations may require the use of respirators to control exposure. Respirators must be worn if the ambient concentration of phenol exceeds prescribed exposure limits. Respirators may be used (1) before engineering controls have been installed, (2) during work operations such as maintenance or repair activities that involve unknown exposures, (3) during operations that require entry into tanks or closed vessels, and (4) during emergencies. Workers should only use respirators that have been approved by NIOSH and the Mine Safety and Health Administration (MSHA).

* Respiratory protection program

Employers should institute a complete respiratory protection program that, at a minimum, complies with the requirements of OSHA's Respiratory Protection Standard [29 CFR 1910.134]. Such a program must include respirator selection, an evaluation of the worker's ability to perform the work while wearing a respirator, the regular training of personnel, respirator fit testing, periodic workplace monitoring, and regular respirator maintenance, inspection, and cleaning. The implementation of an adequate respiratory protection program (including selection of the correct respirator) requires that a knowledgeable person be in charge of the program and that the program be evaluated regularly. For additional information on the selection and use of respirators and on the medical screening of respirator users, consult the latest edition of the NIOSH Respirator Decision Logic [NIOSH 1987b] and the NIOSH Guide to Industrial Respiratory Protection [NIOSH 1987a].

PERSONAL PROTECTIVE EQUIPMENT

Workers should use appropriate personal protective clothing and equipment that must be carefully selected, used, and maintained to be effective in preventing skin contact with phenol. The selection of the appropriate personal protective equipment (PPE) (e.g., gloves, sleeves, encapsulating suits) should be based on the extent of the worker's potential exposure to phenol. The resistance of various materials to permeation by phenol (>70 percent) is shown below:

Material	Breakthrough time (hr)			
Viton	>8			
Saranex	>8			
Barricade	>8			
Chemrel	>8			
Responder	>8			
Neoprene	>4			
Teflon	>4			
4H (PE/EVAL)	>4			
Butyl Rubber	Caution 1 to 4			
Natural Rubber	<1(*)			
Nitrile Rubber	<1(*)			
Polyethylene	<1(*)			
Polyvinyl Alcohol	<1(*)			
Polyvinyl Chloride	<1(*)			

(*) Not recommended, degradation may occur

To evaluate the use of these PPE materials with phenol, users should consult the best available performance data and manufacturers' recommendations. Significant differences have been demonstrated in the chemical resistance of generically similar PPE materials (e.g., butyl) produced by different manufacturers. In addition, the chemical resistance of a mixture may be significantly different from that of any of its neat components.

Any chemical-resistant clothing that is used should be periodically evaluated to determine its effectiveness in preventing dermal contact. Safety showers and eye wash stations should be located close to operations that involve phenol.

Splash-proof chemical safety goggles or face shields (20 to 30 cm long, minimum) should be worn during any operation in which a solvent, caustic, or other toxic substance may be splashed into the eyes.

In addition to the possible need for wearing protective outer apparel (e.g., aprons, encapsulating suits), workers should wear work uniforms, coveralls, or similar fullbody coverings that are laundered each day. Employers should provide lockers or other closed areas to store work and street clothing separately. Employers should collect work clothing at the end of each work shift and provide for its laundering. Laundry personnel should be informed about the potential hazards of handling contaminated clothing and instructed about measures to minimize their health risk.

Protective clothing should be kept free of oil and grease and should be inspected and maintained regularly to preserve its effectiveness.

Protective clothing may interfere with the body's heat dissipation, especially during hot weather or during work in hot or poorly ventilated work environments.

References

ACGIH [1991]. Documentation of the threshold limit values and biological exposure indices. 6th ed. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.

ACGIH [1994]. 1994-1995 Threshold limit values for chemical substances and physical agents and biological exposure indices. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.

Amoore JE, Hautala E [1983]. Odor as an aid to chemical safety: odor thresholds compared with threshold limit values and volatilities for 214 industrial chemicals in air and water dilution. J of App Tox 3(6):272-290.

ATS [1987]. Standardization of spirometry -- 1987 update. American Thoracic Society. Am Rev Respir Dis 136:1285-1296.

CFR. Code of Federal regulations. Washington, DC: U.S. Government Printing Office, Office of the Federal Register.

Clayton G, Clayton F [1981-1982]. Patty's industrial hygiene and toxicology. 3rd rev. ed. New York, NY: John Wiley & Sons.

Cralley LJ, Cralley LV [1985]. Patty's industrial hygiene and toxicology. 2nd ed. Vol. 3. New York, NY: John Wiley & Sons.

DOT [1993]. 1993 Emergency response guidebook, guide 55. Washington, DC: U.S. Department of Transportation, Office of Hazardous Materials Transportation, Research and Special Programs Administration.

Forsberg K, Mansdorf SZ [1993]. Quick selection guide to chemical protective clothing. New York, NY: Van Nostrand Reinhold.

Genium [1990]. Material safety data sheet No. 355. Schenectady, NY: Genium Publishing Corporation.

Grant WM [1986]. Toxicology of the eye. 3rd ed. Springfield, IL: Charles C Thomas.

Hathaway GJ, Proctor NH, Hughes JP, and Fischman ML [1991]. Proctor and Hughes' chemical hazards of the workplace. 3rd ed. New York, NY: Van Nostrand Reinhold.

Lewis RJ, ed. [1993]. Hawley's condensed chemical dictionary. 12th ed. New York, NY: Van Nostrand Reinhold Company.

Mickelsen RL, Hall RC [1987]. A breakthrough time comparison of nitrile and neoprene glove materials produced by different glove manufacturers. Am Ind Hyg Assoc J 48(11): 941-947.

Mickelsen RL, Hall RC, Chern RT, Myers JR [1991]. Evaluation of a simple weight-loss method for determining the permeation of organic liquids through rubber films. Am Ind Hyg Assoc J 52(10): 445-447.

NFPA [1986]. Fire protection guide on hazardous materials. 9th ed. Quincy, MA: National Fire Protection Association.

NIOSH [1987a]. NIOSH guide to industrial respiratory protection. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 87-116.

NIOSH [1987b]. NIOSH respirator decision logic. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, DHHS NIOSH) Publication No. 87-108.

NIOSH [1991]. Registry of toxic effects of chemical substances: Phenol. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, Division of Standards Development and Technology Transfer, Technical Information Branch.

NIOSH [1992]. Recommendations for occupational safety and health: Compendium of policy documents and statements. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 92-100.

NIOSH [1994a]. NIOSH pocket guide to chemical hazards. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 94-116.

NIOSH [1994b]. NIOSH manual of analytical methods. 4th ed. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 94-113.

NLM [1992]. Hazardous substances data bank: Phenol. Bethesda, MD: National Library of Medicine.

OSHA [1994]. Computerized information system. Washington, DC: U.S. Department of Labor, Occupational Safety and Health Administration.

Parmeggiani L [1983]. Encyclopedia of occupational health and safety. 3rd rev. ed. Geneva, Switzerland: International Labour Organisation.

Sax NI, Lewis RJ [1989]. Dangerous properties of industrial materials. 7th ed. New York, NY: Van Nostrand Reinhold Company.

Sittig M [1991]. Handbook of toxic and hazardous chemicals. 3rd ed. Park Ridge, NJ: Noyes Publications.

USC. United States code. Washington. DC: U.S. Government Printing Office.

Windholz M, ed. [1983]. Merck Index 10th ed. Rahway, NJ: Merck & Company.

Introduction | Recognition | Evaluation | Controls | References

Freedom of Information Act | Privacy & Security Statement | Disclaimers | Customer Survey | Important Web Site Notices | International | Contact Us

U.S. Department of Labor | Occupational Safety & Health Administration | 200 Constitution Ave., NW, Washington, DC 20210 Telephone: 800-321-OSHA (6742) | TTY: 877-889-5627 www.OSHA.gov



Best Practices for the Safe Use of Glutaraldehyde in Health Care

OSHA 3258-08N 2006



Employers are responsible for providing a safe and healthful workplace for their employees. OSHA's role is to assure the safety and health of America's employees by setting and enforcing standards; providing training, outreach and education; establishing partnerships; and encouraging continual improvement in workplace safety and health.

This handbook provides a general overview of a particular topic related to OSHA standards. It does not alter or determine compliance responsibilities in OSHA standards or the *Occupational Safety and Health Act of 1970*. Because interpretations and enforcement policy may change over time, you should consult current OSHA administrative interpretations and decisions by the Occupational Safety and Health Review Commission and the Courts for additional guidance on OSHA compliance requirements.

This publication is in the public domain and may be reproduced, fully or partially, without permission. Source credit is requested but not required.

This information is available to sensory impaired individuals upon request. Voice phone: (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

Best Practices for the Safe Use of Glutaraldehyde in Health Care



U.S. Department of Labor

Occupational Safety and Health Administration

OSHA 3258-08N 2006

Contents

Introduction . . . 4

Summary of Health Effects . . . 4

Occupational Exposure Limits for Glutaraldehyde ... 6

GLUTARALDEHYDE USE AS A HIGH-LEVEL DISINFECTANT . . . 6

Engineering Controls . . . 10

Alternatives to Glutaraldehyde for High-Level Disinfection . . . 17

GLUTARALDEHYDE USE AS A TISSUE FIXATIVE ... 18

GLUTARALDEHYDE USE IN X-RAY PROCESSING . . . 20

GENERAL RECOMMENDATIONS APPLICABLE TO ALL USES OF GLUTARALDEHYDE IN HEALTH CARE . . . 23

Additional Resources . . . 32

OSHA Assistance . . . 38

OSHA Regional Offices . . . 43



This best practices booklet is not a standard or regulation, and it creates no new legal obligations. The document is advisory in nature, informational in content, and is intended to assist employers in providing a safe and healthful workplace. The *Occupational Safety and Health Act* (OSH Act) requires employers to comply with hazard-specific safety and health standards. In addition, pursuant to Section 5(a)(1), the General Duty Clause of the Act, employers must provide their employees with a workplace free from recognized hazards likely to cause death or serious physical harm. Employers can be cited for violating the General Duty Clause if there is a recognized hazard and they do not take reasonable steps to prevent or abate the hazard. However, failure to implement these recommendations is not, in itself, a violation of the General Duty Clause. Citations can only be based on standards, regulations, and the General Duty Clause.

OSHA standards that **may** apply in exposure scenarios similar to those described in this publication include Hazard Communication (29 CFR 1910.1200) and Personal Protective Equipment, General Requirements (29 CFR 1910.132); Eye and Face Protection (29 CFR 1910.133); Respiratory Protection (29 CFR 1910.134.); and Hazardous Waste Operations and Emergency Response (29 CFR 1910.120(q)). Scenarios where these OSHA standards may apply are identified in the text of this document.

Mention of any company or product is for informational purposes only and does not constitute an endorsement by OSHA.



Introduction

This document describes best practices for the safe use of glutaraldehyde in health care facilities. Glutaraldehyde is used widely as a cold sterilant to disinfect a variety of heat-sensitive instruments, such as endoscopes, bronchoscopes, and dialysis equipment (NIOSH, 2001). In addition, health care employees may be exposed to glutaraldehyde in its uses as a hardener in x-ray developing and as a tissue fixative in histology and pathology labs.

Glutaraldehyde's properties as a chemical sterilant were initially recognized in the early 1960s as the health care industry searched for a safer alternative to formaldehyde, which is regulated by OSHA as a carcinogen (29 CFR 1910.1048). In the years since its introduction as a disinfectant/sterilant, glutaraldehyde has been linked with a variety of health effects – ranging from mild to severe – including asthma, breathing difficulties, respiratory irritation, and skin rashes (Pryor, 1984; Crandall, 1987).

The purpose of this document is to provide information that can be used by health care employers and employees to understand and control exposures to glutaraldehyde. This document describes engineering controls, work practices, and facility design considerations that will help reduce employee exposure to glutaraldehyde. This document also includes recommendations for personal protective equipment, employee training, exposure monitoring, disposal practices, and spill and cleanup procedures. The use of alternatives to glutaraldehyde is also addressed.

Note: The term "health care facilities" is intended to encompass the broad range of health care facility types and sizes, including hospitals, clinics, freestanding surgical centers, physician offices, and dental clinics, as well as nursing homes and other residential health care facilities.

Summary of Health Effects

The most serious adverse health effect documented among employees exposed to glutaraldehyde vapor is occupational



asthma, a chronic condition characterized by bronchial hyperresponsiveness. Reactions can be either immediate or delayed, with a latent period ranging from a few weeks to several years from the onset of exposure. Human studies on the effects of glutaraldehyde exposure consist of many case reports in the published literature, some identified by both American and British health surveillance systems, and symptom surveys of American health care employees, all of which document an association between exposure to glutaraldehyde and the development of asthma. (Gannon et al., 1995; Rosenman et al., 1997; Keynes et al., 1996; Di Stefano et al., 1999).

In addition, a few cross-sectional studies also show that an increased prevalence of irritant symptoms, including itching of the eyes with increased lacrimation (tearing), and rhinitis, is reported by health care employees who are exposed to short-term (15-minute) concentrations well below 0.2 parts-per-million (ppm) in air, predominantly in the range of about 0.005 to 0.050 ppm (Norback, 1988; Pisaniello et al., 1995).

In addition to causing respiratory effects, glutaraldehyde acts as a contact allergen, giving rise to contact dermatitis, usually on the hands but occasionally on the face. Skin sensitization from contact with glutaraldehyde has been documented in endoscopy nurses, dental assistants, x-ray technicians, hospital maintenance and cleaning staff, and funeral service employees (Marzulli and Maibach, 1974; Fowler, 1989; Nethercott et al., 1988; Maibach and Prystowsky, 1977; Nethercott and Holness, 1988; Ballantyne and Berman, 1984; Waters et al., 2003). Individuals who have become sensitized to glutaraldehyde can develop dermatitis after contacting solutions containing as little as 0.1 percent glutaraldehyde. In contrast, simple skin irritation typically occurs on contact with solutions containing more than 2 percent glutaraldehyde (HSE, 1997). In one study of health care employees who had developed allergic contact dermatitis from glutaraldehyde, ten employees who were followed for six months after initial diagnosis continued to have persistent hand eczema, although five of these employees had left their jobs because of this health problem (Nethercott et al., 1988).



Occupational Exposure Limits for Glutaraldehyde

The Federal Occupational Safety and Health Administration (OSHA) does not have a Permissible Exposure Limit for glutaraldehyde. The National Institute for Occupational Safety and Health (NIOSH) established a Recommended Exposure Limit (REL) of 0.2 ppm in 1989 (http://www.cdc.gov/niosh/npg/npgd0301.html). Other organizations that have occupational exposure limits include the American Conference of Governmental Industrial Hygienists (ACGIH), which currently recommends a Threshold Limit Value (TLV) of 0.05 ppm in air, measured as a ceiling concentration, and the United Kingdom Health and Safety Executive which also has established a 0.05 ppm Workplace Exposure Limit (WEL) averaged over both 8 hours and 15 minutes.

The occupational exposure limits discussed above were current at the time this document was published. However, it is essential that health care personnel keep informed of current Federal, state, and local regulations applicable to glutaraldehyde, as well as with professional guidelines.

GLUTARALDEHYDE USE AS A HIGH-LEVEL DISINFECTANT

Primary Sources of Glutaraldehyde Exposure

Glutaraldehyde-based agents are used to disinfect medical equipment that cannot be subjected to steam sterilization, specifically heat-sensitive, lensed devices typically requiring high-level disinfection between patient uses (ANSI/AAMI, 1996). Glutaraldehyde-based products may be used in a variety of locations within a facility, such as surgery, endoscopy, and respiratory therapy. Trade names of glutaraldehyde-based products include, but are not limited to, Cidex®, Sonacide®, Sporicidin®, Hospex®, and Omnicide® (NIOSH, 2001).



Definitions:

Sterilant: Physical or chemical agent(s) or process which completely eliminates or destroys all forms of life, particularly microorganisms.

Disinfectant: An agent that destroys pathogens by physical or chemical means. Disinfection processes do not ensure the same margin of safety associated with sterilization processes and can vary in their extent of microorganism elimination. This variation leads to subcategories, the first of which is high-level disinfection.

