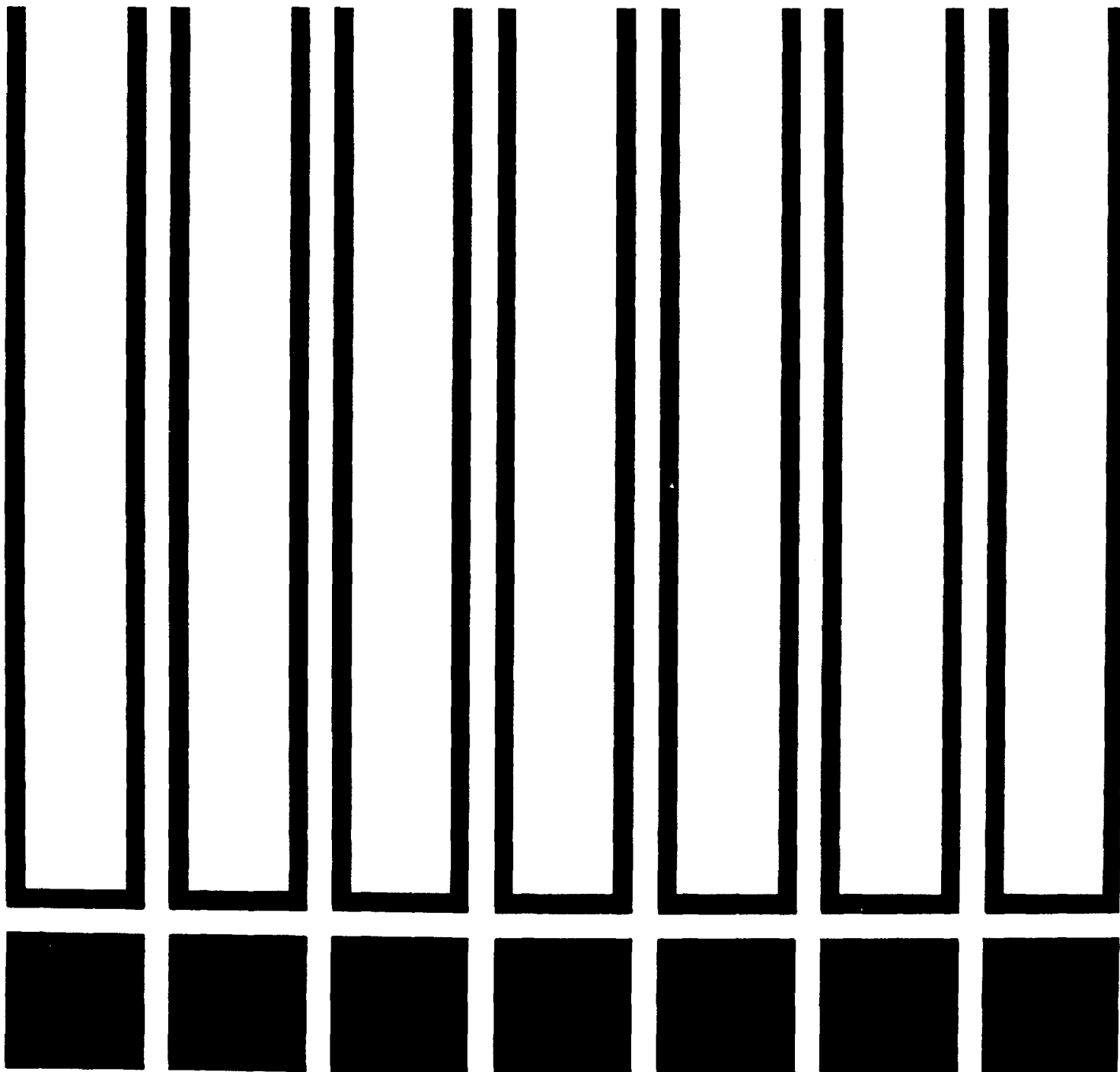


NIOSH

criteria for a recommended standard

occupational exposure to

ISOPROPYL 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
ISOPROPYL 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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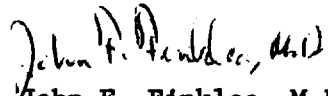
PREFACE

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 isopropyl alcohol by members of my staff, the valuable constructive comments by the Review Consultants on Isopropyl Alcohol, by the ad hoc committees of the American Conference of Governmental Industrial Hygienists and the Society of Toxicology, 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 isopropyl

alcohol. Lists of the NIOSH Review Committee members and of the Review Consultants appear on the following pages.



