

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND
SUPPORTING DOCUMENTATION FOR

*** STODDARD SOLVENT ***

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for STODDARD SOLVENT

The basic text of this document contains the draft technical standard approved by the Joint Review Committee of the NIOSH/OSHA Standards Completion Program and the supporting documentation for the substance STODDARD SOLVENT.

The SCP draft technical standards are recommendations to the Department of Labor for its consideration in rulemaking and have no legal status until final rules have been promulgated by that agency. This draft standard is provided for your information only.

The References and Sources, Respirator Table Documentation and Use/Exposure and Control Documentation are the working documents used by the various SCP working groups during the development of the draft technical standard and serve as the technical foundation for the standard. The classification for each substance and the regulatory statements were derived following a decision logic established for the various sections of the standard.

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(a) DEFINITIONS

- (1) PERMISSIBLE EXPOSURE - "Permissible Exposure" means inhalation of stoddard solvent in concentrations not in excess of 500 parts per million (ppm) (2,950 milligrams per cubic meter, mg/cu.m.) averaged over an eight hour work shift, as stated in section 1910.93, Table G-1.
- (2) ACTION LEVEL - "Action Level" means one half (1/2) of the permissible exposure for stoddard solvent.
- (3) Stoddard Solvent: means a petroleum product with a flash point range of 38.7-60C (102 to 140F); a boiling range of 150 to 200 C (302 to 392F); and an aromatic hydrocarbon content of approximately 15 percent by weight.

Def: ACGIH Doc. of TLV's & Kirk Othmer Encycl. of Chem. Tech.
Vol. 7, 2nd. Edition, 1969.

(b) EMPLOYEE INFORMATION - Each employer who has a workplace in which stoddard solvent is present shall:

- (1) STANDARD AVAILABILITY - Keep a copy of this section with its appendices A, B and C, at the workplace. This material shall be made readily available to affected employees; and
- (2) PRESENCE OF STODDARD SOLVENT - Inform affected employees of the quantity, location, and manner of use or storage of stoddard solvent.

(c) EXPOSURE MEASUREMENT

- (1) INITIAL DETERMINATION - Each employer who has a place of employment in which stoddard solvent is released into the workplace air shall determine if any employee may be exposed to airborne concentrations of stoddard solvent at or above the action level. The determination shall be made each time there is a change in production, process, or control measures which could result in an increase in airborne concentrations of stoddard solvent. A written determination shall be made and it shall contain at least the following information:
 - (i) Any information, observations, or calculations which would indicate employee exposure to stoddard solvent;
 - (ii) Any measurements of airborne concentrations of stoddard solvent taken;
 - (iii) Any employee complaints of symptoms which may be attributable to exposure to stoddard solvent; and
 - (iv) Date of determination, work being performed at the time, location within work site, name, and social security number of each employee considered.
- (2) INITIAL EXPOSURE MEASUREMENT - If the employer determines that any employee may be exposed to airborne concentrations of stoddard solvent at or above the action level, the exposure of the employee believed to have the greatest exposure shall be measured. The exposure measurement shall be representative of the maximum exposure of the employee.
- (3) IDENTIFICATION OF EXPOSED EMPLOYEES - If the exposure measurement taken under paragraph (c)(2) of this section reveals employee exposure to airborne concentrations of stoddard solvent at or above the action level, the employer shall:
 - (i) Identify all employees who may be exposed at or above the action level; and

