Occupational Health Guideline for Stoddard Solvent

INTRODUCTION

This guideline is intended as a source of information for employees, employers, physicians, industrial hygienists, and other occupational health professionals who may have a need for such information. It does not attempt to present all data; rather, it presents pertinent information and data in summary form.

SUBSTANCE IDENTIFICATION

- Formula: Generally C_9 through C_{11} paraffins (85%) and aromatics (15%)
- Synonyms: Dry cleaning safety solvent; mineral spirits
- Appearance and odor: Colorless liquid with kerosene-like odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for Stoddard solvent is 500 parts of Stoddard solvent per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 2950 milligrams of Stoddard solvent per cubic meter of air (mg/m³). NIOSH has recommended that the permissible exposure limit for refined petroleum products, including Stoddard solvent, be reduced to 350 mg/m³ averaged over a work shift of up to 10 hours per day, 40 hours per week, with a ceiling level of 1800 mg/m³ measured over a 15-minute period. The NIOSH Criteria Document for Refined Petroleum Products should be consulted for more detailed information.

HEALTH HAZARD INFORMATION

- **Routes of exposure**

Stoddard solvent can affect the body if it is inhaled, comes in contact with the eyes or skin, or is swallowed.

- **Effects of overexposure**

1. Short-term Exposure: Overexposure to Stoddard solvent causes irritation of the eyes, nose, and throat, and may cause dizziness. Very high air concentrations may cause unconsciousness and death.

2. Long-term Exposure: Prolonged overexposure to the liquid may cause skin irritation.

3. Reporting Signs and Symptoms: A physician should be contacted if anyone develops any signs or symptoms and suspects that they are caused by exposure to Stoddard solvent.

- **Recommended medical surveillance**

The following medical procedures should be made available to each employee who is exposed to Stoddard solvent at potentially hazardous levels:

1. Initial Medical Examination:

—A complete history and physical examination: The purpose is to detect pre-existing conditions that might place the employee at increased risk, and to establish a baseline for future health monitoring. Examination of the skin, liver, blood, urine, and central nervous system should be stressed.

—Skin: Stoddard solvent is a defatting agent and can cause dermatitis on prolonged exposure. Persons with pre-existing skin disorders may be more susceptible to the effects of this agent.

—Liver function tests: Stoddard Solvent may cause liver damage. A profile of liver function should be obtained by utilizing a medically acceptable array of biochemical tests.

—Urinalysis: The kidneys may be affected by Stoddard solvent. Since kidney damage has been observed from exposure, a urinalysis should be performed to include, at a minimum, specific gravity, albumin, glucose, and a microscopic on centrifuged sediment.

—A complete blood count: A complete blood count should be performed, including a red cell count, a white cell count, a differential count of a stained smear, as well as hemoglobin and hematocrit.

—Respiratory system examination: In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of Stoddard solvent might cause exacerbation of symptoms due to its irritant properties.

These recommendations reflect good industrial hygiene and medical surveillance practices and their implementation will assist in achieving an effective occupational health program. However, tney may not be sufficient to achieve compliance with all requirements of OSHA regulations.

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service Centers for Disease Control
National Institute for Occupational Safety and Health

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

*2. Periodic Medical Examination:*The aforementioned medical examinations should be repeated on an annual basis.

• **Summary of toxicology**

Stoddard solvent vapor is a mild narcotic and a mucous membrane irritant. Since it contains both aliphatic and aromatic hydrocarbons in varying concentrations, toxicologic opinion is based upon deductions as to the relative health hazard of the different fractions. The vapor of the aliphatic fractions is chiefly nonane and isodecane. The aromatic component is considered to be more toxic. Stoddard solvent has an odor threshold of about 4 to 5 mg/m^3 and olfactory fatigue has been observed in about 6 minutes at low concentrations. Eye irritation was reported in a test exposure of human subjects at 850 mg/m^3. Industrial exposures to unknown but fairly high concentrations over long periods have resulted in headaches, eye, nose, and throat irritation, fatigue, marrow hypoplasia and, in extreme cases, death. Dermal exposures to the liquid solvent have caused dermatitis and jaundice.

CHEMICAL AND PHYSICAL PROPERTIES

• **Physical data**

1. Molecular weight: 144 (approximately)
2. Boiling point (760 mm Hg): 150 to 200 C (302 to 392 F)
3. Specific gravity (water = 1): 0.78
4. Vapor density (air = 1 at boiling point of Stoddard solvent): 5
5. Melting point: Data not available
6. Vapor pressure at 20 C (68 F): 2 mm Hg (estimate)
7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble
8. Evaporation rate (butyl acetate = 1): Less than 1

• **Reactivity**

1. Conditions contributing to instability: Heat
2. Incompatibilities: Contact with strong oxidizing agents may cause fires and explosions.
3. Hazardous decomposition products: Toxic gases and vapors (such as carbon monoxide) may be released in a fire involving Stoddard solvent.
4. Special precautions: Stoddard solvent will attack some forms of plastics, rubber, and coatings.

