

criteria for a recommended standard

OCCUPATIONAL EXPOSURE TO

TOLUENE

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
National Institute for Occupational Safety and Health

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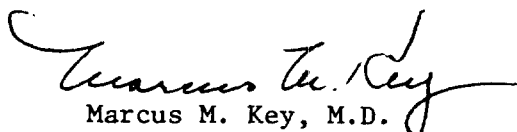
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PREFACE

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. To provide relevant data from which valid criteria and effective standards can be deduced, the National Institute for Occupational Safety and Health has projected a formal system of research, with priorities determined on the basis of specified indices.

It is intended to present successive reports as research and epidemiologic studies are completed and 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 toluene by members of my staff, the valuable and constructive comments presented by the Review Consultants on Toluene, the ad hoc committees of the American Academy of Industrial Hygiene and the Industrial Medical Association, by Robert B. O'Connor, M.D., NIOSH consultant in occupational medicine, and by Edwin C. Hyatt on respiratory protection. The NIOSH recommendations for standards are not necessarily a consensus of all the consultants and professional societies that reviewed this criteria document on toluene. Lists of the NIOSH Review Committee members and of the Review Consultants appear on the following pages.



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The Office of Research and Standards Development, National Institute for Occupational Safety and Health, had primary responsibility for development of the criteria and recommended standard for toluene. George D. Clayton and Associates developed the basic information for consideration by NIOSH staff and consultants under contract No. HSM-99-72-118. Douglas L. Smith, Ph.D., served as criteria manager and had NIOSH program responsibility for development of the document.

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CRITERIA DOCUMENT: RECOMMENDATIONS FOR AN
OCCUPATIONAL EXPOSURE STANDARD FOR TOLUENE

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I. RECOMMENDATIONS FOR A TOLUENE STANDARD

The National Institute for Occupational Safety and Health (NIOSH) recommends that worker exposure to toluene in the workplace be controlled by adherence to the following sections. The standard is designed to protect the health and safety of workers for an 8-hour day, 40-hour week over a working lifetime; compliance with the standard should therefore prevent adverse effects of toluene on the health and safety of workers. The standard is measurable by techniques that are valid, reproducible, and available to industry and government agencies. Sufficient technology exists to permit compliance with the recommended standard.

"Exposure to toluene" means exposure to a concentration of toluene equal to or above one-half the recommended workroom environmental standard. Exposures at lower environmental concentrations will not require adherence to the following sections.

If "exposure" to other chemicals also occurs, for example from contamination of toluene with benzene, provisions of any applicable standard for the other chemicals shall also be followed.

Section 1 - Environmental (Workplace air)

(a) Concentration

Occupational exposure to toluene shall be controlled so that workers shall not be exposed to toluene at a concentration greater

for 100 parts per million parts of air (375 milligrams per cubic meter of air) determined as a time-weighted average (TWA) exposure for an 8-hour workday with a ceiling of 200 parts per million parts of air (750 milligrams per cubic meter of air) as determined by a sampling time of 10 minutes.

(b) Sampling, Collection, and Analysis

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

Section 2 - Medical

Comprehensive preplacement and biennial medical examinations should be provided for all workers subject to "exposure to toluene." The examination should be directed towards but not limited to the incidence of headaches, nausea, and dizziness; particular attention should be focused on complaints and evidence of eye, mucous membrane, and skin irritation. Laboratory tests recommended at the time of the biennial examination include complete blood count and urinalysis.

Section 3 - Labeling (Posting)

Areas where exposure to toluene is likely to occur shall be posted with signs reading:

TOLUENE

WARNING! FLAMMABLE

Keep away from heat, sparks, and open flame.

VAPOR HARMFUL

Keep containers closed.

Use only with adequate ventilation.

Avoid prolonged breathing of vapor.

Avoid prolonged or repeated contact with skin.

If environmental levels are at or greater than the environmental limit, or if a variance permitting use of respiratory controls has been granted, add to the label or placard the location of the respirators.

