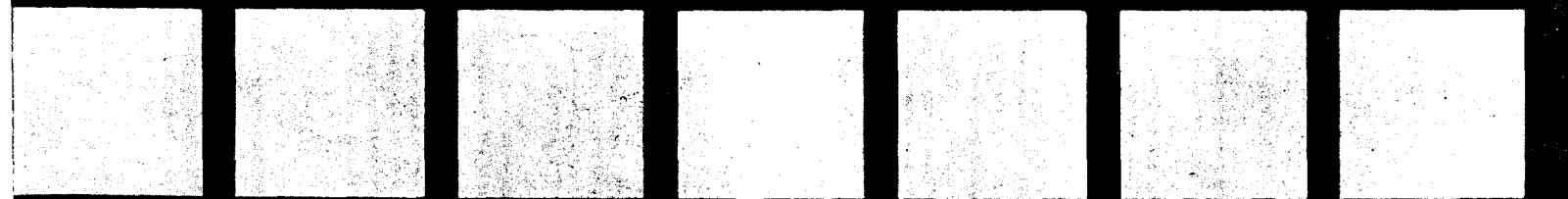
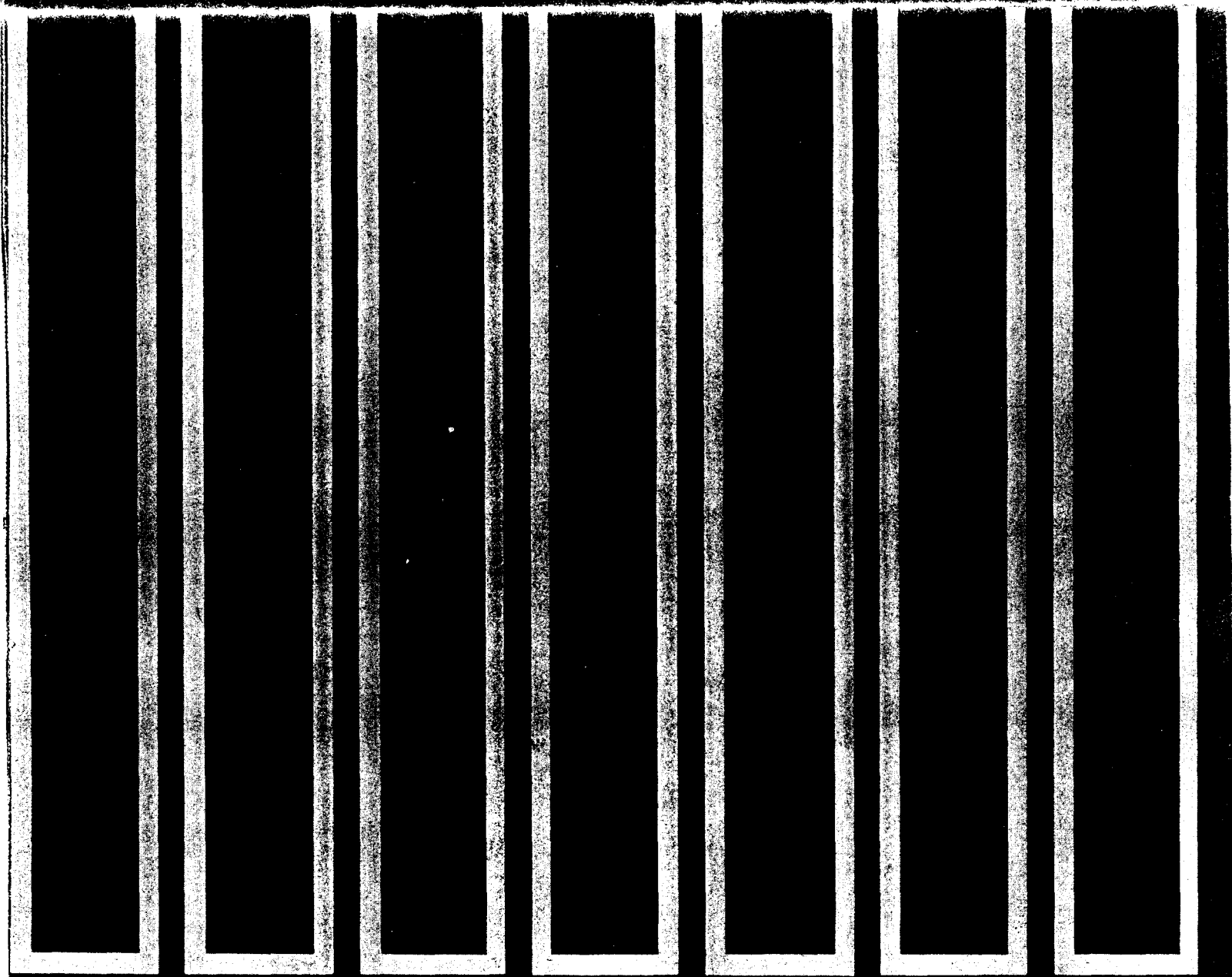