• **Flammability**

1. Flash point: 38.7 to 60 C (102 to 140 F) (closed cup)
2. Autoignition temperature: 226 to 260 C (440 to 500 F)
3. Flammable limits in air, % by volume: Lower: 0.8
4. Extinguishant: Carbon dioxide, dry chemical, foam

• **Warning properties**

1. Odor Threshold: May gives an odor threshold of 30 ppm for Stoddard solvent (mineral spirits). According to the AIHA *Hygienic Guide* for Stoddard solvent, "most Stoddard solvents have a petroleum odor that is perceptible at about 1 ppm."
2. Eye Irritation Level: Grant states that "the vapor of Stoddard solvent is perceptively irritating to human eyes at 400 ppm."
3. Evaluation of Warning Properties: Through its odor and irritant effects, Stoddard solvent can be detected below the permissible exposure limit. For the purposes of this guideline, therefore, Stoddard solvent is treated as a material with good warning properties.

MONITORING AND MEASUREMENT PROCEDURES

• **Eight-Hour Exposure Evaluation**

Measurements to determine employee exposure are best taken so that the average eight-hour exposure is based on a single eight-hour sample or on two four-hour samples. Several short-time interval samples (up to 30 minutes) may also be used to determine the average exposure level. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).

• **Ceiling Evaluation**

Measurements to determine employee ceiling exposure are best taken during periods of maximum expected airborne concentrations of Stoddard solvent. Each measurement should consist of a fifteen (15) minute sample or series of consecutive samples totalling fifteen (15) minutes in the employee's breathing zone (air that would most nearly represent that inhaled by the employee). A minimum of three (3) measurements should be taken on one work shift and the highest of all measurements taken is an estimate of the employee's exposure.

• **Method**

Sampling and analyses may be performed by collection of Stoddard solvent vapors using an adsorption tube with subsequent desorption with carbon disulfide and gas chromatographic analysis. Also, detector tubes certified by NIOSH under 42 CFR Part 84 or other direct-reading devices calibrated to measure Stoddard solvent may be used. An analytical method for Stoddard solvent is in the *NIOSH Manual of Analytical Methods,* 2nd Ed., Vol. 3, 1977, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00261-4).

RESPIRATORS

• Good industrial hygiene practices recommend that engineering controls be used to reduce environmental concentrations to the permissible exposure level. However, there are some exceptions where respirators may be used to control exposure. Respirators may be used when engineering and work practice controls are not technically feasible, when such controls are in the process of being installed, or when they fail and need to be supplemented. Respirators may also be used for operations which require entry into tanks or closed

vessels, and in emergency situations. If the use of respirators is necessary, the only respirators permitted are those that have been approved by the Mine Safety and Health Administration (formerly Mining Enforcement and Safety Administration) or by the National Institute for Occupational Safety and Health.

• In addition to respirator selection, a complete respiratory protection program should be instituted which includes regular training, maintenance, inspection, cleaning, and evaluation.

PERSONAL PROTECTIVE EQUIPMENT

• Employees should be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing necessary to prevent repeated or prolonged skin contact with liquid Stoddard solvent.

• Clothing wet with liquid Stoddard solvent should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of Stoddard solvent from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the Stoddard solvent, the person performing the operation should be informed of Stoddard solvent's hazardous properties.

• Any clothing which becomes wet with liquid Stoddard solvent should be removed promptly and not reworn until the Stoddard solvent is removed from the clothing.

• Employees should be provided with and required to use splash-proof safety goggles where liquid Stoddard solvent may contact the eyes.

SANITATION

• Skin that becomes wet with liquid Stoddard solvent should be promptly washed or showered with soap or mild detergent and water to remove any Stoddard solvent.