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- (ii) Measure the exposure of the employees so identified.
- (4) EXPOSURE ABOVE THE ACTION LEVEL - If an employee exposure measurement reveals that an employee is exposed to airborne concentrations of stoddard solvent at or above the action level, but not above the permissible exposure, the exposure of that employee shall be measured at least every two months.
- (5) EXPOSURE ABOVE THE PERMISSIBLE EXPOSURE - If an employee exposure measurement reveals that an employee is exposed to airborne concentrations of stoddard solvent above the permissible exposure, the employer shall:
 - (i) Inform the employee of the exposure as required by paragraph (N)(1) of this section; and
 - (ii) Measure the exposure of the employee at least monthly; and
 - (iii) Institute control measures as required by paragraph (E) of this section.
- (6) TERMINATION OF EXPOSURE MEASUREMENT - If two consecutive employee exposure measurements taken at least one week apart reveal that the employee is exposed to airborne concentrations of stoddard solvent below the action level, the employer may terminate measurement for the employee. For purposes of this subparagraph, use of respirators shall not constitute reduction of employee exposure below the action level.
- (d) METHODS OF MEASUREMENT - An employee's exposure shall be obtained by any combination of long term or short term samples which represents the employee's actual exposure averaged over an eight hour work shift (Appendix B (iv)). The method of measurement shall have an accuracy, to a confidence level of 95%, of not less than that given in Table 1 below.

Table 1

Concentration	Required Accuracy
Above permissible exposure	Plus or Minus 25%
At or below permissible exposure and above the action level	Plus or Minus 35%
At or below the action level	Plus or Minus 50%

- (e) Methods of Compliance
 - (1) Engineering controls - No employee shall be exposed to Stoddard solvent above the permissible limit as defined in paragraph (a)(1) of this section. Engineering and work practice controls shall be used to reduce exposure to Stoddard solvent to at or below the permissible exposure.
 - (i) When mechanical ventilation is used to control exposure, measurements which demonstrate system efficiency (for example: air velocity, static pressure, or air volume) shall be made at least every three months. Measurements of system efficiency shall also be made within five work days of any change in production, process or control which might result in a reduction in control.
 - (ii) Where a fan is located in duct work and where Stoddard solvent is present in concentrations greater than 2000 ppm, one fourth of the lower flammable limit, the fan rotating element shall consist of, or be lined with, non-sparking material. There shall be sufficient clearance between the

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fan rotating element and the fan casing so as to prevent contact.

- (iii) In the design of open surface tank ventilation for the purposes of section 1910.94 (d), operations involving Stoddard solvent shall be classified as C-3 at 70 F.

(2) Respirators

- (i) Compliance with the permissible exposure may not be achieved by the use of respirators except:
- a. During the time period necessary to install engineering controls; or
 - b. In work situations in which engineering controls are technically not feasible; or
 - c. In work situations in which feasible engineering and work practice controls are insufficient to reduce employees exposure to at or below the permissible exposure. Where technically feasible engineering and work practice controls are not sufficient to reduce exposure to at or below permissible exposure, they shall be used to reduce exposure to the lowest level feasible; or
 - d. For operations not exceeding 40 hours per year; or
 - e. In emergencies.
- (ii) Respirators shall be jointly approved by the mining enforcement and safety administration (formerly Bureau of Mines) and by the National Institute for Occupational Safety and Health under the provisions of 30 CFR Part 11.
- (iii) Employers shall select and provide the appropriate respirator from Table 2 and shall ensure that the employee uses the respirator provided.
- (iv) Employers shall institute a respiratory protection program in accordance with sections 1910.134(b), (d), (e), and (f).

TABLE 2. RESPIRATORY PROTECTION FOR STODDARD SOLVENT

CONDITION	PERMISSIBLE RESPIRATORY PROTECTION
Vapor Concentration	
Equal to or less than 1000 ppm	A chemical cartridge respirator with a full facepiece and an organic vapor cartridge(s).
Equal to or less than 5000 ppm	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 escape and entry	Self-contained breathing apparatus with a full facepiece operated in

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from unknown
concentrations

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.

(f) Fire and Safety

Employers shall familiarize themselves with the information contained in
the Substance Technical Guidelines for Stoddard solvent which is
contained in Appendix B in order to ensure the safe handling and use of
Stoddard solvent.