**NIOSH**

criteria for a recommended standard . . . .

occupational exposure to

**methyl alcohol**



**U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE**

Public Health Service    Center for Disease Control

National Institute for Occupational Safety and Health

**criteria for a recommended standard....**

**OCCUPATIONAL EXPOSURE  
TO  
METHYL ALCOHOL**



**U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE**

**Public Health Service**

**Center for Disease Control**

**National Institute for Occupational Safety and Health**

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## PREFACE

The Occupational Safety and Health Act of 1970 emphasizes the need for standards to protect the health and safety of workers exposed to an ever-increasing number of potential hazards at their workplace. The National Institute for Occupational Safety and Health has projected a formal system of research, with priorities determined on the basis of specified indices, to provide relevant data from which valid criteria for effective standards can be derived. Recommended standards for occupational exposure, which are the result of this work, are based on the health effects of exposure. The Secretary of Labor will weigh these recommendations along with other considerations such as feasibility and means of implementation in developing regulatory standards.

It is intended to present successive reports as research and epidemiologic studies are completed and as sampling and analytical methods are developed. Criteria and standards will be reviewed periodically to ensure continuing protection of the worker.

I am pleased to acknowledge the contributions to this report on methyl alcohol by members of my staff and the valuable constructive comments by the Review Consultants on Methyl Alcohol, by the ad hoc committees of the American Industrial Hygiene Association and the American Medical Association, and by Robert B. O'Connor, M.D., NIOSH consultant in occupational medicine. The NIOSH recommendations for standards are not

necessarily a consensus of all the consultants and professional societies that reviewed this criteria document on methyl alcohol. Lists of the NIOSH Review Committee members and of the Review Consultants appear on the following pages.



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The Division of Criteria Documentation and Standard Development, National Institute for Occupational Safety and Health, had primary responsibility for development of the criteria and the recommended standard for methyl alcohol. Stanford Research Institute developed the basic information and the final document for consideration by NIOSH staff and consultants under contract No. CDC-99-74-31. Gamil Debbas, Ph.D., was the NIOSH criteria manager during the development of this document.

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CRITERIA DOCUMENT:  
RECOMMENDATIONS FOR AN OCCUPATIONAL  
EXPOSURE STANDARD FOR METHYL ALCOHOL

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## I. RECOMMENDATIONS FOR A METHYL ALCOHOL STANDARD

The National Institute for Occupational Safety and Health (NIOSH) recommends that employee exposure to methyl alcohol in the workplace be controlled by adherence to the following sections. The standard is designed to protect the health and safety of workers for up to a 10-hour workday, 40-hour workweek, over a working lifetime. Compliance with all sections of the standard should therefore prevent adverse effects of methyl alcohol on the health and safety of employees. The recommended standard is measurable by techniques that are valid, reproducible, and available to industry and governmental agencies. Sufficient technology exists to permit compliance with the recommended standard. Although the workplace environmental limits are considered to be safe levels based on current information, they should be regarded as the upper boundary of exposure and every effort should be made to maintain the exposure as low as is technically feasible. The criteria and standard will be subject to review and revision as necessary.

These criteria and the recommended standard apply to occupational exposure of workers to the aliphatic alcohol  $\text{CH}_3\text{OH}$ , hereinafter referred to as "methyl alcohol." Synonyms for methyl alcohol include wood spirit, carbinol, wood alcohol, wood naphtha, Columbian spirit, colonial spirit, methylol, pyroxylic spirit, monohydroxymethane, methyl hydroxide, and methanol. "Action level" means half of the time-weighted average (TWA) environmental exposure limit for methyl alcohol. "Occupational exposure to methyl alcohol" means exposure at or above the action level. If "exposure" to other chemicals also occurs, for example to a combination of methyl

alcohol and acetone, provisions of any applicable standard for the other chemicals shall also be followed.