High-Level Disinfection: A process utilizing a sterilant under less than sterilizing conditions. The process kills all forms of microbial life except for large numbers of bacterial spores.

Disinfection activities range from simple soaking of small instruments to automated processing of complex lensed instruments, such as endoscopes. Exposure to glutaraldehyde as a highlevel disinfectant occurs primarily during the following activities:

- activating and pouring glutaraldehyde solution into or out of a cleaning container system (e.g., soaking basin in manual disinfecting operations and reservoir in automated processors);
- opening the cleaning container system to immerse instruments to be disinfected;
- agitating glutaraldehyde solution;
- handling of soaked instruments;
- removing instruments from the container system;
- rinsing the channels of instruments containing residual glutaraldehyde solution;
- flushing out instrument parts with a syringe;
- drying instrument interiors with compressed air;
- disposing of "spent" glutaraldehyde solutions to the sanitary sewer;
- performing maintenance procedures, such as filter or hose changes on automated processors that have not been pre-rinsed with water.

Measurements of health care employee exposure to glutaraldehyde vapor during high-level disinfection have been reported to



range from none detected to 0.20 ppm or greater (Naidu et al., 1995; Pisaniello et al., 1997). NIOSH has documented levels as high as 0.5 ppm (NIOSH, 1985); 0.48 ppm (NIOSH, 1987); and 0.08 ppm (NIOSH, 1991) during disinfection procedures at health care facilities. A recent study (Waters et al., 2003) documented exposures of up to 0.15 ppm in endoscopy disinfection. Exposure levels will vary depending on a number of factors such as the concentration of the glutaraldehyde solution, type of process (manual versus automatic), ventilation conditions, site-specific factors, as well as the duration of the sampling period (e.g., peak, 15-minute short-term, or full task duration).

Manual operations with inadequate or ineffective controls result in higher exposures. Pisaniello et al. (1997) reported on exposures in operating theaters and endoscopy areas with and without local exhaust ventilation (LEV). In endoscopy units, the mean geometric exposure of 14 samples without LEV was 0.093 ppm, and 0.022 ppm with LEV. Figure 1 presents some exposure data for specific operations with and without exposure controls.



Sources: NIOSH, 1991; NJDOHSS, 1998; Naidu et al., 1995. All exposures are personal breathing zone samples.

8



Recommended Exposure Controls

A variety of engineering controls, facility design considerations, and work practices are available to minimize exposure to glutaraldehyde during its use as a disinfectant and sterilant. In good industrial hygiene practice such methods are to be used to control employee exposure, and if they prove to be insufficient to protect employees, respirators and other personal protective equipment are to be used. Employees required by their employer to wear respirators must receive training and a medical evaluation to determine their fitness to use the equipment. Fit testing of the respirator is also required. For details on fit testing and other requirements for employee use of respirators see OSHA's Respiratory Protection standard (29 CFR 1910.134). Employees whose employers do not require them to wear respirators but who choose to do so must obtain certain information concerning the safe use of respirators (Appendix D to Part 1910.134). Respirators protect only the user, and others in the area may be overexposed to glutaraldehyde vapor if it is not adequately controlled at the source of the release.

Other forms of personal protective equipment (PPE), such as gloves, safety eyewear, and isolation gowns, lab coats, or aprons (plus sleeve protectors) should be worn and may be required whenever there is the potential for skin or eye contact with glutaraldehyde. See the following OSHA standards: Personal Protective Equipment, General Requirements (29 CFR 1910.132); Eye and Face Protection (29 CFR 1910.133); Respiratory Protection (29 CFR 1910.134) and Hand Protection (29 CFR 1910.138), and ANSI/AAMI, 1996. Such PPE should always be used *in combination* with effective engineering controls.

Studies have documented the effectiveness of controls in reducing exposure to gluataraldehyde in disinfecting. Butt et al. (1999) documented exposures during sterilization and mixing over a 5-month period, while changes to ventilation, equipment and work practices were made. During this time, exposures to glutaraldehyde during mixing decreased from a high of 0.96 ppm down to 0.04 ppm. The authors indicated that the changes that appeared to have the most impact on reducing mixing exposures were the addition of a waste pump and new filters in the hood.



This section describes recommended engineering controls and work practices to reduce glutaraldehyde exposures to safe levels during disinfection activities. This section also summarizes the most recent information concerning possible substitutes for glutaraldehyde. Employers should consider whether for a particular use of glutaraldehyde there is an effective substitute that has reduced risks to employees.

See *General Recommendations* section of this publication at page 23 for additional information on the selection and use of personal protective equipment, employee information and training, exposure monitoring, disposal of glutaraldehyde solutions, and spill and cleanup procedures applicable to the use of glutaraldehyde as a high-level disinfectant.

Engineering Controls

The goal of engineering controls is to keep glutaraldehyde vapor from entering the workroom and the employee's breathing zone by containing and removing it at the source of release. As described above, the primary sources of employee exposure to glutaraldehyde during disinfection/sterilant activities include pouring glutaraldehyde solutions into container systems, opening soaking basins or reservoirs, and handling instruments containing residual glutaraldehyde. Engineering controls tailored for these exposure sources include ventilation, both general exhaust ventilation and local exhaust systems (such as laboratory chemical hoods), process automation, and isolation (e.g., basins with tightfitting covers, dedicated centralized storage and use areas).

General Room Ventilation

The American National Standards Institute, Inc., in collaboration with the Association for the Advancement of Medical Instrumentation, recommends that rooms where glutaraldehyde disinfection/ sterilization is performed be large enough to ensure adequate dilution of vapor and have a *minimum air exchange rate of 10 air exchanges per hour* (ANSI/AAMI, 1996). Some agencies recommend even higher air exchange rates, e.g., 15 air exchanges per



hour, to ensure dilution of vapor. There are no national standards that apply specifically to glutaraldehyde usage areas; however, local codes may apply. The air exchange rate recommended by ANSI/ AAMI is consistent with the American Institute of Architects' guidelines for health care facilities (ANSI/AAMI, 1996).

Local Exhaust Ventilation

ANSI/AAMI ST58 recommends that local exhaust ventilation <u>also</u> be installed at the point of release of glutaraldehyde vapors. The health care facility must ensure that the ventilation system is operating properly and is not obstructed or disturbed by drafts from sources such as fans, supply air diffusers, open windows and doors, and heavily traveled aisles.

Local exhaust ventilation located at the level of vapor discharge is the preferred method of reducing glutaraldehyde vapor concentrations because it captures and removes vapor at the source before it can escape into the general work environment. Local exhaust ventilation systems for glutaraldehyde-based activities may include a local exhaust hood (such as a laboratory fume hood) and the associated ductwork and fan; or, a self-contained, freestanding, recirculating exhaust ventilation system (i.e., ductless fume hood).

Local Exhaust Hood

The purpose of a local exhaust hood is to capture glutaraldehyde vapor during processing and conduct it into the exhaust system (via the hood). The capture and control of glutaraldehyde vapor is achieved by the inward airflow created by the exhaust hood. The minimum hood-induced air velocity necessary to capture and convey glutaraldehyde vapor into the hood is called the "capture velocity." Pryor (1984) recommends a minimum capture velocity of at least 100 feet per minute to prevent exposure to glutaraldehyde vapor.

The average velocity of the air drawn through the face (opening) of the hood is called the "face velocity." The face velocity of a hood greatly influences the containment efficiency of the hood (i.e., the hood's ability to contain hazardous air contaminants) (National Research Council, 1995). The American Industrial Hygiene



Association recommends an average face velocity of 80 to 120 feet per minute for laboratory exhaust hoods (AIHA, 1992 in ANSI/AAMI, 1996).

Once glutaraldehyde vapor is collected inside a suitable exhaust hood, it is transported through a duct system and then discharged to the outside via a fan.

Ductless Fume Hoods

Ductless fume hoods are ventilated enclosures that have their own exhaust fan that draws air out of the hood, passes it through an air cleaning filter and then discharges the cleaned exhaust air back into the workplace. Ductless fume hoods are "recirculating" exhaust systems used for contaminant control and use a variety of filters for air cleaning purposes, depending on the air contaminant(s). For glutaraldehyde, a filter containing activated charcoal or other suitable sorbent material must be used to effectively capture vapors. Because the collection efficiency of these filters decreases over time, a preventive maintenance program in accordance with the manufacturer's recommendations must be implemented to ensure optimum performance of the system and effective employee protection.

Ductless fume hoods may also come equipped with a variety of features as specified in the American National Standards for Recirculation of Air from Industrial Process Exhaust Systems (ANSI/AIHA, 1998). These safety features are designed to prevent inadvertent exposure in the workplace and include continuous monitoring devices equipped with alarms to alert operators to potential filter break through, and backup air cleaning devices.

Transfer Procedures

Reducing the release of glutaraldehyde vapor during transfer operations can be accomplished by the use of automated and enclosed equipment. For example, the transfer of glutaraldehyde from drums into process containers can be automated using pumps and closed transfer lines. Such automated equipment can help employees avoid glutaraldehyde exposure (OSHA "Hospital



e-Tool; "http://www.osha.gov/SLTC/etools/hospital/index.html); (AFSCME, 2001).

The use of a "safety nozzle" for pouring reduces the potential for splashing and "glugging" during initial pouring of glutaraldehyde solutions. When using a "safety nozzle," be aware that droplets may remain inside the nozzle and take care to avoid spraying droplets into the atmosphere when removing (unscrewing) it from one container and screwing it onto another container.

Automated Disinfection

The use of automated processing equipment to disinfect instruments can significantly reduce the glutaraldehyde exposures of employees performing disinfection procedures, as well as of other employees and non-employees in the vicinity. However, exposure is still possible, especially when poor work practices are used or the equipment is poorly designed or improperly installed. The ANSI/ AAMI ST58 standard contains detailed guidelines (Figure 2, below) for the purchase and installation of automated equipment which is now widely used in health care facilities that perform highvolume disinfection.

Figure 2. Guidelines for the Purchase and Installation of Automated Glutaraldehyde Processing Equipment

Automated processing equipment encloses the glutaraldehyde disinfection/sterilizing operations and can significantly reduce the release of glutaraldehyde vapor into the workroom air (compared with manual disinfection operations). However, the equipment must be properly designed and installed in order to control glutaraldehyde vapor effectively. The ANSI/AAMI ST58 standard contains detailed guidelines for the purchase and installation of such equipment. Key points include the following:

 Purchase automated processing equipment only from a manufacturer who can provide documentation (i.e., exposure monitoring data) of its effectiveness in controlling glutaraldehyde vapor releases.



(Figure 2. continued)

- 2. Other purchase considerations include: space needs, accessibility, safety features, mid-cycle inspection capability, and means of changing and disposing of glutaraldehyde solutions.
- Following installation, the equipment performance should be evaluated before it is put into actual use at the facility. Exposure monitoring should be conducted to ensure that all equipment is performing properly.

Note: Properly installed ventilation is still necessary even with the use of automated glutaraldehyde processing equipment. For example, ventilation is needed to control exposure when glutaraldehyde is poured into the machine's reservoir and whenever the machine is opened to observe or troubleshoot the equipment. Ductless enclosure hoods are available in a variety of sizes, including custom designs, for automated processing equipment (freestanding and countertop units) from select medical/laboratory equipment suppliers.

Mobile Disinfecting Stations

Mobile disinfecting soaking stations designed specifically for manual high-level disinfecting provide an enclosed area for sterilizing trays, protecting employees from splashes and spills, and controlling exposure to vapor from glutaraldehyde and other disinfectants. Mobile disinfecting stations utilize ductless fume hoods for vapor control and may have different types of filters available depending on the disinfectant to be used.

Facility Design

The health care facility should designate central areas for disinfection and sterilization using glutaraldehyde so that specific controls can be utilized (ANSI/AAMI, 1996). Specific engineering controls are more difficult to implement in facilities that permit the widespread use of glutaraldehyde throughout the site. The centralized location should be large enough to permit freedom of


movement (a crowded work space creates the potential for spills), and have limited access. Posting warning signs at the entrance to the centralized location and limiting access to only trained personnel designated to perform operations involving the use of glutaraldehyde will contribute to reducing exposure at the facility.

Recommended Work Practices

Poor work practices can contribute significantly to an employee's glutaraldehyde exposure. The health care facility should evaluate each glutaraldehyde-using operation and observe employees' work practices to determine all potential sources of exposure. Developing procedures for safe work practices may be useful for training and communication purposes. These procedures should emphasize prevention of employee contact with glutaraldehyde solution or vapors. Only trained, designated personnel should be responsible for handling glutaraldehyde. The following sections provide general recommendations for safe work practices addressing the transportation, storage, use, spill control, cleanup, and disposal of glutaraldehyde. Individual facilities should tailor their work practices to the specific glutaraldehyde operations in place at their work sites.

Transportation and Storage of Glutaraldehyde

- Transport glutaraldehyde solution only in closed containers with tight-fitting lids to minimize the potential for spills (NICNAS, 1994).
- Designate centralized locations for using glutaraldehyde to reduce the potential for spills during transport.
- Store unused glutaraldehyde solutions in tightly covered containers in a cool, secured, and properly labeled area (NICNAS, 1994; ANSI/AAMI, 1996).
- Dispose of outdated solutions properly.

Use and Handling Procedures

When transferring glutaraldehyde to soaking basins and reservoirs, pour the liquid carefully and minimize splashing.



Minimize splashing and agitation of glutaraldehyde solutions by careful placement and removal of instruments (NSW Health Department, 1993).

- When transferring and pouring glutaraldehyde solutions, use safety nozzles designed with a flexible spout and shut-off valve, when available (http://www.kemmed.com).
- Keep covers on soaking basins closed as much as possible and use appropriately-sized, tight-fitting lids for containers.
- Use appropriately-sized soaking basins designed to minimize surface area (e.g., narrow, deep container) (ANSI/AAMI, 1996).
- Keep automatic washer doors closed at all times except when necessary for loading or unloading of instruments to be disinfected.
- Rinse soaked instruments under gently running water as close as possible to the soaking tray or washer to contain solution and minimize dripping on other surfaces (NSW Health Department, 1993).
- Use adequate ventilation if using compressed air to dry instruments rinsed with ethyl or isopropyl alcohol rinses. See discussion on Engineering Controls at page 10 in this section.
- Use glutaraldehyde only in designated areas where traffic and ventilation can be controlled.
- Ensure that the ventilation system is operating prior to handling glutaraldehyde solutions. (Consult your facilities department for help on how to check the operation of your ventilation system.) NOTE: The odor threshold of glutaraldehyde has been reported to be 0.04 parts per million (ppm), and odor detection is a potential indicator that the engineering controls are inadequate. However, you cannot always rely on odor detection because some formulations may contain a perfume to mask the odor of glutaraldehyde (ANSI/AAMI, 1996). Additionally, individuals vary in their ability to detect odors; thus, the lack of an odor does not necessarily mean that exposures are adequately controlled.
- Follow recommended ACGIH procedures for proper use of laboratory hoods (see Figure 3 at page 19).



- Close workroom doors to ensure the effectiveness of any available general dilution ventilation (NJDOHSS, 1998).
- Do not store food, eat, drink, smoke, or apply cosmetics in any area where glutaraldehyde is stored or used.
- Clean up small glutaraldehyde spills and releases immediately. In the case of large spills or delayed response, employees should be encouraged to close doors, alert others and activate the HazMat spill response team.

Alternatives to Glutaraldehyde for High-Level Disinfection

When an alternative to glutaraldehyde is available which is at least as effective as an FDA-approved high-level disinfectant, consideration should be given to whether the alternative is safer for employees. Prior to selecting a specific glutaraldehyde alternative, in addition to process and product considerations, consideration should be given to the following: the toxicity of the glutaraldehyde alternative (e.g., there may be limited knowledge regarding the potential health effects of the alternative); disposal, ventilation, personal protective equipment (PPE) and air monitoring requirements.