- (1) Electrical - For the purposes of compliance with section 1910.309,
locations classified as hazardous locations due to the presence of
Stoddard solvent shall be Class I Group D.
- (2) Portable fire extinguishers - For the purposes of compliance with
section 1910.157, Stoddard solvent is classified as a Class B fire
hazard.
- (3) Powered industrial trucks - For the purposes of compliance with
section 1910.178, locations classified as hazardous locations due to
the presence of Stoddard solvent shall be Class I Group D.
- (4) Combustible liquids - For the purposes of compliance with section
1910.106, liquid Stoddard solvent is classified as a Class II
combustible liquid. Spray finishing operations shall be performed
in accordance with sections 1910.107 and 1910.94 (c). Dip tank
operations shall be performed in accordance with sections 1910.108
and 1910.94 (d).
- (5) Sources of ignition - Sources of ignition such as smoking or open
flames are prohibited where Stoddard solvent is handled, used or
stored in a manner so as to create a potential fire or explosion
hazard.
- (6) Storage - Stoddard solvent shall be stored so as not to come in
contact with strong oxidizers.

(g) Personal Protective Equipment

(1) Skin Contact

- (i) Employers shall provide, and require employees to use,
impervious clothing, gloves, face shields (8-inch minimum)
and other appropriate protective clothing necessary to

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prevent repeated or prolonged skin contact to liquid Stoddard solvent. Face shields shall comply with section 1910.133(a)(6).

- (ii) Employers shall ensure that non-impervious clothing wet with liquid Stoddard solvent be removed promptly and not reworn until the Stoddard solvent is removed from the clothing.
- (iii) Employers shall ensure that clothing wet with liquid Stoddard solvent is placed in closed containers for storage until it can be discarded or until the employer provides 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 employer shall inform the person performing the operation of the hazardous properties of Stoddard solvent.

(2) Eye Contact

- (i) Employers shall provide, and require employees to use, splash-proof safety goggles (cup-cover type dust and splash safety goggles), which comply with section 1910.133 (a)(6), where eye contact to liquid Stoddard solvent may occur.

(h) Spills

- (1) Spills of Stoddard solvent shall be cleaned up immediately after eliminating potential sources of ignition and utilizing available ventilation.
- (2) Liquid Stoddard solvent may not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

(i) Sanitation

- (1) Employers shall ensure that employees whose skin becomes wet with liquid Stoddard solvent promptly wash or shower using soap or mild detergent to remove any Stoddard solvent from the skin.

(j) Training and Information - Each employer who has employees exposed to stoddard solvent in excess of the action level, or employees who may have skin or eye contact with liquid stoddard solvent, or employees who work where accidental release, spill, fire, or explosion of stoddard solvent may occur, shall annually:

- (1) Substance Safety Data Sheet - Inform each employee of the information contained in the Substance Safety Data Sheet for stoddard solvent, which is contained in Appendix A; and

(2) Medical -

- (I) Advise employees as to the signs and symptoms of exposure to stoddard solvent.
- (II) Instruct the employees to advise the employer of the development of signs and symptoms of exposure to stoddard solvent which are listed in Appendix A.
- (III) Instruct the employees to inform the employer if they develop any of the medical conditions listed in (k)(2) of this section; and

(3) Procedures -

- (I) Provide training to ensure that employees understand the precautions of safe use, emergency procedures, and the correct use of protective equipment relative to stoddard solvent.

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(II) The procedures required by (j)(1), (2), and (3)(I) shall be provided to employees at the expense of the employer during the employee's normal working hours.