Section 4 - Personal Protective Equipment and Work Clothing

Subsection (a) shall apply whenever a variance from the standard recommended in Section 1 is granted under provisions of the Occupational Safety and Health Act, or in the interim period during the application for a variance. When the limits of exposure to toluene prescribed in subsection (a) of Section 1 cannot be met by limiting the concentration of toluene in the work environment, an employer must utilize, as provided in subsection (a) of this Section,

a program of respiratory protection to effect the required protection of every worker exposed.

(a) Respiratory Protection

Engineering controls shall be used wherever feasible to maintain toluene concentrations below the prescribed limits. Appropriate respirators shall be provided and used when a variance has been granted to allow respirators as a means of control of exposure to routine operations and while the application is pending. Administrative controls should also be used to reduce exposure. Respirators shall also be provided and used for nonroutine operations (occasional brief exposures above the TWA of 100 ppm and for emergencies); however, for these instances a variance is not required but the requirements set forth below continue to apply. Appropriate respirators as described in Table I-1 shall only be used pursuant to the following requirements:

(1) For the purpose of determining the type of respirator to be used, the employer shall measure the atmospheric concentration of toluene in the workplace when the initial application for variance is made and thereafter whenever process, worksite, climate, or control changes occur which are likely to increase the toluene concentration. The employer shall ensure that no worker is being exposed to toluene in excess of the standard either because of improper respirator selection or fit.

(2) Employees experiencing breathing difficulty while wearing respirators shall be medically examined to determine their ability to wear the respirator.

(3) A respiratory protective program meeting the general requirements outlined in Section 3.5 of American National Standard Practices for Respiratory Protection Z88.2-1969 shall be established and enforced by the employer.

(4) The employer shall provide respirators in accordance with the Table below and shall ensure that the employee uses the respirator provided.

(5) Respiratory protective devices described in the following Table I-1 shall be either those approved under the following listed regulations or those approved under 30 CFR 11, published March 25, 1972 or future amendments.

(A) Gas masks-----

30 CFR 13 (Bureau of Mines Schedule 14 F)

(B) Supplied-air respirators-----

30 CFR 12 (Bureau of Mines Schedule 19 B)

(C) Self-contained breathing apparatus-----

30 CFR 11 (Bureau of Mines Schedule 13 E)

(D) Chemical cartridge respirators-----

30 CFR 14 (Bureau of Mines Schedule 23B)

(6) Usage of a respirator specified for use in higher concentrations of toluene is permitted in atmospheres of lower concentrations.

(7) Employees shall be given instruction on the use of respirators assigned to them, cleaning of the respirators, and how to test for leakage.

TABLE I-1
REQUIREMENTS FOR RESPIRATOR USAGE
AT MULTIPLES OF THE STANDARD

<u>Multiples of TWA Limit</u>	<u>Respirator Type</u>
Less than or equal to 10 times	(1) Chemical cartridge respirator with replaceable organic vapor cartridge(s) and half-mask or full facepiece. (2) Air line respirator, demand type (negative pressure), with half-mask facepiece.
Less than or equal to 50 times	(1) Full face gas mask, chin style, with organic vapor canister.

(2) Supplied air respirator, demand type (negative pressure), with full facepiece.

(3) Supplied air respirator, continuous flow type.

Less than or
equal to 100 times

(1) Gas mask, full facepiece, with front or back mounted chest type organic vapor canister.

(2) Combination supplied air respirator, demand type, full facepiece with auxiliary self-contained air supply.

Greater than
100 times

Self-contained breathing apparatus with positive pressure facepiece.

(b) Work Clothing

(1) If operations require continued exposure to liquid toluene, workers should wear impervious clothing, gloves, or coverings to protect the potentially exposed area of the body.

(2) Toluene-wetted clothing, unless impervious, shall be removed promptly.

(A) Workers wearing toluene-wetted clothing shall not go near heaters or open flames.

(B) Toluene-wetted clothing shall not be placed in proximity of flames, heaters, or spark-producing equipment.

(3) Work clothing should be changed at least twice a week or more frequently if required.

(4) Glasses having shatter-resistant glass or equivalent lenses and side shields shall be worn when there is a danger of liquid toluene splashing into the eye.