Section 1 - Environmental (Workplace Air)

(a) Concentration

Occupational exposure to methyl alcohol shall be controlled so as not to exceed 200 parts per million (200 ppm) parts of air by volume (262 milligrams per cubic meter of air) determined as a time-weighted average (TWA) exposure for up to a 10-hour workday, 40-hour workweek, with a ceiling of 800 ppm (1,048 mg/cu m) as determined by a sampling time of 15 minutes.

(b) Sampling, Calibration, and Analysis

Procedures for collection and analysis of environmental samples shall be as provided in Appendices I and II, or by any methods shown to be equivalent in precision, sensitivity, and accuracy to the methods specified.

Section 2 - Medical

Medical surveillance shall be made available as specified below for all employees occupationally exposed to methyl alcohol.

(a) Preplacement medical examinations shall include:

- (1) A comprehensive work history.
- (2) A complete physical examination which should include an ophthalmologic examination.

(b) Medical surveillance and management including ophthalmologic examination shall be promptly provided to any employee who develops ocular symptoms, or has had methyl alcohol splashed in the eyes, or has ingested methyl alcohol, or has been accidentally overexposed by inhalation or dermal contact.

(c) Periodic medical surveillance should be performed annually for all employees occupationally exposed to methyl alcohol.

(d) Initial examinations for employees who are occupationally exposed to methyl alcohol at the time of the promulgation of a standard incorporating these recommendations shall be made available within 6 months.

(e) Medical records shall be maintained for all persons with occupational exposure to methyl alcohol and for maintenance personnel with occasional exposure. Pertinent medical records, including information on required medical examinations, shall be retained for at least 5 years after the termination of the individual's employment.

(f) Pertinent records shall be available to the designated medical representatives of the Secretary of Health, Education, and Welfare, of the Secretary of Labor, of the employee or former employee, and of the employer.

### Section 3 - Labeling (Posting)

(a) Labeling

The following warning sign shall be affixed in a readily visible location on methyl alcohol storage tanks or containers:

METHYL ALCOHOL  
(METHANOL)

WARNING! FLAMMABLE

CAN BE FATAL OR CAUSE BLINDNESS IF SWALLOWED

Keep away from heat, sparks, and open flame.  
No smoking permitted.  
Do not take internally.  
Keep container closed.  
Avoid prolonged or repeated breathing of vapor  
or contact with skin.  
Avoid contact with eyes.  
Use with adequate ventilation.

First Aid: In case of eye or skin contact, flush thoroughly with copious amounts of water. In case of accidental swallowing, call a physician and induce vomiting if the patient is conscious. Change clothing if contaminated.

In case of

Fire: Use water, spray, "alcohol" type foam, dry chemical, or carbon dioxide extinguishers.

Spill: Flush area with water spray.

(b) Posting

Areas in which methyl alcohol is present shall be posted with a sign reading:

METHYL ALCOHOL  
(Methanol)

WARNING! FLAMMABLE

HARMFUL IF INHALED  
CAN BE FATAL OR CAUSE BLINDNESS IF SWALLOWED  
IRRITATING TO SKIN OR EYES

No smoking permitted.  
Provide adequate ventilation.

These warning signs shall be printed both in English and in the predominant language of non-English-speaking employees. All employees shall be trained and informed of the hazardous areas with special instructions given to illiterate employees.

Section 4 - Personal Protective Equipment and Clothing

(a) Protective Clothing

(1) Appropriate protective clothing, including gloves, aprons, suits, boots, and face shields that are impervious to methyl alcohol, shall be provided and worn where needed to prevent repeated or prolonged skin contact.

(2) Soap and water shall be made available to cleanse contaminated skin.

(3) Unless clothing impervious to methyl alcohol is being worn, a change of clothing shall be made immediately available to and used by each employee whose clothes become contaminated with liquid methyl alcohol.

(b) Eye Protection

Chemical safety goggles or face shields meeting the requirements of 29 CFR 1910.133 and ANSI Z87.1-1968 shall be provided and worn in any operation in which there is a reasonable probability that methyl alcohol may be splashed into the eyes.

(c) Respiratory Protection

(1) Engineering controls shall be used wherever feasible to maintain methyl alcohol concentrations below the TWA and ceiling environmental limits. Such control equipment shall be sparkproof.

Compliance with the environmental limits may not be achieved by the use of respirators except:

(A) During the time period necessary to install or test the required engineering controls.

(B) For nonroutine operations such as brief exposures at concentrations in excess of the environmental limits resulting from maintenance or repair activities.