John F. Finklea, M.D.
Director, National Institute for
Occupational Safety and Health

The Division of Criteria Documentation and Standards Development, National Institute for Occupational Safety and Health, had primary responsibility for development of the criteria and the recommended standard for isopropyl 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. Donald M. Valerino, Ph.D., served as criteria manager for development of the document.

REVIEW COMMITTEE
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

Norbert J. Berberich
Division of Surveillance, Hazard
Evaluations, and Field Studies

Robert W. Kurimo
Division of Physical Sciences and
Engineering

Robert Rostand
Division of Technical Services

Joseph A. Seta
Division of Surveillance, Hazard
Evaluations, and Field Studies

William D. Wagner
Division of Biomedical and
Behavioral Science

NIOSH REVIEW CONSULTANTS ON ISOPROPYL ALCOHOL

Carl U. Dernehl, M.D.
Associate Medical Director
Union Carbide Corporation
New York City, New York 10017

Anthony Mazzocchi
Oil Chemical and Atomic Workers Union
Washington, D.C. 20020

Neil K. Weaver, M.D.
American Petroleum Institute
Washington, D.C. 20006

Carrol W. Weil
Mellon Institute
Pittsburgh, Pennsylvania 15230

John G. Willard
Special Services Branch
Division of Occupational Health
Texas State Department of Health
Austin, Texas 78756

J. Henry Wills, Ph.D.
Institute of Experimental Pathology
and Toxicology
Albany Medical College
Albany, New York 12208

CRITERIA DOCUMENT:
RECOMMENDATION FOR AN OCCUPATIONAL
EXPOSURE STANDARD FOR ISOPROPYL ALCOHOL

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I. RECOMMENDATIONS FOR AN ISOPROPYL ALCOHOL STANDARD

The National Institute for Occupational Safety and Health (NIOSH) recommends that employee exposure to isopropyl alcohol in the workplace be controlled by requiring compliance with the following sections. The standard is designed to protect the health and safety of employees for up to a 10-hour workday, 40-hour workweek over a working lifetime. Compliance with all sections of the standard should prevent adverse effects of isopropyl alcohol on the health and safety of employees. The 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.

Because it appears that exposure to carcinogenic agent(s) may occur in the manufacture of isopropyl alcohol, it is recommended that employers engaged in the manufacture of isopropyl alcohol provide special medical surveillance procedures for employees and ensure that employees follow special work practices. Regulated areas shall be established and maintained where isopropyl alcohol is manufactured. Access to these regulated areas shall be limited to authorized persons. A daily roster shall be made of persons authorized to enter; these rosters shall be maintained for at least 30 years. Employers shall ensure that before employees leave a regulated area they remove and leave protective clothing at the point of exit. In addition, it is recommended that employers engaged in the manufacture of isopropyl alcohol install special engineering controls to prevent all exposures of employees to carcinogenic agents.

Although the workplace environmental limits are considered to be safe

levels based on information currently available to NIOSH, every effort should be made to maintain the exposure as low as technically feasible. The criteria and standard will be subject to review and will be revised as necessary.

These criteria and the recommended standard apply to workplace occupational exposures of employees to isopropyl alcohol. Synonyms for isopropyl alcohol include isopropanol, avantine, 2-propanol, sec-propyl alcohol, dimethyl-carbinol, lutosol, petrohol, and propan-2-ol.

"Manufacture of isopropyl alcohol" means a process involved in the production of isopropyl alcohol using sulfuric acid.