Health care facilities that would like to eliminate or reduce their dependence on glutaraldehyde as a high-level disinfectant have two options: (1) use a different (drop-in) liquid chemical disinfectant (e.g., Cidex OPA, Compliance, Sporox II, and Sterilox); or (2) invest in new enclosed equipment technologies that do not utilize glutaraldehyde (e.g., Sterrad and Steris) (Sustainable Hospitals, 2001). Current alternatives to glutaraldehyde for high-level disinfection and/or sterilization can be found on the Food and Drug Administration's (FDA) website at www.fda.gov.cdrh/ode/germlab. html. Material Safety Data Sheets (MSDSs) for each product can be obtained directly from the manufacturer.



Selection and Use of Personal Protective Equipment

See the *General Recommendations* section of this publication at page 23 for additional information on the selection and use of personal protective equipment to control employee exposures to glutaraldehyde. General information on employee training, exposure monitoring, disposal of glutaraldehyde solutions, and spill and cleanup procedures applicable to the use of glutaraldehyde as a high-level disinfectant is also included.

GLUTARALDEHYDE USE AS A TISSUE FIXATIVE

Primary Sources of Glutaraldehyde Exposure

Glutaraldehyde is used in some health care facilities as a fixative in electron and light microscopy and as a tissue preservative. Laboratory personnel may be exposed to solutions containing up to 50% glutaraldehyde during the preparation of fixative solutions for use in microscopy and histology, and to very small quantities of working strength solutions (3-6%) during tissue fixation. If the use is regular and exposure controls are lacking or ineffective, adverse health effects may occur. Eye, skin, and respiratory irritation have been reported for laboratory personnel engaged in tissue fixing (NICNAS, 1994, NIOSH, 1986). The more serious effects, such as skin/respiratory tract sensitization and asthma, may occur in some exposed individuals.

NIOSH has measured and reported air concentrations of glutaraldehyde as high as 1.5 mg/m³ (0.36 ppm) during tissue fixing operations evaluated during maintenance procedures (NIOSH, 1984). The following activities are the primary sources of glutaraldehyde exposure during its use as a tissue fixative:

- preparing glutaraldehyde solution from concentrate to fill enclosed fixing basin;
- draining and cleaning of fixing basin;
- removing and adding materials (e.g., tissue sample) to the fixing basin;
- handling materials fixed in the basin;
- 18

- handling tissue samples for refrigeration;
- rinsing tissue samples in a buffer;
- slicing tissue samples onto slides (NIOSH, 1986).

Recommended Exposure Controls

The use of a properly operating laboratory hood is the recommended method of controlling the exposures of laboratory employees who use glutaraldehyde to prepare slides of tissue samples. As discussed above, for employees who perform instrument disinfection using glutaraldehyde, respirators should not be the primary means of controlling exposure during these laboratory operations. Appropriate PPE, such as gloves and safety eyewear, should always be used <u>in combination</u> with the laboratory hood. Guidelines for the proper use of laboratory hoods are presented in Figure 3, below. These guidelines were developed by the American Conference of Governmental Industrial Hygienists (ACGIH).

Figure 3. Recommended Work Practices for Laboratory Hoods

- 1. Keep all equipment at least 6 inches inside the hood.
- 2. Keep your head outside of the hood during all operations involving hazardous chemicals.
- 3. Do not store chemicals or laboratory equipment inside the hood.
- 4. Keep the hood sash closed as much as possible.
- 5. Do not allow equipment to obstruct the air exhaust slots inside the hood.
- 6. Avoid turbulence at the hood face by minimizing activity in the vicinity of the hood.
- 7. Keep doors and windows closed when the hood is operating (exception: where laboratories are designed to keep doors open).
- 8. Keep the hood sash at the proper operating height. Site Safety and Health or Facilities personnel can provide assistance in evaluating the hood to determine the hood sash location that ensures optimum operation.

Source: ACGIH Industrial Ventilation, 2001.



Selection and Use of Personal Protective Equipment

See the *General Recommendations* section of this publication at page 23 for additional information on the selection and use of personal protective equipment to control exposures to glutaraldehyde. General information on employee training, exposure monitoring, disposal of glutaraldehyde solutions and spill and cleanup procedures applicable to the use of glutaraldehyde as a tissue fixative is also included.

GLUTARALDEHYDE USE IN X-RAY PROCESSING

Primary Sources of Glutaraldehyde Exposure

Health care facilities employees who develop x-rays may be exposed to glutaraldehyde during such operations. Glutaraldehyde is used in developing solutions as a hardening agent to shorten the drying cycle in film processing. X-ray developers are typically supplied as a concentrate containing 30-50% weight-toweight ratio glutaraldehyde and are diluted to working strength solutions containing less than 1-2% glutaraldehyde. Automatic mixers are generally used to mix and dispense developing solutions; however, smaller radiology units may still use manual methods. The primary sources of glutaraldehyde exposure during x-ray processing are as follows:

- mixing glutaraldehyde developer solutions;
- adding solutions to tanks and processors;
- processing x-rays;
- removing incompletely dried processed x-rays;
- cleaning rollers and tanks on x-ray machines;
- emptying tanks and processors;
- fugitive emissions from open tanks and leaky hoses and equipment; and
- automatic processor exhaust.

(Source: NICNAS, 1994.)

20



Measurements of health care employee exposure to glutaraldehyde during x-ray film processing generally show glutaraldehyde levels below recommended exposure standards, especially with automatic mixing and processing operations. Efforts to minimize or eliminate occupational exposure are recommended because glutaraldehyde is a potential sensitizer, health effects may occur at levels lower than current standards, and the effects of simultaneous exposure to multiple chemicals used in developer and fixer solutions are not clearly understood (NICNAS, 1994; Teschke et al., 2002).

Recommended Exposure Controls

As described for previous operations, the primary method of exposure control is enclosing the operation and installing local exhaust ventilation. The following sections describe methods of exposure control during x-ray processing.

Alternative Processes

A good method of glutaraldehyde exposure control is substitution with a safer process that does not require the use of glutaraldehyde. There are commercially available processes that do not require glutaraldehyde as a hardener (Thunthy et al., 1994). Digital x-ray processors are also a viable substitute.

Engineering Controls

Where alternative processes cannot be implemented, engineering controls should be implemented to minimize glutaraldehyde exposure during film processing operations. Examples of engineering controls include:

- installing automatic mixers and processors equipped with local exhaust ventilation that is discharged to outdoors;
- conducting manual mixing and processing within laboratory fume hoods;
- using sealed containers and dispensing units for automatic transfer of glutaraldehyde solutions to processors;
- maintaining glutaraldehyde work areas under slight negative



pressure to prevent glutaraldehyde emissions from escaping into surrounding areas;

 keeping darkroom and processing temperatures as low as possible to minimize glutaraldehyde evaporation.

(Source: NICNAS, 1994.)

Recommended Work Practices

Safe work practices for the use and handling of glutaraldehyde in x-ray film processing include the following:

- regular inspection and maintenance of auto mixers and processors to prevent vapor releases due to leaks and overheating;
- placement and use of mixing tanks and glutaraldehyde solutions in laboratory fume hoods or other enclosed, well ventilated areas;
- careful mixing and handling procedures to minimize vapor release, splashing, spillage, and skin contact;
- use of tight-fitting lids on mixing tanks;
- use of adequately-sized and properly located washing receptacles for cleaning processor equipment and tanks;
- limited handling of wet films; and
- immediate cleanup of small glutaraldehyde spills and releases. See the paragraph on large spills in the *General Recommendations* section of this document at page 31.

(Source: NICNAS, 1994.)

Selection and Use of Personal Protective Equipment

See the *General Recommendations* section of this publication, below, for additional information on the selection and use of personal protective equipment. General information on employee training, exposure monitoring, disposal of glutaraldehyde solutions and spill and cleanup procedures applicable to the use of glutaraldehyde in x-ray processing is also included.

22



GENERAL RECOMMENDATIONS APPLICABLE TO ALL USES OF GLUTARALDEHYDE IN HEALTH CARE

The following recommendations apply to all health care operations involving glutaraldehyde use, and cover:

- selection and use of personal protective equipment;
- employee information and training;
- exposure monitoring;
- disposal of glutaraldehyde solutions; and
- spill control and cleanup procedures.

Selection and Use of Personal Protective Equipment

Employees must wear personal protective equipment (PPE) designed to protect skin and eyes from contact with glutaraldehyde solutions (29 CFR 1910.132 and 1910.133). Contact with clothing should also be prevented. The health care facility should develop and implement a written program outlining the facility's policies and procedures for PPE selection and use, including a hazard assessment and written certification that the hazard assessment has been performed (pursuant to the requirements of 29 CFR 1910.132) to determine the nature of the hazards requiring PPE.

Skin Protection

Employers must select and require employees to use appropriate hand protection when employees' hands are exposed to potential skin absorption of substances such as glutaraldehyde (29 CFR 1910.138). Gloves impervious to glutaraldehyde are required to be worn to prevent contact with glutaraldehyde solutions. Elbowlength gloves or protective sleeves made of glutaraldehydeimpervious material should be worn to protect the hands and forearms (ANSI/AAMI, 1996). The gloves used will depend on the type of work to be done, the duration of contact, and the concentration of glutaraldehyde. Among the chemical-protective materials, *butyl rubber, nitrile* and *Viton*® are the most impervious to 50% glutaraldehyde solutions and have been shown to provide full shift protection against glutaraldehyde permeation (Jordan et al.,

23



1996; Forsberg and Keith, 1999). For shorter exposures, gloves made of polyethylene and styrene-butadiene/styrene-isoprene copolymers (i.e., Allergard Synthetic Surgical Gloves) provide protection for several hours with dilute (2% to 3.4%) glutaralde-hyde solutions (Jordan et al., 1996; Ansell Health Care, 2003).

Latex examination gloves may not provide adequate skin protection against glutaraldehyde. Although one author reports a breakthrough time of 45 minutes with latex examination gloves and standard 2% to 3.4% glutaraldehyde solutions, other materials are available that provide a greater margin of safety. Therefore, latex gloves are not recommended for use with glutaraldehyde.

Polyvinyl chloride (PVC) and neoprene gloves do not provide adequate protection and should not be used with glutaraldehyde solutions because they may retain or absorb glutaraldehyde (Jordan et al., 1996).

If the required hazard assessment (29 CFR 1910.132) indicates a need for additional protection for skin and clothing, it can be provided through the use of isolation gowns, lab coats, or aprons (plus sleeve protectors) that are made of glutaraldehyde-impervious material such as polyethylene-coated, spun-bond polypropylene. Protective clothing that has become saturated should be removed quickly and laundered prior to reuse. If skin contact with glutaraldehyde occurs, the skin should be washed thoroughly with soap and water for at least 15 minutes (ANSI/AAMI, 1996).

Eye Protection

Splashproof goggles or safety glasses with full face shields must be worn wherever there is potential for glutaraldehyde solution to contact the eyes (29 CFR 1910.133). Suitable emergency eyewash equipment must be immediately available for quick drenching or flushing of the eyes (for at least 15 minutes) in all glutaraldehyde usage locations. It is recommended that emergency eyewash units be accessible and located within a 10 second travel time of all affected areas. For additional details, consult American National Standard Z358.1-1998, Emergency Eyewash and Shower Equipment.

If an eyewash and a shower are required, a combination unit should be considered.



Respiratory Protection

Respirators should not be used as a substitute for installing effective engineering controls. When effective engineering controls are not feasible, or while they are being implemented, appropriate respirators may be used to control employee exposure to glutaraldehyde vapor (29 CFR 1910.134(a)(1)).

All personnel who may be required to wear a respirator for routine or emergency use must be included in a written respiratory protection program that meets the requirements of OSHA's Respiratory Protection standard (29 CFR 1910.134). Such a program must have written site-specific procedures for selecting, using, and maintaining respirators; medical evaluations; fit testing; employee training; and routine program evaluation.

Employers must select appropriate respirators based on an exposure assessment or a reasonable estimate of employee exposures to glutaraldehyde vapor during routine and/or emergency work procedures. For protection against exposures to glutaraldehyde vapor during routine procedures, employers may provide air-purifying respirators (i.e., a half-face or full-face airpurifying respirator with organic vapor cartridges), or air-supplying respirators.

If air-purifying respirators are provided, employers must implement a change-out schedule for air-purifying canisters and cartridges to ensure that they are changed before the end of their service life. Change-out schedules must be developed by consulting the respirator manufacturer cartridge or canister test data and evaluating workplace conditions such as estimated glutaraldehyde concentrations, temperature, relative humidity, and employee breathing rate. Cartridge or canister service life calculation formulas are also available on the OSHA website, www.osha.gov.

Air-supplied respirators should be used when exposures may be reasonably anticipated to be higher and for unknown exposures, such as emergency spill situations.

All respirators used must be certified by the National Institute for Occupational Safety and Health (NIOSH) and must be appropriate for use with glutaraldehyde (29 CFR 1910.134(d)(1)(i) and (ii)). The disposable air-purifying particulate respirators (filtering face-



pieces) are not effective against organic vapors, and must not be used for glutaraldehyde protection.

Employees who voluntarily choose to wear respirators, but who are not required by their employers or OSHA to wear a respirator, must still receive the information in Appendix D to 29 CFR 1910.134. See OSHA's Respiratory Protection standard, 29 CFR 1910.134, for further details regarding the requirements for employee use of respirators.

Employee Information and Training

All employers with glutaraldehyde solutions or other hazardous chemicals in their workplaces must develop and implement a written hazard communication program that meets the requirements of OSHA's Hazard Communication standard, 29 CFR 1910.1200. Such a program must include provisions for employee access to material safety data sheets (MSDSs), container labeling, and training for all potentially exposed individuals.

Employees who use, handle, or may have potential exposure (e.g., accidental or possible) to glutaraldehyde solutions must be provided information and training prior to their initial work assignment. Employees must be provided information regarding the requirements of the Hazard Communication standard; operations in their work area where glutaraldehyde solutions (and other hazardous chemicals) are present; and the location and availability of the written hazard communication program and material safety data sheets (MSDSs).

Employee training must include, at a minimum, the following elements (29 CFR 1910.1200):

- methods and observations that may be used to detect the presence or release of glutaraldehyde in the workplace;
- the physical and health hazards of glutaraldehyde;
- the measures employees can take to protect themselves, including specific procedures the employer has implemented to protect employees from exposure to glutaraldehyde, such as appropriate work practices, emergency procedures, and personal protective equipment; and



 an explanation of the material safety data sheet, the employer's labeling system, and how employees can obtain and use the appropriate hazard information.

Exposure Monitoring

Workplace exposure monitoring should be conducted to ensure a safe work environment and to compare monitoring results with recommended occupational exposure limits for glutaraldehyde. Monitoring should be conducted after initiating use of glutaraldehyde solutions; whenever there is a significant change in protocol, work practices, caseload, or workplace ventilation systems; and after major equipment (e.g., endoscope washers or other automated equipment) repairs (ANSI/AAMI, 1996). Exposure monitoring should also be conducted if employees have complaints or symptoms of glutaraldehyde exposure.

Monitoring should be conducted in all glutaraldehyde use areas as well as in the breathing zone of each employee using or handling glutaraldehyde solutions. Special attention should be given to shortterm tasks that may have elevated exposures such as pouring, mixing or otherwise agitating glutaraldehyde solutions.

Several air sampling methods are available for monitoring glutaraldehyde exposures. These methods include active and passive sampling techniques as well as the use of a directreading instrument. Active air sampling uses battery-powered personal sampling pumps and treated filters or sorbent tubes for sample collection. Passive sampling uses small, lightweight, easy-to-use badge assemblies that rely on natural air movement rather than pumps for sample collection. After sampling, the filters or sorbent tubes and passive monitors should be sent to a laboratory for analysis. Accredited laboratories have demonstrated their ability to meet performance standards and are preferred. The OSHA website at www.osha.gov/dts/sltc/methods/organic/org064/ org064.html and NIOSH at www.cdc.gov/niosh/nmam/pdfs/ 2532.pdf may be consulted for additional information regarding validated sampling and analytical methods for glutaraldehyde. In addition, the American Industrial Hygiene Association (www.aiha.org) may be consulted for a listing of consultants and accredited industrial hygiene laboratories.



A direct-reading, handheld, easy-to-use, portable instrument called the "Glutaraldemeter" may also be used to compare monitoring results with recommended glutaraldehyde exposure limits as well as to determine concentrations resulting from spills and other emergencies.