COMMON OPERATIONS AND CONTROLS

The following list includes some common operations in which exposure to Stoddard solvent may occur and control methods which may be effective in each case:

Operation	Controls
Use as a solvent in dry cleaning industry	Process enclosure; local exhaust ventilation; personal protective equipment
Use in paint and varnish industries	General dilution ventilation
Use as a solvent for printing inks and textile-printing industries	General dilution ventilation; local exhaust ventilation; personal protective equipment
Use in manufacture of aerosol sprays as a solvent for paints, varnishes, and insecticides	General dilution ventilation; local exhaust ventilation; personal protective equipment
Use in manufacture of sprays for pesticides, herbicides, household cleaners, and silicone compounds	General dilution ventilation; local exhaust ventilation; personal protective equipment
Use as a solvent and thinner in protective coating materials	General dilution ventilation; local exhaust ventilation; personal protective equipment
Use in metal cleaning and degreasing; and in leather degreasing	Process enclosure; local exhaust ventilation; personal protective equipment
Use as a general solvent in fabric water-proofing, processing of synthetic yarns, extraction of fats and oils, as a tackifying agent for rubber, in rubber cements, and in polishes	Local exhaust ventilation; general dilution ventilation; personal protective equipment

EMERGENCY FIRST AID PROCEDURES

In the event of an emergency, institute first aid procedures and send for first aid or medical assistance.

• **Eye Exposure**

If Stoddard solvent gets into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. If irritation persists after washing, get medical attention. Contact lenses should not be worn when working with this chemical.

• **Skin Exposure**

If Stoddard solvent gets on the skin, promptly wash the contaminated skin using soap or mild detergent and water. If Stoddard solvent soaks through the clothing, remove the clothing immediately and wash the skin using soap or mild detergent and water. If irritation persists after washing, get medical attention.

• **Breathing**

If a person breathes in large amounts of Stoddard solvent, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration.

Keep the affected person warm and at rest. Get medical attention as soon as possible.

• **Swallowing**

If Stoddard solvent has been swallowed, do not induce vomiting. Get medical attention immediately.

• **Rescue**

Move the affected person from the hazardous exposure. If the exposed person has been overcome, notify someone else and put into effect the established emergency rescue procedures. Do not become a casualty. Understand the facility's emergency rescue procedures and know the locations of rescue equipment before the need arises.

SPILL, LEAK, AND DISPOSAL PROCEDURES

• Persons not wearing protective equipment and clothing should be restricted from areas of spills or leaks until cleanup has been completed.

• If Stoddard solvent is spilled or leaked, the following steps should be taken:

1. Remove all ignition sources.
2. Ventilate area of spill or leak.
3. For small quantities, absorb on paper towels. Evaporate in a safe place (such as a fume hood). Allow sufficient time for evaporating vapors to completely clear the hood ductwork. Burn the paper in a suitable location away from combustible materials. Large quantities can be collected and atomized in a suitable combustion chamber. Stoddard solvent should not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

• Waste disposal methods:

Stoddard solvent may be disposed of:

1. By absorbing it in vermiculite, dry sand, earth or a similar material and disposing in a secured sanitary landfill.
2. By atomizing in a suitable combustion chamber.

REFERENCES

• American Conference of Governmental Industrial Hygienists: "Stoddard Solvent," *Documentation of the Threshold Limit Values for Substances in Workroom Air* (3rd ed., 2nd printing), Cincinnati, 1974.

• American Industrial Hygiene Association: "Stoddard Solvent," *Hygienic Guide Series*, Detroit, Michigan, 1975.

• Davis, A., et al.: "The Effects on Human Volunteers of Exposure to Air Containing Gasoline Vapor," *Archives of Environmental Health*, 1:548-554, 1960.

• Grant, W. M.: *Toxicology of the Eye* (2nd ed.), C. C. Thomas, Springfield, Illinois, 1974.

• May, J.: "Solvent Odor Thresholds for the Evaluation of Solvent Odors in the Atmosphere," *Staub-Reinhalt*, 26:9, 385-389, 1966.

• National Institute for Occupational Safety and Health, U.S. Department of Health, Education, and Welfare: *Criteria for a Recommended Standard . . . . Occupational Exposure to Refined Petroleum Products*, HEW Publication No. (NIOSH) 77-192, U.S. Government Printing Office, Washington, D.C., 1977.

• Patty, F. A. (ed.): *Toxicology*, Vol. II of *Industrial Hygiene and Toxicology* (2nd ed. rev.), Interscience, New York, 1963.

• Sax, N. I.: *Dangerous Properties of Industrial Materials* (3rd ed.), Van Nostrand Reinhold, New York, 1968.

RESPIRATORY PROTECTION FOR STODDARD SOLVENT

Condition	Minimum Respiratory Protection* Required Above 500 ppm
Vapor Concentration	
1000 ppm or less	A chemical cartridge respirator with a full facepiece and an organic vapor cartridge(s).
5000 ppm or less	A gas mask with a chin-style or a front- or back-mounted organic vapor canister. Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.
Greater than 5000 ppm or entry and escape from unknown concentrations	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode. 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.
Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.
Escape	Any gas mask providing protection against organic vapors. Any escape self-contained breathing apparatus.

*Only NIOSH-approved or MSHA-approved equipment should be used.