Section 5 - Appraisal of Employees of Hazards from Toluene

(a) Each employee exposed to toluene shall be apprised at the beginning of his employment in, or assignment to, a toluene area of the hazards, relevant symptoms, appropriate emergency procedures, and proper conditions and precautions for safe use of, or exposure to toluene and, during employment, shall be kept currently informed through posting (see Section 3) and instructed as to availability of such information. This information shall be kept on file, including that prescribed in (b) below, and shall be accessible to the worker at each place of employment where exposure to toluene may occur.

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

Section 6 - Work Practices

(a) Smoking materials, including personal matches and lighters, shall be prohibited in all areas where there is toluene.

(b) Emergency Procedures

(1) Fire fighting procedures shall be established and implemented; these shall include procedures for emergencies involving release of toluene vapor.

(A) Drench-type showers, eye-wash fountains, and cleansing facilities should be installed and maintained to provide prompt, immediate access by the workers.

(2) Appropriate respirators shall be available for wear during evacuation.

(3) Appropriate extinguishants shall be available for use in toluene fires.

(c) Exhaust Systems

Where a local exhaust ventilation system is used, it shall be designed and maintained to prevent the accumulation or recirculation of toluene vapor into the workroom.

(d) General Housekeeping

Emphasis shall be placed upon cleanup of spills, inspection and repair of equipment and leaks, and proper storage of materials.

(e) Disposal

(1) The disposal of waste toluene and of materials contaminated with it shall be in accordance with applicable regulations.

(2) Toluene or toluene-containing materials should not be discharged into drains or sewers.

Section 7 - Monitoring and Reporting Requirements

Workroom areas where it has been determined, on the basis of an industrial hygiene survey or the judgment of a compliance officer, that environmental levels do not exceed one-half the environmental standard shall not be considered to have toluene exposure. Records of these surveys, including the basis for concluding that air levels are below one-half the environmental standard, shall be kept.

Requirements set forth below apply to toluene exposures.

(a) Employers shall monitor environmental levels of toluene at least semiannually, except as otherwise indicated by a professional industrial hygiene survey. If the time-weighted average or ceiling concentrations are at or above the standard, environmental levels shall be monitored monthly. This increased frequency of monitoring shall be continued until at least two 30-day monitoring periods have demonstrated environmental levels which are at or below the standard.

Air samples shall be collected in the breathing zone of workers to permit calculation of a time-weighted average exposure and ceiling concentration for every toluene exposure area. As a minimum, samples for determination of the following number of time-weighted average and ceiling concentrations shall be collected and analyzed, based on the

number of workers exposed in any toluene exposure area, or as otherwise indicated by a professional industrial hygiene survey.

<u>Number of Employees Exposed</u>	<u>Number of Samples</u>
1-20	5 samples or 50% of the total number of workers, whichever is greater
20-100	10 samples plus 25% of the excess over 20 workers
over 100	30 samples plus 5% of the excess over 100 workers

(b) Records shall be maintained for all sampling schedules to include the sampling methods, analytical methods, type of respiratory protection in use (if applicable), and the time-weighted average and ceiling concentrations of toluene in each work area. Records of results shall be maintained so that they can be classified by employee; they shall be made available to each 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 toluene. 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 describeexposure 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 workers from exposure to hazardous chemical and physical agents. It should be pointed out that any recommended criteria for a 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 toluene are part of a continuing series of criteria developed by NIOSH. The proposed standard applies only to the processing, manufacture, and use of toluene in

products as applicable under the Occupational Safety and Health Act of 1970.

These criteria were developed to ensure that the standard based thereon would (1) protect against development of acute and chronic toluene poisoning, (2) be measurable by techniques that are valid, reproducible, and available to industry and governmental agencies, and (3) be attainable with existing technology.

For many years, toxicity to the blood and blood forming organs has been attributed to toluene, primarily because of the close structural similarity which exists between toluene and benzene and the established myelotoxicity of benzene. Toluene has been contaminated frequently with benzene. Current scientific evidence obtained from human and animal studies indicates that chemical alkylation of the benzene ring structure such as exists with toluene (methyl benzene) results in a loss of the myelotoxic activity. Benzene appears to be unique among the monocyclic aromatic hydrocarbons in its myelotoxic properties; therefore, the major problem of toluene toxicity concerns its narcotic effects on workers by causing symptoms and signs such as muscular weakness, incoordination, and mental confusion which may pose a risk to both the worker and others.