(K) Medical Surveillance

- (1) The employer shall provide medical procedures as required by paragraph (k). These procedures shall be provided at no cost to the employee.
- (2) Preplacement Questionnaire - The employer shall obtain from each employee who will be exposed to liquid Stoddard solvent, or airborne concentrations of Stoddard solvent at or above the action level, a written statement as to whether such employee has a history of any of the following:
 - (i) Skin disease
 - (ii) Chronic lung disease
 - (iii) Liver disease
 - (iv) Kidney disease
- (3) Preplacement Medical Examination - The employer shall provide a medical examination for an employee if the employee provides a history of any of the conditions named in paragraph (k)(2).
- (4) Results of Preplacement Examination - The employer shall obtain a physician's written opinion based on the medical examination pursuant to paragraph (k)(3).
- (5) Periodic Medical Examinations - The employer shall provide a medical examination for an employee if the employee advises the employer of the development of:
 - (i) Any of the medical conditions listed in (k)(2).
 - (ii) Signs and symptoms listed in Appendix A which the employee suspects may be caused by exposure to Stoddard solvent.
- (6) Results of Periodic Examinations - The employer shall obtain a physician's written opinion based on the medical examination pursuant to paragraph (k)(5).
- (7) Exclusion or Removal from Exposure - No employee shall continue to be exposed to Stoddard solvent if such exposure could place the employee at increased risk of material impairment of his health.
- (8) Emergency Procedures - The employer shall provide emergency and follow-up medical examinations and treatment for any employee injured through exposure to Stoddard solvent.
- (9) Informing the Physician - The employer shall provide to the examining physician the following information:
 - (i) A copy of this section with its Appendices A, B, and C;
 - (ii) A description of the employee's duties as they relate to his exposure to Stoddard solvent;
 - (iii) A description of any personal protective equipment, including respirators, required to be used;
 - (iv) The results of any employee's exposure measurement, if available;
 - (v) The employee's anticipated exposure level; and
 - (vi) Upon request of the physician, information from previous medical examination of the employee.
- (10) Physician's Written Opinion
 - (i) The physician's written opinion shall be a signed statement by the examining physician specifically stating:

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- (A) Whether the employee has any detected medical conditions which could be directly or indirectly aggravated by exposure to Stoddard solvent or which could significantly interfere with the ability of the employee to follow recommended or required procedures for protecting himself from unusual or emergency exposure.
- (B) Any recommended limitations upon the employee's exposure to Stoddard solvent.
- (C) The employee has been informed by the physician of any detected medical conditions which require further medical examination or treatment.
- (ii) The written opinion shall not reveal medical information unrelated to exposure to Stoddard solvent.
- (11) Refusal to be Medically Examined - If an employee refuses any required medical examination, the employer shall inform the employee of the possible health consequences of such refusal and obtain a signed statement from the employee indicating that the employee understands the risks involved by refusing to be examined.
- (1) Recordkeeping.
 - (1) Initial determination.
 - (i) The employer shall keep an accurate record of all initial determinations required to be made pursuant to paragraph (c)(1) of this section.
 - (ii) The record shall include the written determination and any supporting documentation as required in paragraph (c)(1) of this section.
 - (iii) This record shall be maintained until replaced by a more recent record.
 - (2) Exposure measurements.
 - (i) The employer shall keep an accurate record of all measurements taken to determine employee exposure to stoddard solvent.
 - (ii) This record shall include:
 - (a) The date of measurement;
 - (b) A reference to the subparagraph of this regulation which required the measurement, if any;
 - (c) Operations involving exposure to stoddard solvent which are being monitored;
 - (d) Sampling and analytical methods used and evidence of their accuracy;
 - (e) Number, duration, and results of samples taken;
 - (f) Name, Social Security number, and exposure of the employee monitored.
 - (iii) This record shall be maintained until replaced by a more recent record but in no event for less than one year.
 - (3) Mechanical ventilation.
 - (i) When mechanical ventilation is used as an engineering control, the employer shall maintain a record of measurements demonstrating the effectiveness of such ventilation as required by paragraph (e)(1)(i) of this section.
 - (ii) This record shall include:
 - (a) Date of measurement;