Active air sampling methods require sampling expertise and special sampling supplies and should be performed by an industrial hygienist or other qualified professional trained in industrial hygiene air sampling strategies and techniques. Passive monitors and the Glutaraldemeter do not necessarily require sampling expertise and can be used by health care personnel to evaluate workplace exposures. Proper use of passive monitors may be determined by consulting the manufacturer's instructions and/or the laboratory that will conduct the analyses. Proper use and maintenance of the Glutaraldemeter may be determined by consulting the equipment manufacturer (e.g., MSA or PPM Technology).

Active sampling methods are more sensitive and reliable than passive monitors/badges and the Glutaraldemeter. Quantitative limits of detection (LOD) for the active methods are in the range of 0.44 ppb (parts per billion), while the reliable LOD for passive methods and the Glutaraldemeter are in the range of 20-100 ppb.

Disposal of Glutaraldehyde Solutions

Dispose of glutaraldehyde solutions in accordance with local, state, and Federal regulations. Check with your local Publicly Owned Treatment Works (POTW) to determine if glutaraldehyde solutions can be disposed of in the sanitary sewer system. Some POTWs may prohibit the disposal of glutaraldehyde solutions in the sanitary sewer system or may require neutralization prior to disposal. If there are no disposal restrictions, glutaraldehyde solutions may be disposed of, along with copious amounts of cold water, into a drain connected to the sanitary sewer system. Do not discard glutaraldehyde solutions (including neutralized solutions) into septic systems. Unlike municipal sewage treatment systems, septic systems are not diluted by other waste streams. Consequently, glutaraldehyde concentrations entering the system may be



higher and have an adverse effect on the microorganisms that are necessary for proper functioning of the septic system. Dispose of empty glutaraldehyde containers according to product label instructions.

Spill Control and Cleanup Procedures

All glutaraldehyde spills have the potential to create vapor concentrations that exceed recommended exposure limits. Vayas et al. (2000) measured airborne concentrations during two spills that occurred during their study. The TWA exposures to glutaraldehyde were 0.27 mg/m³ (0.06 ppm) for a spill of about one liter in an unventilated room, and 0.439 mg/m³ (0.11 ppm) for a spill greater than 5 liters in a positive pressure theater. Niven et al. (1997) also reported on glutaraldehye monitoring results (as high as 1.4 ppm) from various spill scenarios. Consequently, a suitable plan of action with procedures for handling glutaraldehyde spills should be developed and implemented by knowledgeable and responsible individuals at the facility. In the development of this plan, consideration should be given to the physical characteristics of the area(s) where glutaraldehyde solutions are used (e.g., type and effectiveness of ventilation, room size and temperature) as well as the quantity and concentration(s) of the solution(s). The spill control plan should incorporate the following key elements (ANSI/AAMI, 1996):

- designation of individuals responsible for managing spill cleanup;
- evacuation procedures for nonessential personnel, if necessary;
- medical treatment procedures for exposed individuals;
- site-specific reporting requirements (e.g., site safety and health personnel);
- cleanup procedures, the location of spill control supplies, and required personal protective equipment;
- location and availability of material safety data sheets (MSDSs) for glutaraldehyde-based sterilants/disinfectants and manufacturer recommendations for emergency response;



- employee training requirements;
- air exchange rate(s) within the areas of use and procedures to prevent the dispersal of glutaraldehyde vapor to other areas of the facility through the general ventilation system; and
- respiratory protection program requirements pertaining to glutaraldehyde.

General Procedures

All spills should be cleaned up immediately, regardless of size. All necessary spill cleanup equipment (e.g., sponges, towels, absorbent mats/wipes, spill pillows, mop and bucket, plastic dustpan and trash bags) and personal protective equipment (i.e., eye, hand, body and respiratory protection) should be readily available. Whether or not a spill can be cleaned up safely without the use of neutralizing chemicals and/or a respirator will depend on a number of factors such as the glutaraldehyde concentration and the amount spilled, the temperature of the room and the solution, and the effectiveness of the ventilation in the spill area. (ANSI/AAMI, 1996). Any spill larger than a drip or a splash may need to be neutralized; and, when vapor concentrations are unknown, airsupplied or atmosphere-supplying respirators are appropriate.

Neutralizing Chemicals

Before using any type of glutaraldehyde-based product, review the manufacturer's recommendations for spill cleanup. Several chemicals can be used to lower the glutaraldehyde concentration in solutions and/or the ambient vapor level during a spill. Examples include household ammonia, ammonium carbonate powder, dibasic ammonium phosphate, and sodium bisulfite. Glycine is also used as a neutralizer, and may be less hazardous than others. There are also commercially available products for this purpose (ANSI/AAMI, 1996), including powders, solutions, and salts.

Drips and Splashes

A reusable or disposable sponge, towel, or mop may be used to quickly clean up small spills. Glutaraldehyde solutions can also be neutralized with an appropriate chemical agent before wiping



up with a sponge, towel, or mop. Cleanup supplies should be thoroughly rinsed with large amounts of water prior to reuse. Rinse water and disposable cleanup supplies should be discarded according to applicable regulations as well as the procedures outlined in the facility spill control plan (ANSI/AAMI, 1996).

Drips and splashes may also be cleaned up with commercially available spill control kits that contain mats/wipes to absorb and neutralize small spills. The absorbed medium should be disposed of according to local, state and Federal regulations.

Large Spills

Any glutaraldehyde spill larger than small drips or splashes should be cleaned up by properly trained and equipped spill response personnel. Certain larger spills of glutaraldehyde are covered by the requirements of OSHA's Hazardous Waste Operations and Emergency Response standard (29 CFR 1910.120(q)).

Pre-planning for spills is a critical piece of the facility exposure control plan. Personnel should understand the necessity to evacuate until the spill is cleaned up and the worksite is safe for reentry of employees. Appropriate spill-response equipment placed outside the affected area for access after the area is evacuated will facilitate compliance with the emergency spill response plan. Supplied air respirators are an important component of a spill-response kit. Appropriate training on the use of the respirators is an important piece of the pre-spill planning, so that spill responders are adequately equipped and trained.

Large spills should be contained and neutralized or contained and collected for disposal. Once contained, spills may be neutralized with an appropriate chemical agent such as sodium bisulfite (2-3 parts (by weight) per part of glutaraldehyde solution) with a contact time of 5 minutes at room temperature, using a mop or other tool to thoroughly blend in the deactivation compound. A less hazardous neutralizer, glycine, can be used in a ratio of 25 grams per gallon of 2.4% glutaraldehyde solution to neutralize in 5 minutes. Depending on the size of the spill and site conditions, heat and vapor may be liberated by the reaction with the neutral-



izing chemicals (ANSI/AAMI, 1996). Commercially available spill pillows and booms may also be used to easily contain, absorb, and/or neutralize large glutaraldehyde spills.

After the glutaraldehyde solution is removed, the spill area and the cleanup supplies/tools should be thoroughly rinsed with large amounts of cold water. Rinse water, disposable cleanup supplies and absorbent medium (if used) should be disposed of according to applicable regulations and the procedures outlined in the facility spill control plan (ANSI/AAMI, 1996).

Additional Resources

Rutala, W.A. 1996. APIC Guideline for Selection and Use of Disinfectants. *Am J Infect Control*, 24:313-42.

Environmental Protection Agency (EPA). 2002. Replacing ethylene oxide and glutaraldehyde. Online at http://www.ciwmb. ca.gov/wpie/healthcare/EPAEtOGlut.pdf

National Institute for Occupational Safety and Health (NIOSH). 2001. Glutaraldehyde: occupational hazards in hospitals. Online at http://cdc.gov/niosh/2001-115html

References

ACGIH, 2001. Industrial Ventilation – A Manual of Recommended Practice. American Conference of Governmental Industrial Hygienists. 24th Edition. Cincinnati, OH. ACGIH.

ACGIH, 2004. Documentation of the Threshold Limit Values and Biological Exposure Indices. American Conference of Governmental Industrial Hygienists. 7th Edition. 2004 Supplement, ACGIH.

AFSCME Health and Safety Program 2001. Fact Sheet, Glutaraldehyde. 1625 L Street, N.W., Washington, DC 20036, and online.

Ansell Health Care. 2003. Allergard® II Sterile Synthetic Copolymer Surgical Gloves. [Technical Data Sheet]. Red Bank, NJ: Ansell Health Care.



ANSI/AAMI. 1996. ST58. American National Standard for the Safe use and handling of glutaraldehyde-based products in health care facilities. Arlington, VA: Association for the Advancement of Medical Instrumentation.

ANSI/AIHA (Z9.7) 1998. American National Standard for Recirculation of Air from Industrial Process Exhaust Systems. Fairfax, VA: American Industrial Hygiene Association.

APIC Guideline. 1994. APIC Guideline for Infection Prevention and Control in Flexible Endoscopy. Association for Professionals in Infection Control and Epidemiology. APIC, Inc. 1994.

Ballantyne, B. and B. Berman. 1984. Dermal sensitizing potential of glutaraldehyde: a review and recent observations. *J Toxicol Cutaneous Ocul Toxicol* 3(3):251-262.

Butt, G., Greenley, P., Herrick, R., and L. DiBerardinis. 1999. Exposure to glutaraldehyde vapors during endoscopic sterilization processes in a large research and teaching institution. *Journal of Healthcare Safety, Compliance & Infection Control* 3(4): 172179.

Crandall, M.S. 1987. Montgomery Hospital, Norristown, PA., NIOSH Health Hazard Evaluation Report No. 86-226-1769. NIOSH.

Di Stefano, F., Siriruttanapruk, S., McCoach, J. and P. Sherwood Burge. 1999. Glutaraldehyde: an occupational hazard in the hospital setting. *Allergy* 54:1105-1109.

Ellet, M.L., Mikels, C.A., and J.W. Fullhart. 1995. SGNA Endoscopic Disinfectant Survey. *Gastroenterol Nurs* 18(1):2-10.

FDA. 2003. FDA-Cleared Sterilants and High Level Disinfectants with General Claims for Processing Reusable Medical and Dental Devices. U.S. Department of Health and Human Services, Food and Drug Administration, Center for Devices and Radiological Health. Online at http://www.fda.gov/cdrh/ode/germlab.html

Forsberg, K., and L.H. Keith. 1997. Chemical Protective Clothing Performance Index. 2nd Edition. New York: John Wiley & Sons, Inc., pp. 326-327.

Fowler J.F., Jr. 1989. Allergic contact dermatitis from glutaraldehyde exposure. *J Occup Environ Med*, 31(10):852-853.



Gannon, P.F.G., Bright, P., Campbell, M., O'Hickey, S.P., and P.S. Burge. 1995. Occupational asthma due to glutaraldehyde and formaldehyde in endoscopy and x-ray departments. *Thorax*, 50:156-159.

Health & Safety Executive, UK. 1997. Glutaraldehyde criteria document for an occupational exposure, ISBN 07176 1443 3.

Jordan, S.L.P., Stowers, M.F., Trawick, E.G., and A.B. Theis. 1996. Glutaraldehyde permeation: choosing the proper glove. *Am J Infect Control*, 24(2):67-69.

Keynes, H.L., Ross, D.J. and J.C. McDonald. 1996. SWORD '95: Surveillance of work-related and occupational respiratory disease in the U.K. *Occup Med* 46(5):379-381.

Maibach, H.I. and S.D. Prystowsky. 1977. Glutaraldehyde (pentanedial) allergic contact dermatitis. *Arch Dermatol* 113:170-171.

Marzulli, F.N. and H.I. Maibach. 1974. The use of graded concentrations in studying skin sensitizers: experimental contact sensitization in man. *Food Cosmet Toxicol*, 12: 219-227.

Naidu, V., S. Lam, and G. O'Donnell. 1995. Typical glutaraldehyde vapour levels in endoscope disinfection units in New South Wales hospitals. *J Occup Health and Safety* - Austral NZ 11(1): 43-57.

National Research Council. 1995. Prudent Practices in the Laboratory – Handling and Disposal of Chemicals. Washington, D.C.: National Academy Press.

Nethercott, J.R., and D.L. Holness. 1988. Contact dermatitis in funeral service workers. *Contact Dermatitis*, 18:263-267.

Nethercott J.R., Holness D.L., and E. Page. 1988. Occupational contact dermatitis due to glutaraldehyde in health care workers. *Contact Dermatitis*, 18:193-196.

NICNAS, 1994. Priority Existing Chemical No. 3, Glutaraldehyde, Full Public Report, http://www.nicnas.gov.au/publications/CAR/PEC/ PEC3/PEC3index.htm

National Industrial Chemicals Notification and Assessment Scheme, Australian Government Publishing Service, Canberra.



NIOSH. 1984. Health Hazard Evaluation Report No. HETA 83-074-1525. National Jewish Hospital, Denver, Colorado. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, Cincinnati, OH.

NIOSH. 1986. Health Hazard Evaluation Report No. HETA 84-535-1690. National Jewish Hospital, Denver, Colorado. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, Cincinnati, OH.

NIOSH. 1987. Health Hazard Evaluation Report No. HETA-85-257-1791. Mercy Medical Center, Denver, Colorado. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, Cincinnati, OH.

NIOSH. 1991. Health Hazard Evaluation Report No. HETA-90-296-2149. Monongalia General Hospital, Morgantown, West Virginia. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, Cincinnati, OH.

NIOSH. 2001. Glutaraldehyde: Occupational Hazards in Hospitals. DHHS (NIOSH) Publication No. 2001-115. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, Cincinnati, OH.

Niven, K.J.M., Cherrie, J.W. and J. Spencer. 1997. Estimation of exposure from spilled glutaraldehyde solutions in a hospital setting. *Ann Occup Hyg*, 41(6):691-698.

NJDOHSS. 1998. Glutaraldehyde survey. New Jersey Department of Health and Senior Services, Occupational Disease and Injury Services, Trenton, NJ.

Norbäck, D. 1988. Skin and respiratory symptoms from exposure to alkaline glutaraldehyde in medical services. *Scand J Work Environ Health*, 14:366-371.

Nova Scotia Department of Environment and Labour, 2000. Glutaraldehyde Hazard Alert. Occupational Health and Safety Division. Hazard Alerts.



NSW Health Department. 1993. Guidelines for the Safe Use of Glutaraldehyde in Health Care Establishments - Amendment (http://www.health.nsw.gov.au/fcsd/rmc/cib/circulars/1993/cir93-99.pdf), North Sydney, Australia, File No. 1225/3, Circular No. 93/99.

Occupational Safety and Health Administration, online at: http://www.osha.gov

Pryor, P.D., 1984. National Jewish Hospital, Denver, Colorado. NIOSH Health Hazard Evaluation Report No. 83-074-1525.

Pisaniello, D.L., Gun, R.T., Tkaczuk, M.N., Nitshcke, M. and J. Crea. 1997. Glutaraldehyde exposures and symptoms among endoscopy nurses in South Australia. *Appl Occup Environ Hyg*, 12(3):171-177.

Rosenman, K.D., Reilly, M.J. and D.J. Kalinowski. 1997. A state-based surveillance system for work-related asthma. *J Occup Environ Med*, 39(5):415-425.

Sustainable Hospitals. 2001. The Lowell Center for Sustainable Production. Sustainable Hospitals Project. Glutaraldehyde control in hospitals. Available online at http://www.sustainablehospitals.org/ HTMLSrc/IP_Glutcontrol.html

Stern, M.L., et al. Contact hypersensitivity response to glutaraldehyde in guinea pigs and mice. *Toxicol Ind Health*, 5(1):31-43, 1989.

Teschke, K., Chow, Y., Brauer, M., Chessor, E., Hirtle, B., Kennedy, S.M., Yeung, M.C. and H.D. Ward. 2002. Exposures and their determinants in radiographic film processing. *Am Ind Hyg Assoc J*, 63:11-21.

Thunthy, K.H., Yeadon, W.R. and R. Winberg. 1994. Sensitometric and archival evaluation of Kodak RA films in dental automatic processing. *Oral Surg Oral Med Oral Pathol*, 77(4): 427-430.