(C) During emergencies when air concentrations of methyl alcohol may exceed the environmental limits.

(2) When a respirator is permitted by paragraph (c)(1) of this Section, it shall be selected and used pursuant to the following requirements:

(A) For the purpose of determining the type of respirator to be used, the employer shall measure the atmospheric concentration of methyl alcohol in the workplace initially and thereafter whenever process, worksite, climate, or control changes occur which are likely to increase the methyl alcohol concentrations. This requirement shall not apply when only atmosphere-supplying positive pressure respirators will be used. The employer shall ensure that no employee is being exposed to methyl alcohol in excess of the environmental limits because of improper respirator selection, fit, use, or maintenance.

(B) A respiratory protection program meeting the requirements of 29 CFR 1910.134 as amended shall be established and enforced by the employer.

(C) The employer shall provide respirators in accordance with Table I-1 and shall ensure that the employee uses the



respirator provided.

(D) Respiratory protective devices described in Table I-1 shall be those approved under the provisions of 30 CFR 11.

(E) Respirators specified for use in higher concentrations of methyl alcohol may be used in atmospheres of lower concentrations.

(F) The employer shall ensure that respirators are adequately cleaned, and that employees are instructed on the use of respirators assigned to them and on how to test for leakage.

(G) Where an emergency may develop which could result in employee overexposure to methyl alcohol, the employer shall provide respiratory protection as listed in Table I-1.

TABLE I-1

RESPIRATOR SELECTION GUIDE FOR PROTECTION AGAINST METHYL ALCOHOL

Concentration	Respirator Type
Less than or equal to 2,000 ppm	(1) A supplied-air respirator (2) A self-contained breathing apparatus
Less than or equal to 10,000 ppm	(1) A supplied-air respirator with a full facepiece, helmet, or hood (2) Any self-contained breathing apparatus with a full facepiece
Less than or equal to 25,000 ppm	A Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure mode or with a full facepiece, helmet, or hood operated in continuous-flow mode
Greater than 25,000 ppm	(1) Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode
CAUTION! The lower explosive limit is approximately 67,000 ppm	(2) A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode
Firefighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode
Escape	(1) Any gas mask providing protection against methyl alcohol (2) Any escape self-contained breathing apparatus

Section 5 - Informing Employees of Hazards from Methyl Alcohol

(a) Each employee occupationally exposed to methyl alcohol shall be informed of the hazards, especially flammability; the consequences of overexposure by ingestion, inhalation, and skin contact; appropriate emergency procedures; proper conditions for safe use, and precautions to minimize exposure. Records of such training should be kept to facilitate checking of the training and frequency of such training for each worker. The employee should be reformed at least once a year, or whenever there is a process change. This appraisal shall include, as a minimum, all information set forth in Appendix III which is applicable to that specific product or material containing methyl alcohol.

(b) Information as required shall be recorded on the US Department of Labor form OSHA-20, "Material Safety Data Sheet" shown in Appendix III, or on a similar form approved by the Occupational Safety and Health Administration, US Department of Labor.

(c) Each employee shall be informed of the location of the information described in paragraph (b) of this Section. This information shall be kept on file at each establishment or department and shall be readily accessible to all employees occupationally exposed to methyl alcohol.

Section 6 - Work Practices

(a) Emergency Procedures

For all work areas in which there is potential for emergencies, procedures as specified below, as well as any other procedures appropriate for a specific operation or process, shall be formulated in advance and employees shall be instructed in their implementation.

(1) Procedures shall include prearranged plans for obtaining emergency medical care and for necessary transportation of injured workers.

(2) Firefighting procedures shall be established and implemented. These shall include procedures for emergencies involving the release of methyl alcohol vapor. In case of fire, methyl alcohol sources shall be shut off or removed. Containers shall be removed or cooled with water spray. Chemical foam, carbon dioxide, or dry chemicals should be used for fighting methyl alcohol fires, and proper respiratory protection and protective clothing shall be worn.

(3) Approved eye, skin, and respiratory protection as specified in Section 4 shall be used by personnel essential to emergency operations.

(4) Nonessential employees shall be evacuated from exposure areas during emergencies. Perimeters of hazardous exposure areas shall be delineated, posted, and secured.

(5) Personnel properly trained in the procedures and adequately protected against the attendant hazards shall shut off sources of methyl alcohol, clean up spills, and immediately repair leaks.