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- (b) Type of measurement taken;
 - (c) Result of measurement.
- (iii) This record shall be maintained for at least one year.
- (4) Training and information.
 - (i) The employer shall keep an accurate record of all employee training and advice required by paragraph (j) of this section.
 - (ii) The record shall include:
 - (a) Date of training;
 - (b) Name and Social Security number of employees trained;
 - (c) Substance of training provided.
 - (iii) This record shall be maintained until replaced by a more recent record.
- (5) Medical records.
 - (i) The employer shall keep an accurate medical record for each employee.
 - (ii) The record shall include:
 - (a) Physician's written opinion;
 - (b) Preplacement questionnaire;
 - (c) Any employee medical complaints relative to exposure to stoddard solvent;
 - (d) A signed statement of any refusal to be examined;
 - (e) A copy of information provided to the physician pursuant to paragraph (k)(9)(ii) through (vi) of this section.
 - (iii) This record shall be maintained for the duration of the employment of the affected employee.
- (6) Access to records.
 - (i) All records required to be maintained by this section shall be made available upon request to authorized representatives of the Assistant Secretary and the Director.
 - (ii) Employee exposure measurement records required to be maintained by this section shall be made available to employees and former employees and their designated representatives.
 - (iii) Employee medical records required to be maintained by this section shall be made available upon written request to a physician designated by the employee or former employee.
- (m) Observation of monitoring.
 - (1) Duty.

The employer shall give affected employees or their representatives an opportunity to observe any monitoring of employee exposure to stoddard solvent which is conducted pursuant to this section.
 - (2) Exercise of opportunity to observe monitoring.
 - (i) When observation of the monitoring of employee exposure to stoddard solvent requires entry into an area where the use of personal protective devices is required, the observer shall use such equipment and comply with all other applicable safety procedures.
 - (ii) Without interfering with the measurement, observers shall be entitled to:
 - (a) Receive an explanation of the measurement procedures;

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(b) Visually observe all steps related to the measurement of exposure to stoddard solvent that are being performed at the place of exposure.

(c) Record the results obtained.

(n) Employee notification.

(1) The employer shall notify in writing, within five work days, every employee who is found to be exposed to stoddard solvent above the permissible exposure. The employee shall also be notified of the level of his exposure and the corrective action being taken to reduce the exposure to at or below the permissible exposure.

(2) Pursuant to paragraph (k) of this Section, when an employee is medically examined the employer shall provide the employee with a copy of the physician's written opinion.

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APPENDIX A

SUBSTANCE SAFETY DATA SHEET

I. SUBSTANCE IDENTIFICATION

SUBSTANCE: Stoddard solvent

PERMISSIBLE EXPOSURE: 500 parts of Stoddard solvent per million parts of air (ppm) or 2950 milligrams of Stoddard solvent per cubic meter of air (mg/cu m)

APPEARANCE AND ODOR: Colorless liquid with a kerosene-like odor.

II. HEALTH HAZARD DATA

A. Ways in Which the Chemical Affects Your Body: Stoddard solvent can affect your body if you inhale it or if it comes in contact with your eyes or skin or if you swallow it.

B. Effects of Overexposure:

1. Short-Term Overexposure: 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 Overexposure: Prolonged overexposure to the liquid may cause skin irritation.

3. Reporting Signs and Symptoms: You should inform your employer if you develop any signs or symptoms associated with Stoddard solvent exposure.

III. EMERGENCY FIRST AID PROCEDURES

A. Eye Exposure: If Stoddard solvent gets into your eyes, wash the 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.

B. Skin Exposure: If Stoddard solvent gets on your skin, promptly wash the contaminated skin using soap or mild detergent. If Stoddard solvent soaks through your clothing, remove the clothing immediately and wash the skin using soap or mild detergent. If irritation persists after washing, get medical attention. Do not wear the clothing again until the Stoddard solvent has been removed. Replace or repair impervious clothing that has developed leaks.

C. Breathing: If you or any other person breathes in large amounts of Stoddard solvent remove the exposed person to fresh air at once. If

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breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.

- D. Swallowing: If Stoddard solvent has been swallowed, do not cause vomiting. Get medical attention immediately.
- E. Rescue: Move 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 yourself. Understand your emergency rescue procedures and know the locations of the equipment before the need arises.