"Isopropyl alcohol-manufacturing area" is a controlled area consisting of all process equipment beginning with the reactor in which propylene feed enters and ending with the column where the refined isopropyl alcohol and other refined products emerge.

"Action level" means one-half of the time-weighted average limit (TWA) for isopropyl alcohol.

"Occupational exposure to isopropyl alcohol" means exposure at or above the action level. Exposure to isopropyl alcohol at concentrations less than one-half of the workplace environmental limit will not require adherence to the following sections, except for 4(a), 5(a,b), 6 (a-f), and 7. If "exposure" to other chemicals also occurs, provisions of any applicable standard for the other chemicals shall also be followed.

Section 1 - Environmental (Workplace Air)

(a) Workplace Environmental Limits

Employee exposure to airborne isopropyl alcohol shall not exceed 400

parts per million (400 ppm) parts of air by volume (approximately 984 mg/cu m of air) determined as a TWA exposure for up to a 10-hour workday, 40-hour workweek, with a ceiling of 800 ppm (approximately 1,968 mg/cu m) as determined by a sampling time of 15 minutes.

(b) Sampling, Collection, and Analysis

Procedures for collection of workplace environmental samples shall be as provided in Appendix I, or by a method shown to be equivalent in precision, accuracy, and sensitivity. Analysis of samples shall be as provided in Appendix II, or by any method shown to be equivalent in precision, sensitivity, and accuracy.

Section 2 - Medical

Medical surveillance shall be made available as designated below.

(a) Preplacement medical examinations shall include:

- (1) Comprehensive or interim medical and work histories.
- (2) Complete physical examination.

(b) For those workers employed in isopropyl alcohol-manufacturing areas, periodic examinations shall be made available on an annual basis.

These examinations shall include, but shall not be limited to:

- (1) Interim medical history and work history.
- (2) Examinations giving particular attention to the skin, sinuses, and to the respiratory system. The examinations shall provide an evaluation of the workers' ability to use negative or positive pressure respirators.

- (3) Such further tests as X-rays, laryngoscopy, and

bronchoscopy may be considered by the responsible physician.

(c) Periodic medical surveillance should be considered at an interval to be determined by the responsible physician for all employees occupationally exposed to isopropyl alcohol especially where there is concurrent exposure to chlorinated hydrocarbons in which case appropriate liver function tests may be needed.

(d) Examinations of current employees shall be performed within 6 months of the promulgation of a standard incorporating these recommendations.

(e) Appropriate health care shall be provided for employees with adverse effects reasonably assumed to have resulted from isopropyl alcohol exposure.

(f) Medical records shall be maintained for all persons with occupational exposure to isopropyl alcohol, for maintenance personnel with occasional occupational exposure, and for all employees engaged in the manufacture of isopropyl alcohol. 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, except for those workers employed in isopropyl alcohol-manufacturing areas in which case records shall be maintained for at least 30 years.

(g) Pertinent medical records shall be available to the 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) Containers of isopropyl alcohol shall bear the following label in addition to, or in combination with, labels required by other statutes, regulations, or ordinances:

ISOPROPYL ALCOHOL
(ISOPROPANOL)

WARNING! FLAMMABLE

Keep away from sparks and open flame.
Do not take internally.
Keep container closed.
Avoid contact with eyes.
Avoid prolonged or repeated breathing of vapor.
Use with adequate ventilation.

First Aid: In case of eye contact, flush with plenty of water; call a physician.

In case of

Fire: Use water, foam, dry chemical, or CO2.

Spill: Flush area with water spray.

(b) All containers used to collect residues and wastes in the isopropyl alcohol-manufacturing area shall carry a label stating:

CANCER-SUSPECT AGENT

(c) Areas where there is occupational exposure to isopropyl alcohol shall be posted with a sign reading:

ISOPROPYL ALCOHOL
(ISOPROPANOL)

WARNING! FLAMMABLE

Keep out sparks or open flames.
No smoking permitted.