(b) Exhaust Systems

Engineering procedures shall be established to reduce exposure of employees to methyl alcohol through implementation of adequate ventilation methods. When a local exhaust ventilation system is used, it shall be designed and maintained to prevent the accumulation or recirculation of methyl alcohol vapor into the workroom, so that the airborne methyl alcohol concentrations do not exceed the environmental limits. Exhaust systems discharging into outside air must conform with applicable local, state, and federal air pollution regulations. When mechanical ventilation is used to control exposure, measurements which demonstrate system efficiency (eg, air velocity, static pressure, or air volume) shall be made at least every 3 months. Measurements of system efficiency shall also be made within 5 workdays of any change in production, process, or control that might result in an increase in airborne concentrations. When a fan is located in duct work and where methyl alcohol is likely to be present at concentrations at or above 0.67% (one-tenth the lower flammable limit, 67,000 ppm), the fan rotating element shall be of nonsparking material or the casting shall be coated with, or consist of, a nonsparking material. The ventilation system shall contain devices along the length of the exhaust system intended to prevent the propagation of flashbacks.

(c) Loading and Unloading

The handling and storage of methyl alcohol shall comply with NFPA Article 30 for flammable and combustible liquids.

(1) Safety showers and eyewash fountains shall be installed in loading and unloading areas.

(2) Fire extinguishers approved for Class I B fires, such as dry chemical extinguishers, shall be available in loading and unloading areas. Fire extinguishers shall be inspected annually and recharged or replaced if necessary.

(3) The equipment required by c(1) of this Section shall be inspected regularly to ensure that it is in working order. The employer shall ensure that such inspection is performed by a qualified person.

(4) In the event of a leak that may lead to airborne concentrations exceeding the environmental limits, the operations shall be stopped and resumed only after necessary repair or replacement has been completed.

(5) Bonding facilities for protection against static sparks during the loading of tank vehicles shall be provided as required in 29 CFR 1910.106(f)(3)(IV).

(d) Methyl Alcohol Car and Truck Loading Procedure

(1) Smoking, matches, or lighters shall be prohibited in the methyl alcohol car and truck loading area.

(2) The safety shower and eyewash fountain in the loading and unloading area shall be checked regularly.

(3) A wheel chock, a car loading sign, and the derail shall be placed in position and ground cables attached before connecting any lines to the tank car.

(4) Wheel chocks, ground cables, and loading sign shall be in place before connecting any lines to a trailer.

(5) Ground cables shall be removed only when loading or unloading lines have been removed and the dome covers have been secured.

(6) Rubber gloves and face shields shall be used where the possibility of methyl alcohol splashes exists. Breathing of methyl alcohol vapor should be avoided whenever possible.

(7) Any part of the body on which methyl alcohol has been spilled should be washed immediately with large quantities of water. Eyes should be flushed immediately with copious amounts of water and the incident should be reported immediately to the appropriate health unit.

(e) Storage

Storage of bulk amounts shall meet the requirements for Class I B flammable liquid storage as specified in 29 CFR 1910.106(b).

(f) Disposal

Spills of large amounts of methyl alcohol should be washed with water. Discarding of waste shall be in compliance with applicable EPA standards. When it is not possible to wash a spill with water, the area should be cordoned off until cleanup operations have been completed. If a vacuum truck is used to remove the alcohol, care must be taken to ensure that there are no sources of ignition and that sufficient flashback devices are provided.

(g) Vessel Entry

Vessels include tanks and reactors in which occupational exposure to airborne methyl alcohol may exist. Special work procedures are required for entering vessels. Before allowing an employee to enter the vessel, a technically competent person authorized by the employer shall sign a safety permit declaring the job to be safe. The following precautions shall be taken to ensure safety:

(1) All lines shall be disconnected or blocked while the vessel is being cleaned. All valves or pumps leading to and from the vessel shall be locked out or tagged out.

(2) The vessel shall be washed with water and purged with air, or with nitrogen and then with air.

(3) A calibrated combustible gas meter shall be used to check for explosion hazard. The test should be performed by a person trained in the use of the combustible gas meter. (See Appendix IV)

(4) The vessel shall then be checked for airborne methyl alcohol, oxygen, and other likely contaminant concentrations and safe levels of each assured, unless a positive pressure respirator is used.

(5) If a respirator is necessary, an appropriate type shall be provided to the employee. Section 4(c) of this chapter describes the types of respirators which are suitable under various conditions.