University of North Carolina-Chapel Hill Health and Safety Manual. http://www.ehs.unc.edu/manuals/HSMManual/ Chapter5html/h5-03.htm



Vyas, A., Pickering, C.A., Oldham, L.A., Francis, H.C., Fletcher, A.M., Merrett, T., and R. M. Niven. 2000. Survey of symptoms, respiratory function, and immunology and their relation to glutaraldehyde and other occupational exposures among endoscopy nursing staff. *Occup Environ Med*, 57:752-759.

Waters, A., Beach, J., and M. Abramson. 2003. Symptoms and lung function in health care personnel exposed to glutaraldehyde. *Am J Ind Med*, 43:196-203.

37



OSHA Assistance

OSHA can provide extensive help through a variety of programs, including technical assistance about effective safety and health programs, state plans, workplace consultations, voluntary protection programs, strategic partnerships, training and education, and more. An overall commitment to workplace safety and health can add value to your business, to your workplace and to your life.

Safety and Health Program Management Guidelines

Effective management of employee safety and health protection is a decisive factor in reducing the extent and severity of work-related injuries and illnesses and their related costs. In fact, an effective safety and health program forms the basis of good employee protection and can save time and money (about \$4 for every dollar spent) and increase productivity and reduce employee injuries, illnesses and related workers' compensation costs.

To assist employers and employees in developing effective safety and health programs, OSHA published recommended *Safety and Health Program Management Guidelines* (54 *Federal Register* (16): 3904-3916, January 26, 1989). These voluntary guidelines apply to all places of employment covered by OSHA.

The guidelines identify four general elements critical to the development of a successful safety and health management program:

- Management leadership and employee involvement.
- Work analysis.
- Hazard prevention and control.
- Safety and health training.

The guidelines recommend specific actions, under each of these general elements, to achieve an effective safety and health program. The *Federal Register* notice is available online at www.osha.gov

State Programs

The Occupational Safety and Health Act of 1970 (OSH Act) encourages states to develop and operate their own job safety and



health plans. OSHA approves and monitors these plans. Twentyfour states, Puerto Rico and the Virgin Islands currently operate approved state plans: 22 cover both private and public (state and local government) employment; Connecticut, New Jersey, New York and the Virgin Islands cover the public sector only. States and territories with their own OSHA-approved occupational safety and health plans must adopt standards identical to, or at least as effective as, the Federal standards.

Consultation Services

Consultation assistance is available on request to employers who want help in establishing and maintaining a safe and healthful workplace. Largely funded by OSHA, the service is provided at no cost to the employer. Primarily developed for smaller employers with more hazardous operations, the consultation service is delivered by state governments employing professional safety and health consultants. Comprehensive assistance includes an appraisal of all mechanical systems, work practices and occupational safety and health hazards of the workplace and all aspects of the employer's present job safety and health program. In addition, the service offers assistance to employers in developing and implementing an effective safety and health program. No penalties are proposed or citations issued for hazards identified by the consultant. OSHA provides consultation assistance to the employer with the assurance that his or her name and firm and any information about the workplace will not be routinely reported to OSHA enforcement staff.

Under the consultation program, certain exemplary employers may request participation in OSHA's Safety and Health Achievement Recognition Program (SHARP). Eligibility for participation in SHARP includes receiving a comprehensive consultation visit, demonstrating exemplary achievements in workplace safety and health by abating all identified hazards and developing an excellent safety and health program.

Employers accepted into SHARP may receive an exemption from programmed inspections (not complaint or accident investigation inspections) for a period of one year. For more information concerning consultation assistance, see the OSHA website at www.osha.gov



Voluntary Protection Programs (VPP)

Voluntary Protection Programs and on-site consultation services, when coupled with an effective enforcement program, expand employee protection to help meet the goals of the *OSH Act*. The three levels of VPP are Star, Merit, and Star Demonstration designed to recognize outstanding achievements by companies that have successfully incorporated comprehensive safety and health programs into their total management system. The VPPs motivate others to achieve excellent safety and health results in the same outstanding way as they establish a cooperative relationship between employers, employees and OSHA.

For additional information on VPP and how to apply, contact the OSHA regional offices listed at the end of this publication.

Strategic Partnership Program

OSHA's Strategic Partnership Program, the newest member of OSHA's cooperative programs, helps encourage, assist and recognize the efforts of partners to eliminate serious workplace hazards and achieve a high level of employee safety and health. Whereas OSHA's Consultation Program and VPP entail one-on-one relationships between OSHA and individual worksites, most strategic partnerships seek to have a broader impact by building cooperative relationships with groups of employers and employees. These partnerships are voluntary, cooperative relationships between OSHA, employers, employee representatives and others (e.g., labor unions, trade and professional associations, universities and other government agencies).

For more information on this and other cooperative programs, contact your nearest OSHA office, or visit OSHA's website at www.osha.gov

Alliance Programs

The Alliance Program enables organizations committed to workplace safety and health to collaborate with OSHA to prevent injuries and illnesses in the workplace. OSHA and the Alliance participants work together to reach out to, educate and lead the nation's employers and their employees in improving and advancing workplace safety and health.



Groups that can form an Alliance with OSHA include employers, labor unions, trade or professional groups, educational institutions and government agencies. In some cases, organizations may be building on existing relationships with OSHA that were developed through other cooperative programs.

There are few formal program requirements for Alliances and the agreements do not include an enforcement component. However, OSHA and the participating organizations must define, implement and meet a set of short- and long-term goals that fall into three categories: training and education; outreach and communication; and promoting the national dialogue on workplace safety and health.

OSHA Training and Education

OSHA area offices offer a variety of information services, such as compliance assistance, technical advice, publications, audio-visual aids and speakers for special engagements. OSHA's Training Institute in Arlington Heights, IL, provides basic and advanced courses in safety and health for Federal and state compliance officers, state consultants, Federal agency personnel, and private sector employers, employees and their representatives.

The OSHA Training Institute also has established OSHA Training Institute Education Centers to address the increased demand for its courses from the private sector and from other Federal agencies. These centers are nonprofit colleges, universities and other organizations that have been selected after a competition for participation in the program.

OSHA also provides funds to nonprofit organizations, through grants, to conduct workplace training and education in subjects where OSHA believes there is a lack of workplace training. Grants are awarded annually. Grant recipients are expected to contribute 20 percent of the total grant cost.

For more information on grants, training and education, contact the OSHA Training Institute, Office of Training and Education, 2020 South Arlington Heights Road, Arlington Heights, IL 60005, (847) 297-4810 or see "Training" on OSHA's website at www.osha.gov. For further information on any OSHA program, contact your nearest OSHA area or regional office listed at the end of this publication.



Information Available Electronically

OSHA has a variety of materials and tools available on its website at www.osha.gov. These include *e-Tools* such as *Expert Advisors*, *Electronic Compliance Assistance Tools (e-cats), Technical Links;* regulations, directives and publications; videos and other information for employers and employees. OSHA's software programs and compliance assistance tools walk you through challenging safety and health issues and common problems to find the best solutions for your workplace.

A wide variety of OSHA materials, including standards, interpretations, directives, and more, can be purchased on CD-ROM from the U.S. Government Printing Office, Superintendent of Documents, phone toll-free (866) 512-1800.

OSHA Publications

OSHA has an extensive publications program. For a listing of free or sales items, visit OSHA's website at www.osha.gov or contact the OSHA Publications Office, U.S. Department of Labor, 200 Constitution Avenue, NW, N-3101, Washington, DC 20210. Telephone (202) 693-1888 or fax to (202) 693-2498.

Contacting OSHA

To report an emergency, file a complaint or seek OSHA advice, assistance or products, call (800) 321-OSHA or contact your nearest OSHA regional or area office listed at the end of this publication. The teletypewriter (TTY) number is (877) 889-5627.

You can also file a complaint online and obtain more information on OSHA Federal and state programs by visiting OSHA's website at www.osha.gov



OSHA Regional Offices

Region I

(CT,* ME, MA, NH, RI, VT*) JFK Federal Building, Room E340 Boston, MA 02203 (617) 565-9860

Region II

(NJ,* NY,* PR,* VI*) 201 Varick Street, Room 670 New York, NY 10014 (212) 337-2378

Region III

(DE, DC, MD,* PA, VA,* WV) The Curtis Center 170 S. Independence Mall West Suite 740 West Philadelphia, PA 19106-3309 (215) 861-4900

Region IV

(AL, FL, GA, KY,* MS, NC,* SC,* TN*) 61 Forsyth Street, SW Atlanta, GA 30303 (404) 562-2300

Region V

(IL, IN,* MI,* MN,* OH, WI) 230 South Dearborn Street Room 3244 Chicago, IL 60604 (312) 353-2220

Region VI

(AŘ, LA, NM,* OK, TX) 525 Griffin Street, Room 602 Dallas, TX 75202 (214) 767-4731 or 4736 x224

Region VII

(IA,* KS, MO, NE) City Center Square 1100 Main Street, Suite 800 Kansas City, MO 64105 (816) 426-5861

Region VIII

(CO, MT, ND, SD, UT,* WY*) 1999 Broadway, Suite 1690 PO Box 46550 Denver, CO 80202-5716 (720) 264-6550

Region IX

(American Samoa, AZ,* CA,* HI,* NV,* Northern Mariana Islands) 71 Stevenson Street, Room 420 San Francisco, CA 94105 (415) 975-4310

Region X

(AK,* ID, OR,* WA*) 1111 Third Avenue, Suite 715 Seattle, WA 98101-3212 (206) 553-5930

* These states and territories operate their own OSHA-approved job safety and health programs (Connecticut, New Jersey, New York and the Virgin Islands plans cover public employees only). States with approved programs must have standards that are identical to, or at least as effective as, the Federal standards.

Note: To get contact information for OSHA Area Offices, OSHAapproved State Plans and OSHA Consultation Projects, please visit us online at www.osha.gov or call us at 1-800-321-OSHA.







hoods (capture velocity of at least 100 feet per minute) to control vapor.

- Keep glutaraldehyde baths under a fume hood where possible.
- Use only enough glutaraldehyde to perform the required disinfecting procedure.
- Store glutaraldehyde in closed containers in well ventilated areas. Air-tight containers are available. Post signs to remind staff to replace lids after using product.
- Use specially designed, mobile, compact, disinfectant soaking stations to facilitate sterilization of heat sensitive equipment such as endoscopes, or GI scopes. These soaking stations provide an enclosed area for sterilizing trays, and remove fumes from glutaraldehyde and other disinfectants.
- Use appropriate PPE covered under [<u>29 CFR 1910.132(a)</u>] including:
 - Use gloves that are impervious to glutaraldehyde such as those made of Butyl Rubber, Nitrile, and Viton®, which have been shown to provide full shift protection from glutaraldehyde.
 - For shorter exposures, you can use gloves made of polyethylene. Do not use Neoprene and PVC gloves because they do not provide adequate protection against glutaraldehyde and may actually absorb it.
 - Do not use latex surgical exam gloves for skin protection against glutaraldehyde, except in situations where only short-term, incidental contact is expected.
 - Wear lab coats, aprons, or gowns made of appropriate materials such as polypropylene to provide additional protection.
 - Wear splash-proof goggles and/or full face shields when working with glutaraldehyde to protect eyes.
- All employees who may be exposed to above the ceiling threshold limit value (TLV) of 0.05 ppm, should use appropriate respirators for glutaraldehyde vapor during routine or emergency work. Respirator requirements are found in the OSHA respiratory protection standard [29 CFR 1910.134]
- Provide eye wash fountains for immediate emergency use [29 CFR 1910.151(c)].
 - Use eye wash fountains and emergency showers if there is skin contact with glutaraldehyde. Flush area with water for at least 15 minutes to remove chemical.
 - Change into clean clothes if clothing becomes contaminated.
- Clean up spills immediately.
 - Refer to <u>ANSI/AAMI</u> [1996] for further information about emergency procedures in the event of a large spill.
- Do not eat, drink, or smoke in any area where glutaraldehyde is handled or stored.
- Use a vacuum or wet method to reduce dust while cleaning up pure glutaraldehyde. Do not dry sweep.
- Use less toxic products if feasible and available, or other processes for sterilization.
- Automate the transfer of pure glutaraldehyde or pump liquid glutaraldehyde from drums or other storage containers to appropriate containers and operations, avoiding exposure to glutaraldehyde by keeping it in a contained process.
- Hazard Communication Standard [29 CFR 1910.1200] requires employers to ensure that the hazards of all chemicals are evaluated and that this information is transmitted to the employees by means of a hazards communication program which includes, labeling, material safety data sheets, and employee training.

For additional information, see Healthcare Wide Hazards - <u>PPE</u>, and <u>Hazardous</u> <u>Chemicals</u>.

Additional Information:

- <u>Best Practices for the Safe Use of Glutaraldehyde in Health Care</u> [261 KB PDF^{*}, 48 pages]. OSHA Publication 3258-08N, (2006).
- OSHA does not currently have a required permissible exposure level (PEL) for glutaraldehyde.
 - The American Conference of Government Industrial Hygienists (ACGIH) has a recommended ceiling Threshold Limit Value (TLV) of 0.05 ppm (parts per million). This represents an airborne concentration that should not be exceeded during any part of the work shift.
 - NIOSH has established a recommended exposure limit of 0.2 ppm for glutaraldehyde vapor from either activated or unactivated solutions. This TLV is based on the irritation threshold in humans.



Revised November 1995



Glutaraldehyde

TABLE OF CONTENT

- FIND OUT IF YOU ARE WORKING WITH GLUTARALDEHYDE
- HOW GLUTARALDEHYDE ENTERS AND AFFECTS YOUR BODY
- <u>TESTS FOR EXPOSURE AND MEDICAL EFFECTS</u>
- LEGAL EXPOSURE LIMITS
- <u>REDUCING YOUR EXPOSURE</u>
- <u>RESOURCES</u>

Health Hazard Summary: The most common effect of overexposure to glutaraldehyde is irritation of the eyes, nose, throat, and skin. Glutaraldehyde can also cause asthma and allergic reactions of the skin.

HOW TO FIND OUT IF YOU ARE WORKING WITH GLUTARALDEHYDE

Odor and Appearance: Glutaraldehyde is most often available as 50%, 25%, or 2% solutions in water. A 2% glutaraldehyde solution is "activated" by alkali for use as a broad-spectrum disinfectant. Glutaraldehyde solutions are pale yellow liquids that smell like rotten apples. Glutaraldehyde is slow to evaporate into the air unless heated.
Glutaraldehyde

Some synonyms and trade names for glutaraldehyde and glutaraldehyde products are:

	R R
glutaral	Cidex
glutaric aldehyde	Glutarex ^R
glutardialdehyde	Sonacide ^R
Glutarolglutaric dialdehyde	Sonacide ^R
1,5-pentanedial	Verucasep ^R
1,5-pentanedione	1,3-diformylpropane

Uses: Glutaraldehyde is used as a sterilant and disinfectant, leather tanning agent, tissue fixative, embalming fluid, resin or dye intermediate, and cross-linking agent. It is also used in X-ray film processing, in the preparation of dental materials, surgical grafts, and bioprostheses, and as a fixative for electron microscopy.

Your Right to Know: Under California's Hazard Communication Standard (Cal/OSHA regulation *GISO 5194*), your employer must tell you if you are working with any hazardous substances, including glutaraldehyde, and must train you to use them safely.

If you think you may be exposed to hazardous chemicals at work, ask to see the Material Safety Data Sheets (MSDSs) for the products in your work area. An MSDS lists the hazardous chemicals in a product, describes its health and safety hazards, and gives methods for its safe use, storage, and disposal. An MSDS should also include information on fire and explosion hazards, chemical reactivity, first aid, and methods for handling leaks and spills. Your employer must have an MSDS for any workplace product that contains a hazardous substance, and must make the MSDS available to employees on request.

This Fact Sheet is an aid for worker training programs. It does not take the place of a Material Safety Data Sheet.

HOW GLUTARALDEHYDE ENTERS AND AFFECTS YOUR BODY

Glutaraldehyde can affect you when you breathe its vapor or touch the liquid. Glutaraldehyde mainly affects the first body tissue it touches (usually the eyes, nose, throat, and lungs, or the skin). The most common effect of overexposure is irritation of the eyes, nose, throat, and skin, as described below.