(d) Isopropyl alcohol-manufacturing areas shall be posted with a sign reading:

CANCER-SUSPECT AGENT

AUTHORIZED PERSONNEL ONLY

These warning signs shall also be printed in the predominant language of non-English-reading 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) A clean change of clothing shall be made available promptly to each employee whose clothes become wetted with isopropyl alcohol spills, and to each employee whose clothes become wetted with spills of any material in isopropyl alcohol-manufacturing areas.

(2) If it is necessary for employees to withdraw samples from the isopropyl alcohol-manufacturing process, employees shall be required to wear appropriate protective clothing including impervious suits, gloves, boots, and air-supplied hoods.

(3) Eye protective devices such as safety goggles or safety glasses shall be provided for any employee working in an operation that might result in isopropyl alcohol splashing into the eyes. Suitable eye protective devices shall conform to 29 CFR 1910.133.

(b) Respiratory Protection

(1) Engineering controls shall be used wherever feasible to maintain isopropyl alcohol concentrations below the prescribed limits. Such control equipment shall be sparkproof. Compliance with the permissible exposure limit may not be achieved by the use of respirators except:

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

(B) For nonroutine operations such as a brief exposure to isopropyl alcohol concentrations in excess of the workplace environmental limit as a result of maintenance or repair activities.

(C) During emergencies, when airborne concentrations of isopropyl alcohol may exceed the permissible limit.

(2) When a respirator is permitted by paragraph (b)(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, when possible, the airborne concentration of isopropyl alcohol in the workplace initially and thereafter whenever process, worksite, or control changes occur which are likely to increase the isopropyl alcohol concentrations; this requirement does not apply when only atmosphere-supplying positive pressure respirators are used. The employer shall ensure that no worker is being exposed to isopropyl alcohol at concentrations in excess of the workplace environmental limits because of improper respirator selection, fit, use, or maintenance.

(B) A respiratory protection program meeting the requirements of 29 CFR 1910.134 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 isopropyl 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 injury from inhalation of isopropyl alcohol, the employer shall provide respiratory protection as listed in Table I-1.

TABLE I-1

RESPIRATOR SELECTION GUIDE

Concentration of Isopropyl Alcohol	Respirator Type
Less than or equal to 1,000 ppm	Chemical cartridge respirator with organic vapor cartridge(s)
Less than or equal to 5,000 ppm	Gas mask, full facepiece with chin-style canister for organic vapors
Less than or equal to 20,000 ppm	(1) Gas mask, full facepiece with front- or back-mounted chest-type canister for organic vapors; or (2) Type C supplied-air respirator with full facepiece, demand or continuous-flow type
Unknown concentration CAUTION! The lower explosive limit is approximately 20,000 ppm	(1) Self-contained breathing apparatus in pressure-demand mode with full facepiece; or (2) Combination supplied-air respirator pressure-demand type, with auxiliary self-contained air supply and full facepiece
Escape CAUTION! The lower explosive limit is approximately 20,000 ppm	(1) Positive pressure self-contained breathing apparatus; or (2) Combination supplied-air respirator pressure-demand type, with auxiliary self-contained air supply and full facepiece

Section 5 - Informing Employees of Hazards from Isopropyl Alcohol

(a) . At the beginning of employment, employees who will work in areas required to be posted in accordance with Section 3 shall be informed of the hazards, signs and symptoms of overexposure, emergency procedures, and precautions to ensure safe use and to minimize exposure. First aid procedures shall be included. This information shall be posted in the workplace and kept on file, readily accessible to the worker.

(b) Employers shall ensure that all such workers have current knowledge of job hazards, maintenance procedures, and cleanup methods, and that they know how to use respiratory protective equipment and protective clothing.