(6) Each employee shall use a lifeline when entering a vessel. At least 2 other persons equipped with respiratory protection shall watch at all times from the outside. At least one other person shall be available to assist in emergencies.

(h) General Housekeeping

Employers shall ensure that proper maintenance of equipment is provided in order to minimize the accidental escape of methyl alcohol. Cleanup of spills and repair of equipment and leaks shall be performed as soon as practical.



## Section 7 - Sanitation Practices

### (a) Food Facilities

In accordance with the provisions of 29 CFR 1910.141(g)(2) and (g)(4), the consumption or storage of food or beverages shall be prohibited in the worksite.

### (b) Smoking

Smoking shall be prohibited in areas where methyl alcohol is used, transferred, stored, or manufactured.

### (c) Handwashing Facilities

Adequate facilities providing soap and water for handwashing shall be made available.

## Section 8 - Monitoring and Recordkeeping

Workroom areas where it has been determined on the basis of an industrial hygiene survey that environmental levels are below half the time-weighted average environmental limit are not considered to have occupational exposure to methyl alcohol. Records of these surveys, including the basis for concluding that environmental concentrations are below the action level, shall be maintained until a new survey is completed. Surveys shall be repeated when a process change indicates to a qualified person in authority the need for reevaluation.

Requirements set forth below apply to work areas in which there is occupational exposure to methyl alcohol.

(a) An adequate number of breathing zone samples shall be collected and analyzed to characterize the TWA and ceiling concentrations of each operation and work location in which there is occupational exposure

to methyl alcohol.

This sampling and analysis shall be repeated every 6 months except as otherwise indicated by a professional industrial hygienist. The first sampling period shall be completed within 6 months of the effective date of the promulgation of a standard based on these recommendations. Additional sampling and analysis shall be performed whenever changes in process, worksite, climate, or engineering control are likely to cause an increase in airborne concentrations. If initial, periodic, or special evaluations indicate TWA or ceiling concentration limits are exceeded, corrective engineering or other control measures shall be promptly instituted to ensure the safety of employees, until concentrations below these environmental limits are achieved. In such cases, sampling of each operation and work location shall be conducted at least monthly until two consecutive 30-day sampling periods have shown that concentrations of methyl alcohol are at or below the workplace environmental limits.

(b) Records shall be maintained and shall include sampling and analytical methods, types of respiratory protection used, and TWA and ceiling concentrations found. Each employee shall have access to data on his own environmental exposures. Pertinent records of required medical examinations, including records of occupational accidents and environmental exposures within the workplace, shall be maintained for 5 years after the worker's employment has ended, and shall be available to the designated medical representatives of the Secretary of Labor, of the Secretary of Health, Education, and Welfare, of the employer, and of the employee or former employee.

## II. INTRODUCTION

This report presents the criteria and the recommended standard based thereon which were prepared to meet the need for preventing occupational diseases arising from exposure to methyl alcohol. The criteria document fulfills the responsibility of the Secretary of Health, Education, and Welfare, under Section 20(a)(3) of the Occupational Safety and Health Act of 1970 to "...develop criteria dealing with toxic materials and harmful physical agents and substances which will describe...exposure levels at which no employee will suffer impaired health or functional capacities or diminished life expectancy as a result of his work experience."

The National Institute for Occupational Safety and Health (NIOSH), after a review of data and consultation with others, formalized a system for the development of criteria upon which standards can be established to protect the health of employees from exposure to hazardous chemical and physical agents. It should be pointed out that any criteria and recommended standard should enable management and labor to develop better engineering controls resulting in more healthful work practices and should not be used as a final goal.

These criteria for a standard for methyl alcohol are in a continuing series of criteria developed by NIOSH. The recommended standard applies only to the processing, manufacture, and use of methyl alcohol in products as applicable under the Occupational Safety and Health Act of 1970. The standard was not designed for the population-at-large, and any extrapolation beyond occupational exposures is not warranted. It is intended to (1) protect against development of acute and chronic methyl

alcohol poisoning, (2) be measurable by techniques that are valid, reproducible, and available to industry and official agencies, and (3) be attainable with existing technology.

Areas in which research is needed are epidemiologic studies on humans, primate studies to help develop a dose-response relationship and understand the mechanism of toxicity for methyl alcohol and its metabolites. Additional studies are needed to investigate the possibility of mutagenic, teratogenic, or carcinogenic effects of methyl alcohol. Further work is needed to develop improved sampling and analytical procedures for this substance.