Eyes, Nose, and Throat: Glutaraldehyde vapor in the air can cause teary eyes, burning nose, sore throat, coughing, and headache. These effects can occur when the amount of glutaraldehyde in the air is about 0.1"ppm" (the legal exposure limit is 0.2 ppm - see "Legal Exposure Limits" on page 3).

Direct contact with liquid glutaraldehyde severely irritates the eyes and can cause permanent eye damage. *In case of eye contact, immediately rinse the eyes with water for 15 minutes and then seek medical attention.*

Skin: Glutaraldehyde can remove your skin's natural protective oils. This can irritate the skin and cause dermatitis (skin rash), with dryness, redness, flaking, and cracking of the skin. Glutaraldehyde easily soaks through ordinary clothing and can severely burn the skin beneath it. Repeated skin contact can also cause an allergic skin reaction, with redness, itching, hives, and blisters.

Lungs: Glutaraldehyde vapor can irritate the lungs, causing chest pain and shortness of breath.

Repeated exposure to glutaraldehyde can cause asthma. Asthma has occurred even in people exposed to low levels of glutaraldehyde (0.05 ppm). Symptoms of asthma include chest tightness, shortness of breath, wheezing, and coughing. A person who has developed asthma can react even to very small amounts of glutaraldehyde or other irritant chemicals.

Cancer: Whether glutaraldehyde can cause cancer in humans has not been studied. It does not cause genetic mutations in most laboratory tests. This suggests that it is unlikely to cause cancer. However, it is closely related to the cancer-causing chemical formaldehyde. Glutaraldehyde is now being tested to see whether it causes cancer in animals that breathe its vapor.

Reproductive System: Whether glutaraldehyde can affect the reproductive system has not been studied thoroughly. In limited studies, it did not harm the offspring of animals exposed during pregnancy. Glutaraldehyde is believed to be unlikely to affect pregnancy or reproductive function so long as exposure levels are below those that cause noticeable symptoms.

Glutaraldehyde has not been tested to see whether it could affect male reproductive function.

TESTS FOR EXPOSURE AND MEDICAL EFFECTS

Glutaraldehyde reacts quickly with body tissues and does not stay in the body for long. No test can accurately measure the amount of glutaraldehyde in the body, so routine testing is not recommended or required.

Patch testing can be used to diagnose allergic contact dermatitis. Inhalation challenge testing by a pulmonary specialist can be used to determine whether asthma may be related to glutaraldehyde exposure.

It is generally recommended that workers who are regularly exposed to hazardous substances get a complete physical examination, including an occupational and medical history, at the beginning of their

employment. They should also have periodic follow-up examinations.

LEGAL EXPOSURE LIMITS

California's Division of Occupational Safety and Health (Cal/OSHA) sets and enforces workplace chemical exposure limits. Cal/OSHA has set a Ceiling Limit for the amount of glutaraldehyde in workplace air. The Ceiling Limit for glutaraldehyde is 0.2 parts of glutaraldehyde in each million parts of air (0.2 "parts per million," or 0.2 "ppm"). This is about equal to 0.8 milligrams of glutaraldehyde per cubic meter of air (0.8 mg/m³). Legally, your exposure must never exceed this Ceiling Limit for any period of time.

Concentrations of glutaraldehyde lower than the legal limits can cause eye, nose, and throat irritation as well as asthma. These effects have been reported to occur at glutaraldehyde levels as low as 0.05 to 0.1 ppm.

Although Cal/OSHA does not prohibit skin contact with glutaraldehyde, it is important to avoid skin contact with it in order to avoid serious burns.

According to one report, many people can smell glutaraldehyde at a concentration of 0.04 ppm; however, some people may not smell it even at higher levels. Eye, nose, and throat irritation can occur at about the same exposure level. If you can smell glutaraldehyde or feel its irritant effects, you may be getting overexposed, and may run a risk of developing asthma. However, measuring the amount of a substance in the air is the only reliable way to determine the exposure level.

If you think you may be overexposed, talk to your union or your supervisor. If any worker might be exposed to a substance at more than the legal limit, the employer must measure the amount of the substance in the air in the work area (Cal/OSHA regulation GISO 5155(e)). You have the legal right to see the results of monitoring relevant to your exposure (GISO 3204).

You also have the right to see and copy your own medical records, and records of your exposure to toxic substances. These records are important in determining whether your health has been affected by your work. Employers who have such records must keep them and make them available to you for at least 30 years after the end of your employment.

REDUCING YOUR EXPOSURE

Your employer is required to protect you from being exposed to chemicals at levels above the legal limit. Cal/OSHA and Cal/OSHA Consultation Service can help you and your employer - see the "Resources" section below.

Substitution: The most effective way to prevent harmful exposure is to use a safer chemical, if one is available. However, the health and safety hazards of substitutes must also be carefully considered, to

Glutaraldehyde

make sure that they are actually safer.

Engineering Controls: Whenever possible, employers must use engineering control methods rather than personal protective equipment to prevent overexposure. Engineering control methods include installing ventilation, changing the work process, and changing work practices. Containers of glutaraldehyde should be tightly covered to prevent evaporation. Certain work processes can be isolated, enclosed, or automated to reduce exposures.

Local exhaust ventilation systems ("hoods") are the most effective type of ventilation control. These systems capture contaminated air at its source before it spreads into the air you breathe.

Personal Protective Equipment: If skin contact with glutaraldehyde is likely, protective equipment such as gloves, goggles, or faceshields should be worn. Protective clothing should be made of a material that is resistant to glutaraldehyde, such as butyl rubber, neoprene, polyvinyl chloride, or Viton. Even the most resistant materials will be penetrated quickly and can become dangerous, so gloves should be replaced often.

When engineering controls cannot reduce exposures enough, a respirator must be worn and a respiratory protection program must be developed, as described in detail in Cal/OSHA regulations (*GISO 5144*). An industrial hygienist or other trained person should be consulted, to make sure that the equipment is appropriate and is used correctly.



Appendix B Standard Operating Procedure – Formaldehyde



Formaldehyde

1. Process

a. General handling of Formaldehyde (37%) solutions and/or Formalin-fixed specimens

2. Describe process, hazardous chemical, or hazard class

- a. Toxic
- b. Carcinogen
- c. Flammable

3. Personal Protective Equipment

- a. If airborne exposures are suspected contact the CHEMICAL HYGIENE OFFICER for consultation. Formaldehyde Exposure Assessments are required by law.
- b. Eye: Eye protection should be selected on potential for splash and exposure. *Minimum potential:* safety glasses with side shields when only low splash hazard exists (e.g. placing a tissue sample in a container). Chemical splash goggles should be worn if using or transferring larger quantities.
- c. Skin: Disposable or lightweight nitrile (8-mil) gloves provide protection from incidental contact. Heavier (Butyl) gloves should be used when extended handling of contaminated or preserved materials or immersion is likely. A chemically resistant apron should be used when transferring or using large quantities and splash is likely.

4. Engineering Controls

- a. Work with formal dehyde solutions and/or formalin-fixed specimens only in a fume hood or with local exhaust ventilation.
- b. Use only in an area equipped with an emergency shower and eyewash.

5. Special Handling Procedures and Storage Requirements

- a. Read Safety Data Sheet (SDS) prior to first use.
- b. Keep in a tightly closed container.
- c. Separate from oxidizing agents.
- d. Keep away from heat and flame.

6. Spill and Accident Procedures

- a. Small spills: Do not attempt cleanup if you feel unsure of your ability to do so or if you perceive the risk to be greater than normal laboratory operations. Absorb incidental spills. Collect and submit for waste disposal by SBVC's designated hazardous waste contractor (EMT).
- b. Notify others in area. Evacuate room/immediate area. If splashed on an individual or in eyes flush for 15 minutes with copious quantities of water. Call CHEMICAL HYGIENE OFFICER, SITE SAFETY OFFICE or District Police (after hours) for emergency response. Prevent unnecessary entry until SBVC emergency response team arrives. Provide assistance to CHEMICAL HYGIENE OFFICER/emergency response team as requested.
- c. Inhalation: Remove to fresh air. If breathing has stopped give artificial respiration immediately.
- d. Ingestion: If swallowed and the victim is conscious, dilute, inactivate, or absorb the ingested formaldehyde by giving 1 to 2 cups of milk, and induce vomiting. After vomiting, give mixture of 2 Tbs. of activated charcoal mixed with 1 cup of water. Any organic material will inactivate formaldehyde. Get medical attention immediately.



- e. Skin Contact: In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.
- f. Eye Contact: Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

7. Decontamination Procedures

- a. Wash surfaces thoroughly with soap and water.
- b. Contain decontamination materials for proper waste disposal by SBVC's designated hazardous waste contractor (EMT).

8. Waste Disposal Procedures

a. Formaldehyde is a listed RCRA hazardous waste. Dispose of waste through SBVC's designated hazardous waste contractor (EMT).

9. SDS Location

- a. Available in lab
- b. Available through Chemical Hygiene Officer
- c. Available through manufacturer's website



Appendix C Standard Operating Procedure – Phenol



Phenol

1. Process

a. General handling of Phenol (5%)

2. Describe process, hazardous chemical, or hazard class

- a. Toxic
- b. Severe body tissue irritant
- c. Combustible solid

3. Personal Protective Equipment

- a. If airborne exposures are suspected contact the CHEMICAL HYGIENE OFFICER for consultation. Phenol Exposure Assessments are recommended.
- b. Eye: Eye protection should be selected on potential for splash and exposure. *Minimum potential:* safety glasses with side shields when only low splash hazard exists (e.g. placing a tissue sample in a container). Chemical splash goggles should be worn if using or transferring larger quantities.
- c. Skin: Butyl or polyethylene gloves provide protection from incidental contact. Heavier gloves should be used when extended handling of contaminated or preserved materials or immersion is likely. A chemically resistant apron should be used when transferring or using large quantities and splash is likely.

4. Engineering Controls

- a. Work with phenol only in a fume hood or with local exhaust ventilation.
- b. Use only in an area equipped with an emergency shower and eyewash.

5. Special Handling Procedures and Storage Requirements

- a. Read Safety Data Sheet (SDS) prior to first use.
- b. Keep in a tightly closed container.
- c. Separate from strong oxidizers, acids, and halogens.
- d. Keep away from heat and flame.

6. Spill and Accident Procedures

- a. Small spills: Do not attempt cleanup if you feel unsure of your ability to do so or if you perceive the risk to be greater than normal laboratory operations. Absorb incidental spills. Collect and submit for waste disposal by SBVC's designated hazardous waste contractor (EMT).
- b. Notify others in area. Evacuate room/immediate area. If splashed on an individual or in eyes flush for 15 minutes with copious quantities of water. Call CHEMICAL HYGIENE OFFICER, SITE SAFETY OFFICE or District Police (after hours) for emergency response. Prevent unnecessary entry until SBVC emergency response team arrives. Provide assistance to CHEMICAL HYGIENE OFFICER/emergency response team as requested.
- c. Inhalation: Remove to fresh air. If breathing has stopped give artificial respiration immediately.
- d. Ingestion: If swallowed and the victim is conscious, give no more than 1 to 2 cups of water for dilution. Do not induce vomiting. Get medical attention immediately.
- e. Skin Contact: In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.



f. Eye Contact: Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

7. Decontamination Procedures

- a. Wash surfaces thoroughly with soap and water.
- b. Contain decontamination materials for proper waste disposal by SBVC's designated hazardous waste contractor (EMT).

8. Waste Disposal Procedures

a. Phenol is a listed RCRA hazardous waste. Dispose of waste through SBVC's designated hazardous waste contractor (EMT).

9. SDS Location

- a. Available in lab
- b. Available through Chemical Hygiene Officer
- c. Available through manufacturer's website



Appendix D Standard Operating Procedure – Glutaraldehyde



Glutaraldehyde

1. Process

a. General handling of Glutaraldehyde (25%)

2. Describe process, hazardous chemical, or hazard class

- a. Toxic by ingestion, inhalation and skin contact
- b. Irritant to body tissue
- c. Combustible liquid

3. Personal Protective Equipment

- a. If airborne exposures are suspected contact the CHEMICAL HYGIENE OFFICER for consultation. Glutaraldehyde Exposure Assessments are recommended.
- b. Eye: Eye protection should be selected on potential for splash and exposure. *Minimum potential:* safety glasses with side shields when only low splash hazard exists (e.g. placing a tissue sample in a container). Chemical splash goggles should be worn if using or transferring larger quantities.
- c. Skin: Butyl rubber, neoprene, polyvinyl chloride, or Viton gloves provide protection from incidental contact. Heavier gloves should be used when extended handling of contaminated or preserved materials or immersion is likely. A chemically resistant apron should be used when transferring or using large quantities and splash is likely.

4. Engineering Controls

- a. Work with glutaraldehyde only in a fume hood or with local exhaust ventilation.
- b. Use only in an area equipped with an emergency shower and eyewash.

5. Special Handling Procedures and Storage Requirements

- a. Read Safety Data Sheet (SDS) prior to first use.
- b. Keep in a tightly closed container.
- c. Separate from strong oxidizers, strong bases, and alkalis.
- d. Keep away from heat and flame.

6. Spill and Accident Procedures

- a. Small spills: Do not attempt cleanup if you feel unsure of your ability to do so or if you perceive the risk to be greater than normal laboratory operations. Absorb incidental spills. Collect and submit for waste disposal by SBVC's designated hazardous waste contractor (EMT).
- b. Notify others in area. Evacuate room/immediate area. If splashed on an individual or in eyes flush for 15 minutes with copious quantities of water. Call CHEMICAL HYGIENE OFFICER, SITE SAFETY OFFICE or District Police (after hours) for emergency response. Prevent unnecessary entry until SBVC emergency response team arrives. Provide assistance to CHEMICAL HYGIENE OFFICER/emergency response team as requested.
- c. Inhalation: Remove to fresh air. If breathing has stopped give artificial respiration immediately.
- d. Ingestion: Give large quantities of water. Do not induce vomiting unless directed to do so by medical personnel. Call a physician or poison control at once.
- e. Skin Contact: In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Get medical attention immediately.
- f. Eye Contact: Immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention immediately.



SAN BERNARDINO VALLEY COLLEGE SAN BERNARDINO COMMUNITY COLLEGE DISTRICT MAY 27, 2015

7. Decontamination Procedures

- a. Wash surfaces thoroughly with soap and water.
- b. Contain decontamination materials for proper waste disposal by SBVC's designated hazardous waste contractor (EMT).

8. Waste Disposal Procedures

a. Glutaraldehyde is not a listed RCRA hazardous waste. Dispose of waste through SBVC's designated hazardous waste contractor (EMT).

9. SDS Location

- a. Available in lab
- b. Available through Chemical Hygiene Officer
- c. Available through manufacturer's website



Appendix E Standard Operating Procedure – Laboratory Exhaust Ventilation Systems



SPECIFICATION

Product: Mini-TEX Wall / Ceiling Mounted, Telescopic, Local Extractor, Standard Edition.



Unit shall consist of a localized fume extractor with an outer anodized aluminum tube and an inner anodized aluminum tube. Tubes shall be connected by white PVC hose attached by plastic straps. The extractor shall be available in two separate lengths of 44" and 60" and diameters of 3" and 4".

The extractor shall have a telescopic function with an adjustable friction collar located between the two tubes. The inner tube shall rotate 360 degrees.

The mounting arrangements shall provide full 360 degree swivel functionality between the extractor and the wall bracket thereby avoiding metal-on-metal contact. Exhaust connection shall be 5" diameter.

Unit shall be equipped with one external gas spring to support the weight of the extractor while two friction washers maintain the position desired. Each extractor shall consist of an internal air tight shut off damper.

Unit shall be designed so the combination of the metal plate joint and the 360 degree swivel function allow the extractor to avoid unusable angles. All extractors shall operate in extracted air temperature range of -22°F to 212°F.

Ceiling mounted extractors shall be designed to mount directly to a single ceiling bracket. Mounting of the extractor shall not use special joints or flexible connections and allow only one penetration through the finished ceiling. Ceiling brackets shall act as the exhaust and shall be rigid square shaped anodized aluminum and support the weight of the extractor. Ceiling brackets shall consist of a mounting plate and exhaust connection. Ceiling brackets shall be designed in standard lengths of 10" increments up to 80".