(c) In addition, employees and members of emergency teams who work adjacent to isopropyl alcohol systems or containers, where a potential for emergencies exists, shall participate in periodic drills, simulating emergencies appropriate to the work situation. Drills shall be held at intervals not greater than 6 months. Drills should cover, but should not be limited to:

- Evacuation procedures.
- Handling of spills and leaks, including decontamination.
- Location and use of emergency firefighting equipment, and handling of isopropyl alcohol systems and/or containers in case of fire.
- First aid and rescue procedures, including prearranged procedures for obtaining emergency medical care.
- Location, use, and care of protective clothing and respiratory protective equipment.
- Location of shut-off valves or switches.
- Location, purpose, and use of safety showers and eye-wash fountains.
- Operating procedures including communication procedures.
- Entry procedures for confined spaces.

Deficiencies noted during drills shall be included in the continuing educational program, together with the required remedial actions. Records of drills and training conducted shall be kept for one year and made available for inspection by authorized personnel as required.

(d) Information as required shall be recorded on the "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.

(e) Employees in the isopropyl alcohol-manufacturing areas shall be informed of the possible cancer hazard.

Section 6 - Work Practices

Isopropyl alcohol presents a significant fire hazard. Therefore, appropriate regulations for Class I B flammable liquids as provided in 29 CFR 1910.106 shall be followed.

(a) Engineering Controls

(1) Engineering controls shall be established to reduce exposure of employees to isopropyl alcohol vapors through implementation of adequate ventilation systems. If a local exhaust ventilation system is used, it shall be designed and maintained to prevent the accumulation or recirculation of isopropyl alcohol vapor into the workplace environment. Quarterly checks shall be made to ensure that the ventilation system is functioning properly. Such control equipment shall be sparkproof.

(2) An isopropyl alcohol-manufacturing process shall be a closed process in order to minimize exposures to possible carcinogenic agents. Weekly checks shall be made to ensure that the process is completely contained and the results of such checks shall be recorded. If

a leak exists, it shall be corrected promptly regardless of the concentration of isopropyl alcohol in the air.

(b) Sources of Ignition

(1) Precautions shall be taken to prevent the ignition of isopropyl alcohol vapor.

(2) Workplaces in which explosive concentrations of isopropyl alcohol vapor may develop shall meet regulations for Class I, Division 2, as specified by the National Electrical Code.

(3) Spark- and flame-generating operations, such as cutting or welding, and use of internal combustion engines shall be started only after an authorized representative of the employer signs a permit declaring the operation to be safe. This should be done only after a calibrated combustible gas meter or other suitable meter indicates that the concentration of isopropyl alcohol vapor is less than 0.2% by volume (10% of the lower explosive limit, or 2,000 ppm).

(4) Isopropyl alcohol in bulk quantity shall not be dispensed into containers unless the nozzle and the container are bonded. The container and the nozzle shall be grounded properly as required by 29 CFR 1910.106.

(5) Smoking shall be prohibited in isopropyl alcohol work areas.

(c) Loading and Unloading

(1) Safety showers, eyewash fountains, and fire extinguishers, such as dry chemicals approved for Class B fires, shall be installed in bulk loading and unloading areas. Safety showers, eyewash fountains, and fire extinguishers shall be checked to ensure they are in

working order before loading or unloading isopropyl alcohol.

(2) If there is a leak, the operation shall be stopped and resumed only after necessary repair or replacement has been completed.

(3) Bonding facilities for protection against sparks from discharge of static charge during the loading of tank vehicles shall be provided as required by 29 CFR 1910.106.

(d) Storage

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

(2) Storage of isopropyl alcohol in aluminum containers shall be prohibited.

(e) Disposal

(1) Spills shall be washed with water. Where it is not possible to wash a spill with water, the area should be cordoned off until it is cleaned by other means, such as a vacuum system.

(2) Wastes and residues produced in isopropyl alcohol-manufacturing areas shall be collected in impervious containers and incinerated in such a manner that no possible carcinogenic products are released.

(f) Vessel Entry

(1) Entry into confined spaces, such as tanks, pits, tank cars, and process vessels which have contained isopropyl alcohol shall be controlled by a permit system. Permits shall be signed by an authorized employer representative, certifying that preparation of the confined space, precautionary measures, and personal protective equipment are adequate, and that prescribed procedures will be followed.