Please note: CAD Drawings and technical information are available by contacting MOVEX Inc.

MOVEX Inc. 104 Commerce Drive Northampton, PA 18067 Tel. 610-440-0478 Fax 610-440-0480



General

Laboratory Exhaust Ventilation Systems

Laboratory fume hoods serve to control exposure to toxic, offensive or flammable vapors, particulates, gases, and aerosols. Fume hoods are the primary method of exposure control in the laboratory. It is important to use the right hood for the job:

1. General Purpose Hoods include:

- a. Standard Chemical Fume Hood
- b. Bypass Hood, or Constant Volume Hood
- 2. Snorkels or Elephant Trunks- flexible duct or hose connected to an exhaust system. It can only capture contaminants that are very close to the inlet of the hose, typically less than a distance equal to one half of the diameter of the duct.

Good Work Practices

- a. *Never put your head inside a hood while operations are in progress.* The plane of the sash is the imaginary boundary that should not be crossed except to setup or dismantle equipment. Also, remain alert to changes in air flow.
- b. Work at least 6 inches back from the face opening of the hood; this will avoid turbulence at the sash edge and provide greater protection. A stripe on the bench surface is a good reminder.
- c. Always use chemical splash goggles, and wear a full face shield if there is a possibility of an explosion or eruption.
- d. Do not make quick motions into or out of the hood, use fans, or walk quickly by the hood opening. All will cause airflow disturbances which reduce the effectiveness of the hood.
- e. Substitute less hazardous or less volatile chemicals where possible.
- f. Place apparatuses and equipment as far back as possible in hood for safety and optimal performance. Equipment should be placed a minimum of 8 inches inside the hood. Keep electrical connections outside of hood.
- g. Ensure that equipment or materials do not block the baffle vents in the back of the hood.
- h. When using a large apparatus inside the hood, place the equipment on blocks, when safe and practical, to allow adequate airflow beneath it.
- i. Do not place electrical apparatuses or other ignition sources inside the hood when flammable liquids or gases are present. Keep in mind that liquids with low flash points may ignite if they are near heat sources such as hot plates or steam lines.
- j. Report airflow problems and problems with the physical structure of the hood to the CHEMICAL HYGIENE OFFICER as soon as possible.
- k. *Do not dismantle or modify the physical structure of the hood or exhaust system* in any way without first consulting the CHEMICAL HYGIENE OFFICER.
- I. Refer to the MOVEX local extractor specification sheet for further instructions on use of the snorkel exhaust system.

Waste Disposal

Do not use the hood as an evaporative waste disposal mechanism. Apparatuses used in a hood should be fitted with condensers, traps, or scrubbers to contain and collect waste solvents, toxic vapors or dust.

Good Housekeeping Practices



- a. *Keep hood storage to an absolute minimum.* Keep only items needed for ongoing operation inside the hood.
- b. Store hazardous chemicals such as flammable liquids in an approved safety cabinet;
- c. Keep caps tight on chemical reagent bottles and check fittings on laboratory glassware to minimize vapor loss;
- d. Always use good housekeeping techniques to maintain the hood at optimal performance levels. Excessive storage of materials or equipment can cause eddy currents or reverse flow resulting in contaminants escaping from the hood.
- e. Clean up spills as soon as possible.

Proper Sash Use

- a. Do not remove sashes from sliding sash hoods. *Lower the sash completely* when you are not physically working in the hood.
- b. Use sliding sash for partial protection during hazardous work.
- c. Do not remove the sash or panels except when necessary for apparatus set-up. Replace sash or panels before operating.
- d. Keep the slots of the hood baffles free of obstruction by apparatuses or containers.
- e. Keep the hood sash closed as much as possible.

Fume Hood Operations

- a. Before beginning work in a chemical fume hood, confirm the fume hood has been certified within the last 12 months. If the date on the certification sticker is more than 12 months, contact the CHEMICAL HYGIENE OFFICER or DISTRICT EH&S OFFICER for action.
- b. Hoods should be evaluated by the user before each use to ensure adequate face velocities and the absence of excessive turbulence. In case of exhaust system failure, shut down all fume hood operations and lower the sash completely. Leave the area immediately and notify the CHEMICAL HYGIENE OFFICER or the SITE SAFETY OFFICER.
- c. Confirm air is flowing into the hood before use. The required face velocity is 100 feet per minute. This velocity is capable of controlling most low-velocity cross drafts and turbulence created by normal working practices at the face of the hood. All hoods should have a sticker or label designating the maximum safe sash height. Keep the sash at the appropriate level to ensure optimal face velocity.
- d. When determining the minimum flow rate through the fume hood, the sash stop position may not be lower than 18 inches above the work surface.

Snorkel or Elephant Trunk Operations

- a. Local exhaust ventilation systems are available in the labs where dissections are to take place to remove contaminants from the source.
- b. Move snorkel trunk and place directly over the contaminant source (i.e. specimen bags, trays and/or containers) and equal to one half of the diameter of the duct.
- c. Before opening specimen bags and/or containers, switch on snorkel system and ensure discernable airflow into the trunk. Systems should remain on for the duration of the task, including during cleanup operations, and should remain on for approximately ten (10) minutes following removal of the contaminant source.
- d. Average face volocities for snorkel or elephant trunk systems is 150 to 200 feet per minute.

Testing

Operable fume hoods, snorkel and/or elephant trunk systems shall be tested and certified annually by an approved, licensed contractor for minimum average face velocity.



Appendix F Safety Data Sheets

Specimens in Carolina's Perfect Solution®

CAROLINA® www.carolina.com

Section 1

Product Description

Product Name: Recommended Use: Synonyms: Distributor: Specimens in Carolina's Perfect Solution® Science education applications Specimens in Carosafe 2000 Carolina Biological Supply Company 2700 York Road, Burlington, NC 27215 1-800-227-1150 800-227-1150 (8am-5pm (ET) M-F) 800-424-9300 (Transportation Spill Response 24 hours)

Chemical Information: Chemtrec:

Hazard Identification

Classification of the chemical in accordance with paragraph (d) of §1910.1200;

WARNING

Section 2

Causes mild skin irritation

GHS Classification: Skin Corrosion/Irritation Category 3

Acute Toxicity Oral Contains100 % ofAcute Toxicity Dermal Contains100 % ofAcute Toxicity Inhalation Gas100 % ofContains100 % ofAcute Toxicity Inhalation Vapor100 % ofContains100 % ofAcute Toxicity Inhalation Dust/Mist100 % ofContains100 % of

100 % of the mixture consists of ingredient(s) of unknown toxicity 100 % of the mixture consists of ingredient(s) of unknown toxicity 100 % of the mixture consists of ingredient(s) of unknown toxicity 100 % of the mixture consists of ingredient(s) of unknown toxicity 100 % of the mixture consists of ingredient(s) of unknown toxicity

Section 3

Composition / Information on Ingredients

<u>CAS #</u>

Proprietary

Chemical Name

The composition of this mixture is proprietary and is protected as a Trade Secret.

Section 4

First Aid Measures

Emergency and First Aid Procedures

 Inhalation:
 In case of accident by inhalation: remove casualty to fresh air and keep at rest.

 Eyes:
 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

 Skin Contact:
 After contact with skin, wash immediately with plenty of water.

 Ingestion:
 If swallowed, do not induce vomiting: seek medical advice immediately and show this container or label.

Section 5

Firefighting Procedures

Extinguishing Media: Fire Fighting Methods and Protection:

Fire and/or Explosion Hazards: Hazardous Combustion Products: Use dry chemical, CO2 or appropriate foam. Firefighters should wear full protective equipment and NIOSH approved self-contained breathing apparatus. Fire or excessive heat may produce hazardous decomposition products. Carbon dioxide, Carbon monoxide

<u>%</u> 100

Section 6

Steps to Take in Case Material Is **Released or Spilled:**

Spill or Leak Procedures

No health affects expected from the clean-up of this material if contact can be avoided. Follow personal protective equipment recommendations found in Section 8 of this MSDS Ventilate the contaminated area.

Prevent the spread of any spill to minimize harm to human health and the environment if safe to do so. Wear complete and proper personal protective equipment following the recommendation of Section 8 at a minimum. Dike with suitable absorbent material like granulated clay. Gather and store in a sealed container pending a waste disposal evaluation.

Section 7

Handling and Storage

Handling: Storage: Storage Code:

Avoid contact with skin and eyes. Wear suitable protective clothing, gloves and eye/face protection. Keep container tightly closed in a cool, well-ventilated place. Green - general chemical storage

Section 8	Protection I	nformation		
	ACG	SIH	OSHA	PEL
Chemical Name	<u>(TWA)</u>	<u>(STEL)</u>	<u>(TWA)</u>	(<u>STEL)</u>
Proprietary ingredient	1000 ppm	N/A	1000 ppm	N/A
Control Parameters				
Engineering Measures:	Local exhaust ventilation	on or other engineering	g controls are normally i	equired when
Personal Protective Equipment (PDE)	handling or using this p	product to avoid overe	xposure.	
Personal Protective Equipment (PPE): Respiratory Protection:	Lab coat, apron, eye w	ash, salety shower.	nal conditions of use . P	rovide general room
Respiratory Protection.	exhaust ventilation if s	motoms of overexpos	sure occur as explained	Section 11 A
	respirator is not normal	lly required.		
Eye Protection:	Wear chemical splash	goggles when handlin	g this product. Have an	eye wash station
	available.			
Skin Protection:	Avoid skin contact by v	vearing chemically res	istant gloves, an apron	and other protective
	equipment depending u	upon conditions of use	 Inspect gloves for che stive equipment regularit 	mical break-through
	other exposed areas w	ith mild soan and wate	r before eating drinking	7. Wash hanus and
	work.			j, and whom loaving
Gloves:	Butyl rubber, Neoprene	e, Nitrile, Polyvinyl chlo	oride	
Soction 0	Physics	al Data		
	FITYSIC	ar Dala		

Formula: See Section 3	Vapor Pressure: No data available
Molecular Weight: Not applicable.	Evaporation Rate (BuAc=1): No data available
Appearance: Colorless Liquid	Vapor Density (Air=1): 0.9887
Odor: Moderate distinct biological and organic solvent odor	Specific Gravity: .99 (Carolina's Perfect Solution®)
Odor Threshold: No data available	Solubility in Water: Soluble
pH: No data available	Log Pow (calculated): No data available
Melting Point: No data available	Autoignition Temperature: No data available
Boiling Point: No data available	Decomposition Temperature: No data available
Flash Point: > 93 C	Viscosity: No data available
Flash Point: > 93 C	Viscosity: No data available
Flammable Limits in Air: No data available	Percent Volatile by Volume: No data available

Section 10

Reactivity Data

Reactivity: Chemical Stability: Conditions to Avoid: Incompatible Materials: Hazardous Decomposition Products: Hazardous Polymerization:

Not generally reactive under normal conditions. Stable under normal conditions. **Elevated temperatures** Strong acids, Strong oxidizing agents Carbon dioxide, Carbon monoxide Will not occur

Section 11

Toxicity Data

Routes of Entry Symptoms (Acute):

Inhalation and ingestion. **Respiratory Irritation**

Delayed Effects:	Respiratory Irritation Dermititis Headache					
Acute Toxicity: Chemical Name Specimens in Carolina's	s Perfect Solution®	CAS Number Proprietary	Oral LD5 Oral LD50 Ra 5000 mg/kg	50 Derm at > Dermal L Rabbit E 20000 m	al LD50 ₋D50 stimated > ig/kg	Inhalation LC50 Inhalation LC50 (4h) Rat Estimated > 20000 ppm
Carcinogenicity:						05114
No data available		Proprietary	Not listed	Not listed	d	Not listed
Chronic Effects: Mutagenicity: Teratogenicity: Sensitization: Reproductive: Target Organ Effects: Acute: Chronic:	No evidence of a mu Evidence of a terato Teratogenic effect o No evidence of a se No evidence of nega No information av No information av	utagenic effect. genic effect (birth def nly observed for chro nsitization effect. ative reproductive effe railable railable	fect). nic ingestion rot ects.	ute of entry for on	e component	t.
Section 12		Ec		lata		
Overview: Mobility: Persistence: Bioaccumulation: Degradability: Other Adverse Effects Chemical Name Specimens in Carolina`	This materia This materia Dissolved in Bioconcentra Biodegrades Material has s Perfect Solution®	l is not expected to b l is expected to have to water, Biodegrada ation is not expected s slowly. microbiocidal proper CAS Number E Proprietary	e harmful to the high mobility in tion, Evaporatio to occur. ties. co Toxicity	ecology. soil. It absorbs w n into atmosphere	eakly to mos	t soil types.
Disposal Methods: Waste Disposal Code	Disp cont (s): This	ose in accordance w act a permitted waste material is not consid	ith all applicable disposer (TSD dered to be a R	e Federal, State ar) to assure compli CRA hazardous w	nd Local regu iance. /aste.	ulations. Always
Section 14		Trans	port Infor	mation		
Ground - DOT Proper Shipping Name:Air - IATA Proper Shipping Name:Not regulated for transport by US DOTNot regulated for air transport by IATA.						
Section 15		Regula	atory Info	rmation		
TSCA Status:	All c	omponents in this pro	oduct are on the	TSCA Inventory.		
Chemical Name	CAS Number	§ 313 Name	§ 304 RQ	CERCLA RQ	§ 302 TPO	Q CAA 112(2) TQ
No data available	Proprieta	iry No	No	No	No	No
California Prop 65:		WARNING: T to cause cand	his product cont cer.	tains a chemical k	nown to the	state of California
Section 16		Additi	onal Infor	mation		
Revised: 06/20/2013	Re	eplaces: 04/22/2013		Printed: 01	1-14-2014	

The information provided in this (Material) Safety Data Sheet represents a compilation of data drawn directly from various sources available to us. Carolina Biological Supply makes no representation or guarantee as to the suitability of this information to a particular application of the substance covered in the (Material) Safety Data Sheet.

Glossary			
ACGIH	American Conference of Governmental	NTP	National Toxicology Program
	Industrial Hygienists	OSHA	Occupational Safety and Health Administration
CAS	Chemical Abstract Service Number	PEL	Permissible Exposure Limit
CERCLA	Comprehensive Environmental Response,	ppm	Parts per million
	Compensation, and Liability Act	RCRA	Resource Conservation and Recovery Act
DOT	U.S. Department of Transportation	SARA	Superfund Amendments and Reauthorization Act
IARC	International Agency for Research on Cancer	TLV	Threshold Limit Value
N/A	Not Available	TSCA	Toxic Substances Control Act
		IDLH	Immediately dangerous to life and health

SDS #: 352.00 **Revision Date:** March 21, 2014

Pictograms

SECTION 1 — CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Formaldehyde Solution

Flinn Scientific, Inc. P.O. Box 219, Batavia, IL 60510 (800) 452-1261

CHEMTREC Emergency Phone Number: (800) 424-9300

Signal Word

DANGER

SECTION 2 — HAZARDS IDENTIFICATION

Hazard class: Flammable liquid and vapor (Category 3). Flammable liquid (H226). Keep away from heat, sparks, open flames, and hot surfaces. No smoking (P210).

Hazard class: Acute toxicity, oral, dermal, and inhalation (Category 3). Toxic if swallowed, in contact with skin or if inhaled (H301+H311+P331). Do not eat, drink or smoke when using this product (P270).

Hazard class: Skin corrosion or irritation (Category 1). Causes severe skin burns and eye damage (H314).

Hazard class: Sensitization, skin (Category 1). May cause an allergic skin reaction (H317). Avoid breathing mist, vapors or spray (P261).

Hazard class: Carcinogenicity (Category 2). Suspected of causing cancer (H351).

Hazard class: Causes damage to organs (H370). Specific target organ toxicity, single exposure (Category 1).