(2) Confined spaces which have contained isopropyl alcohol shall be inspected and tested for oxygen deficiency, the airborne concentration of isopropyl alcohol and other contaminants, and the space shall be thoroughly ventilated, cleaned, neutralized, and washed, as necessary, prior to entry.

(3) Inadvertent entry of isopropyl alcohol into the confined space while work is in progress shall be prevented. Isopropyl alcohol supply lines shall be disconnected and blocked off.

(4) Confined spaces shall be ventilated while work is in progress to keep any airborne isopropyl alcohol concentration below the limit and to prevent oxygen deficiency.

(5) Individuals entering confined spaces where they may be exposed to isopropyl alcohol shall be equipped with the necessary personal protective equipment and a lifeline tended by another worker outside the space, who shall also be equipped with the necessary protective equipment.

(g) Emergency Procedures

For all work areas in which there is a reasonable 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 employees.

(2) Firefighting procedures shall be established. These shall include procedures for emergencies involving release of isopropyl alcohol vapor. In case of fire, isopropyl alcohol sources shall be shut

off or removed. Isopropyl alcohol containers shall be removed or cooled with water spray. Chemical foam, carbon dioxide, or dry chemicals shall be used for fighting isopropyl alcohol fires, and proper respiratory protective devices and protective clothing shall be worn.

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

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

(5) Only personnel properly trained in the relevant procedures and adequately protected against the attendant hazards shall shut off sources of isopropyl alcohol, clean up spills, and repair leaks.

Section 7 - Sanitation Practices

(a) Handwashing facilities, soap, and water shall be made available. Any isopropyl alcohol spill on the body shall be promptly washed.

(b) Eating and smoking shall be prohibited in the work area.

(c) Maintenance practices shall attempt to control leakage and prevent the accidental escape of isopropyl alcohol. Prompt repair of equipment and cleanup of spills and leaks shall be accomplished.

Section 8 - Monitoring and Recordkeeping Requirements

Workroom areas where it has been determined on the basis of an industrial hygiene survey that environmental levels do not exceed half the time-weighted average environmental limits are not considered to have occupational exposure to isopropyl alcohol. Records of these surveys, including the basis for concluding that environmental levels do not exceed 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 isopropyl 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 isopropyl 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 controls 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 isopropyl alcohol are at or below the workplace environmental limits.

(b) Records shall be maintained and shall include sampling and analytic methods, types of respiratory protective devices 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 at least 30 years after the worker's employment in isopropyl alcohol-manufacturing areas has ended. For all other areas of isopropyl alcohol exposure, pertinent records shall be maintained for at least 5 years after the worker's employment has ended. These records 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 isopropyl alcohol or its manufacture. 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 more healthful work environments. Simply complying with the recommended standard should not be the final goal.

These criteria for a standard for isopropyl alcohol are part of a continuing series of criteria developed by NIOSH. The proposed standard applies only to the processing, manufacture, and use of isopropyl alcohol in products as applicable under the Occupational Safety and Health Act of 1970. This standard was not developed for the population-at-large and any extrapolation beyond general occupational exposures is not warranted. It

is intended to (1) protect against the fire hazard posed by isopropyl alcohol, (2) protect against the development of harmful effects of isopropyl alcohol exposure, (3) protect against the development of cancer in the isopropyl alcohol-manufacturing areas, (4) be measurable by techniques that are valid, reproducible, and available to industry and governmental agencies, and (5) be attainable with existing technology.

The development of the recommended standard for occupational exposure to isopropyl alcohol has revealed deficiencies in the data base in the following areas:

(1) epidemiologic studies of employees exposed to chemicals used or produced during isopropyl alcohol manufacture by the current sulfuric acid and propylene process;

(2) animal studies designed to determine long-term and short-term effects of isopropyl alcohol at concentrations up to 400 ppm.

To fill these information gaps, a concerted effort is required by those people involved with the health and safety of employees exposed to isopropyl alcohol.