SECTION 3 — COMPOSITION, INFORMATION ON INGREDIENTS

Component Name	CAS Number	Formula	Formula Weight	Concentration
Formaldehyde	50-00-0	НСНО	30.03	37%
Methyl alcohol	67-56-1	CH₃OH	32.04	10-12%
Water	7732-18-5	H_2O	18.00	51-53%
Synonyms: Formalin; Methanal				

SECTION 4 — FIRST AID MEASURES

If exposed or concerned: Call a POISON CENTER or physician (P307+P311). **If inhaled:** Remove victim to fresh air and keep at rest in a position comfortable for breathing (P304+P340). **If in eyes:** Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do so. Continue rinsing (P305+P351+P338). **If on skin (or hair):** Immediately remove all contaminated clothing. Rinse skin with water (P303+P361+P353). Wash contaminated clothing before reuse (P363). **If skin irritation or rash occurs:** Get medical advice or attention (P333+P313). **If swallowed:** Rinse mouth. Do NOT induce vomiting (P301+P330+P331). Immediately call a POISON CENTER or physician (P301+P310).

SECTION 5 — FIRE FIGHTING MEASURES

Class IIIA combustible liquid.	NFPA CODE
Flash point: 85 °C Flammable limits: Lower: 7% Upper: 73% Autoignition Temperature: 300 °C	H-3
When heated, releases flammable fumes.	F-2
In case of fire: Use a tri-class dry chemical fire extinguisher (P370+P378).	R-0

SECTION 6 — ACCIDENTAL RELEASE MEASURES

Remove all ignition sources and ventilate area. Contain spill with sand or other inert absorbent material; deposit in sealed bag or container. See Sections 8 and 13 for further information.

SECTION 7 — HANDLING AND STORAGE

Flinn Suggested Chemical Storage Pattern: Organic #3. Store with hydrocarbons, oils, esters and aldehydes. Keep container tightly closed (P233). Keep cool (P235). Do not breathe mist, vapors or spray (P260). Use only in a hood or well-ventilated area (P271).

SECTION 8 — EXPOSURE CONTROLS, PERSONAL PROTECTION

Wear protective gloves, protective clothing, and eye protection (P280). Wash hands thoroughly after handling (P264). Contaminated work clothing should not be allowed out of the workplace (P272). Use only in a hood or well-ventilated area (P271). **Exposure guidelines:** TLV-C 0.3 ppm (ACGIH); PEL 0.75 ppm (OSHA). **Odor threshold** 0.05 - 1 ppm. If the odor of formaldehyde is detected more ventilation is needed.

SECTION 9 — PHYSICAL AND CHEMICAL PROPERTIES

Colorless liquid. Characteristic pungent odor. 37% formaldehyde gas in water. Methanol added as a stabilizer. Soluble: Water and alcohol Boiling point: 101 °C Flash point: 85 °C Specific gravity: 1.08

SECTION 10 — STABILITY AND REACTIVITY

Avoid contact with strong acids, strong bases, and strong oxidizers. Shelf life: Fair. Slowly polymerizes to polyformaldehyde.

SECTION 11 — TOXICOLOGICAL INFORMATION

Acute effects: Severe eye irritant, sensitizer. Chronic effects: Pulmonary edema, carcinogen, mutagen. Target organs: Eyes, kidneys. Effects may be delayed. ORL-RAT LD₅₀: 100 mg/kg IHL-RAT LC₅₀: 203 mg/m³ SKN-RBT LD₅₀: 0.27 mL/kg

N.A. = Not available, not all health aspects of this substance have been fully investigated.

SECTION 12 — ECOLOGICAL INFORMATION

Data not yet available.

SECTION 13 — DISPOSAL CONSIDERATIONS

Please review all federal, state and local regulations that may apply before proceeding. Flinn Suggested Disposal Method #2 is one option.

SECTION 14 — TRANSPORT INFORMATION

Shipping name: Formaldehyde solutions, Flammable, Hazard class: 3, Flammable, UN number: UN1198

N/A = Not applicable

SECTION 15 — REGULATORY INFORMATION

TSCA-listed, EINECS-listed (200-001-8), RCRA code U122.

SECTION 16 — OTHER INFORMATION

This Safety Data Sheet (SDS) is for guidance and is based upon information and tests believed to be reliable. Flinn Scientific, Inc. makes no guarantee of the accuracy or completeness of the data and shall not be liable for any damages relating thereto. The data is offered solely for your consideration, investigation, and verification. The data should not be confused with local, state, federal or insurance mandates, regulations, or requirements and CONSTITUTE NO WARRANTY. Any use of this data and information must be determined by the science instructor to be in accordance with applicable local, state or federal laws and regulations. The conditions or methods of handling, storage, use and disposal of the product(s) described are beyond the control of Flinn Scientific, Inc. and may be beyond our knowledge. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH THE HANDLING, STORAGE, USE OR DISPOSAL OF THIS PRODUCT(S).

Consult your copy of the *Flinn Science Catalog/Reference Manual* for additional information about laboratory chemicals. **Revision Date:** March 21, 2014

© 2014 Flinn Scientific, Inc. All Rights Reserved.

SDS #: 586.00 Revision Date: March 25, 2014

DANGER

Pictograms

SECTION 1 — CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Phenol

Flinn Scientific, Inc. P.O. Box 219, Batavia, IL 60510 (800) 452-1261

CHEMTREC Emergency Phone Number: (800) 424-9300

Signal Word

SECTION 2

SECTION 2 — HAZARDS IDENTIFICATION	A	
Hazard class: Acute toxicity, oral (Category 4). Harmful if swallowed (H302). Do not eat, drink or smoke when using this product (P270).		
Hazard class: Acute toxicity, dermal (Category 3) and inhalation (Category 3). Toxic in contact with skin (H311). Do not eat, drink, or smoke when using this product (P270).		
Hazard class: Germ cell mutagenicity (Category 2). Suspected of causing genetic defects (H341). Obtain special instructions before use (P201). Do not handle until all safety precautions have been read and understood (P202). Use personal protective equipment as required (P281).		
Hazard class: Specific target organ toxicity, repeated exposure (Category 2). May cause damage to organs through prolonged or repeated exposure (H373). Do not eat, drink or smoke when using this product (P270).	\sim	
Contact with phenol may cause a severe blistering skin effect. Phenol in contact with more than 100 sq. in. of skin is		

absorbed so quickly that it may be fatal in 90 seconds. Avoid all body tissue contact. Readily absorbed through the skin.

SECTION 3 - COMPOSITION, INFORMATION ON INGREDIENTS

Component Name	CAS Number	Formula	Formula Weight	Concentration
Phenol	108-95-2	C ₆ H ₅ OH	94.11	
Synonyms: Carbolic acid; Hydroxybenzene				

SECTION 4 — FIRST AID MEASURES

Call a POISON CENTER or physician (P311).

If inhaled: Remove victim to fresh air and keep at rest in a position comfortable for breathing (P304+P340).

If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do so. Continue rinsing.

If on skin: Remove phenol with isopropyl alcohol or undiluted polyethylene glycol, then wash continuously with SOAPY water for at least 15 minutes. Water alone will increase absorption.

If swallowed: Do NOT give water. Do NOT induce vomiting. Call a physician or poison control at once. Water may enhance absorption.

SECTION 5 — FIRE FIGHTING MEASURES

Class IIIA combustible solid.	NFPA CODE
Flash point: 79 °C Flammable limits: Lower: 1.8% Upper: 8.6% Autoignition Temperature: 715 °C	H-4
Phenol, when heated, forms explosive mixtures with air. When heated to decomposition, may emit toxic fumes.	F-2
In case of fire: Use a tri-class dry chemical fire extinguisher.	R-0

SECTION 6 — ACCIDENTAL RELEASE MEASURES

Remove all ignition sources and ventilate area. Sweep up (if liquid, contain spill with sand and absorbent material), place in sealed bag or container and dispose. Ventilate area and wash spill site after material pickup is complete. See Sections 8 and 13 for further information.

Phenol

SECTION 7 — HANDLING AND STORAGE

Flinn Suggested Chemical Storage Pattern: Organic #8. Store with phenols and cresols. Store in a poisons cabinet. Store in a Flinn Chem-SafTM bag. Keep container tightly closed (P233).

SECTION 8 — EXPOSURE CONTROLS, PERSONAL PROTECTION

Wear protective **Neoprene** gloves, protective clothing, and eye protection (P280). Wash hands thoroughly after handling (P264). Wear respiratory protection (P284).

Exposure guidelines: PEL/TLV 5 ppm (OSHA/ACGIH) Odor threshold is 0.04 ppm. Readily absorbed through the skin.

SECTION 9 — PHYSICAL AND CHEMICAL PROPERTIES White crystalline mass, loose crystals or liquefied. Boiling point: 182

Disinfectant-like odor. Soluble: Water, alcohol and other organic solvents Boiling point: 182 °C Melting point: 42.5-43 °C Specific gravity: 1.07 Vapor density: 3.24 Vapor pressure: 0.35 mmHg

SECTION 10 — STABILITY AND REACTIVITY

Avoid contact with strong oxidizing agents, strong bases, strong acids.

Shelf life: Fair to poor. Changes color on exposure to light. Absorbs water from air and liquefies. See Section 7 for further information.

SECTION 11 — TOXICOLOGICAL INFORMATION

Acute effects: Highly toxic, blistering agent, absorbed through skin.OChronic effects: Dermatitis.IHTarget organs: Liver, kidneys, nervous system, spleen.SH

ORL-RAT LD₅₀: 317 mg/kg IHL-RAT LC₅₀: 316 mg/m³ SKN-RBT LD₅₀: 850 mg/kg

N.A. = Not available, not all health aspects of this substance have been fully investigated.

SECTION 12 — ECOLOGICAL INFORMATION

Data not yet available.

SECTION 13 — DISPOSAL CONSIDERATIONS

Please review all federal, state and local regulations that may apply before proceeding. Flinn Suggested Disposal Method #24a is one option.

SECTION 14 — TRANSPORT INFORMATION

Shipping name: Phenol, solid. Hazard class: 6.1, Poison. UN number: UN1671.

N/A = Not applicable

SECTION 15 — REGULATORY INFORMATION

TSCA-listed, EINECS-listed (203-632-7), RCRA code U188.

SECTION 16 — OTHER INFORMATION

This Safety Data Sheet (SDS) is for guidance and is based upon information and tests believed to be reliable. Flinn Scientific, Inc. makes no guarantee of the accuracy or completeness of the data and shall not be liable for any damages relating thereto. The data is offered solely for your consideration, investigation, and verification. The data should not be confused with local, state, federal or insurance mandates, regulations, or requirements and CONSTITUTE NO WARRANTY. Any use of this data and information must be determined by the science instructor to be in accordance with applicable local, state or federal laws and regulations. The conditions or methods of handling, storage, use and disposal of the product(s) described are beyond the control of Flinn Scientific, Inc. and may be beyond our knowledge. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH THE HANDLING, STORAGE, USE OR DISPOSAL OF THIS PRODUCT(S).

Consult your copy of the *Flinn Science Catalog/Reference Manual* for additional information about laboratory chemicals. **Revision Date:** March 25, 2014

© 2014 Flinn Scientific, Inc. All Rights Reserved.

FLINN SCIENTIFIC INC.

"Your Safer Source for Science Supplies"

Material Safety Data Sheet (MSDS)

Section 1 — Chemical Product and Company Identification

Glutaraldehyde Solution

Flinn Scientific, Inc. P.O. Box 219 Batavia, IL 60510 (800) 452-1261 CHEMTREC Emergency Phone Number: (800) 424-9300

Section 2 — Composition, Information on Ingredients

Glutaraldehyde (111-30-8) 49%, and Water (7732-18-5) 51%. Synonym: Glutaral, 1,5-pentane-dial

CAS#: None established

Section 3 — Hazards Identification

Colorless liquid. Distinct chlorine odor. Toxic by ingestion, inhalation and skin contact. Irritant to body tissue. Avoid all body contact.

Health-3 Flammability-0 Reactivity-1 Exposure-1

0 is low hazard, 3 is high hazard

Section 4 — First Aid Measures

Call a physician, seek medical attention for further treatment, observation and support after first aid. Inhalation: Remove to fresh air at once. If breathing has stopped give artificial respiration immediately. Eye: Immediately flush with fresh water for 15 minutes. External: Wash continuously with fresh water for 15 minutes. Internal: Give large quantities of water. Call a physician or poison control at once.

Section 5 — Fire Fighting Measures

Combustible liquid. When heated to decomposition, emits acrid smoke and irritating fumes. Fire Fighting Instructions: Use triclass, dry chemical fire extinguisher. Firefighters should wear PPE and SCBA with full facepiece operated in positive pressure mode.

Section 6 — Accidental Release Measures

Restrict unprotected personnel from area. Remove all ignition sources and water. Sweep up, place in sealed bag or container and dispose. Ventilate area and wash spill site after material pickup is complete. See Sections 8 and 13 for further information.

Section 7 — Handling and Storage

Flinn Suggested Chemical Storage Pattern: Organic #3. Store with hydrocarbons, esters and aldehydes. Store in a cool dry place. Use and dispense in a hood.

Section 8 — Exposure Controls, Personal Protection

Avoid contact with eyes, skin and clothing. Wear chemical splash goggles, chemical-resistant gloves and chemical-resistant apron. Use ventilation to keep airborne concentrations below exposure limits. Always wear a NIOSH-approved respirator with proper cartridges or a positive pressure, air-supplied respirator when handling this material in emergency situations (spill or fire). Exposure guidelines: (CEILING) 0.2 ppm (NIOSH)

PAGE 1 OF 2

MSDS #: 371.10 Revision Date: November 25, 2002

FLINN AT-A-GLANCE

Storage-0

NFPA CODE None Established

FLINN SCIENTIFIC INC.

"Your Safer Source for Science Supplies"

Material Safety Data Sheet (MSDS)

Glutaraldehyde Solution

MSDS #: 371.10 Revision Date: November 25, 2002

Section 9 — Physical and Chemical Properties

Colorless liquid. Distinct chlorine odor. Solubility: Soluble in water and alcohol.

Specific Gravity: 1.106

Section 10 — Stability and Reactivity

Avoid contact with strong oxidizers. Shelf life: Indefinite.

Section 11 — Toxicological Information

Acute effects: Highly toxic, corrosive, sensitizer Chronic effects: N.A. Target organs: N.A. ORL-RAT LD50:134 mg/kg IHL-RAT LC50: N.A. SKN-RBT LD50:2560 mg/kg

N.A. = Not available, not all health aspects of this substance have been fully investigated.

Section 12 — Ecological Information

Data not yet available.

Section 13 — Disposal Considerations

Please consult with state and local regulations before disposal. Flinn Suggested Disposal Method #2 is one option.

Section 14 — Transport Information

Shipping Name: Not regulated Hazard Class: N/A UN Number: N/A

N/A = Not applicable

Section 15 — Regulatory Information

TSCA-listed, EINECS-listed (203-856-5).

Section 16 — Other Information

Consult your copy of the Flinn Scientific Catalog/Reference Manual for additional information about laboratory chemicals. This Material Safety Data Sheet (MSDS) is for guidance and is based upon information and tests believed to be reliable. Flinn Scientific Inc. makes no guarantee of the accuracy or completeness of the data and shall not be liable for any damages relating thereto. The data is offered solely for your consideration, investigation, and verification. Flinn Scientific Inc. assumes no legal responsibility for use or reliance upon this data.

FLINN SCIENTIFIC INC.

"Your Safer Source for Science Supplies"

Need a Chemical Fast?--Order from Flinn

> flinn@flinnsci.com www.flinnsci.com P.O. Box 219 Batavia IL 60510 (800) 452-1261 Fax (866) 452-1436

San Bernardino Community College District

Safety Program Approval

Safety Program: Formaldehyde, Phenol & Glutaraldehyde Program – San Bernardino Valley College (SBVC) – Drafted 05/27/15

Reviewed by: _ Date_05129115

Whitney Fields, District Environmental Health & Safety Administrator

Approved by: _____ Date_ C/1/65

Dr. Susan Bangasser, SBVC, Dean, Science Division/Chemical Hygiene Officer (CHO)

milita

Approved by: Date Co - 1. C

Scott Stark, SBVC, Vice President Administrative Services/Business Services

_____Date_6-2-15 Approved by:

Gloria Fisher, J.D., SBVC, President