IV. RESPIRATORS AND PROTECTIVE CLOTHING

- A. RESPIRATORS: Respirators are not the best way to control exposure to stoddard solvent. You can only be required to wear them for routine use if your employer is in the process of installing controls or if control measures prove inadequate. You may be required to wear respirators for non-routine activities or in emergencies. If respirators are worn, they must have a Mining Enforcement and Safety Administration (MESA)/National Institute for Occupational Safety and Health (NIOSH) approval label. (Older respirators may have a Bureau of Mines approval label.) For effective protection, respirators must fit your face and head snugly. Respirators should not be loosened or removed in work situations where their use is required. If you can smell stoddard solvent while wearing a respirator, the respirator is not working correctly; go immediately to fresh air. If you experience difficulty breathing while wearing a respirator, tell your employer.
- B. PROTECTIVE CLOTHING: You must wear impervious clothing, gloves, face shield or other appropriate protective clothing to prevent repeated or prolonged skin contact with liquid Stoddard solvent.
- C. EYE PROTECTION: You must wear splash-proof safety goggles (cup-cover type dust and splash safety goggles) where eye contact to liquid Stoddard solvent may occur.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

- A. Stoddard solvent is a combustible liquid and its vapors can form explosive mixtures with air at elevated temperatures.
- B. Stoddard solvent must be stored in tightly closed containers in a cool, well ventilated area away from heat, sparks, flames and strong oxidizers.
- C. Sources of ignition such as smoking and open flames are prohibited wherever Stoddard solvent is handled, used or stored in a manner that could create a potential fire or explosion hazard.
- D. You must use non-sparking tools when opening or closing metal containers of Stoddard solvent, and containers must be bonded and grounded when pouring or transferring liquid Stoddard solvent.
- E. You must promptly remove any non-impervious clothing that becomes wet with liquid Stoddard solvent and this clothing must not be reworn until the Stoddard solvent is removed from the clothing.

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- F. If your skin becomes wet with liquid Stoddard solvent, you must promptly wash or shower using soap or mild detergent to remove the Stoddard solvent from your skin.
- G. Fire extinguishers, where provided, must be readily available and you should know where they are and how to operate them.
- H. Ask your supervisor where Stoddard solvent is used in your work area and for any additional plant safety and health rules.

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APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES
STODDARD SOLVENT

- I. PHYSICAL AND CHEMICAL DATA
- A. Substance Identification
1. Synonyms: dry cleaning safety solvent; mineral spirits
 2. Formula: C_9H_{20} (approximately 15 per cent aromatic hydrocarbons)
 3. Molecular weight: 144 (approximately)
- B. Physical Data
1. Boiling point (760 mm Hg): 150 - 200 C (302 - 392 F)
 2. Specific gravity (water=1): 0.78
 3. Vapor density (air=1 at boiling point of Stoddard solvent): 5
 4. Melting point: data not available
 5. Vapor pressure at 20 C (68 F): 2 mm Hg (estimate)
 6. Solubility in water, % by weight at 20 C (68 F): insoluble
 7. Evaporation rate (butyl acetate=1): less than 1
 8. Appearance and odor: Colorless liquid with a kerosene-like odor
- II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA
- A. Fire
1. Flash point: 38.7 - 60 C (102 - 140 F) (closed cup)
 2. Autoignition temperature: 226 - 260 C (440 - 500 F)
 3. Flammable limits in air, % by volume: Lower: 0.8
 4. Extinguishing media: Carbon dioxide, dry chemical, foam
 5. Special fire-fighting procedures: Do not use a solid stream of water since a stream will scatter and spread the fire. Use water spray to cool containers exposed to a fire.
 6. Unusual fire and explosion hazards: Stoddard solvent is a combustible liquid. At elevated temperatures its vapors can form explosive mixtures with air. All ignition sources must be controlled where Stoddard solvent is used, handled or stored. Stoddard solvent vapors are heavier than air and may travel along the ground and be ignited by sparks or open flames at locations remote from the site at which Stoddard solvent is handled.
 7. For purposes of complying with the requirements of 29 CFR 1910.106, Stoddard solvent is classified as a Class II combustible liquid. At 2000 ppm, one-fourth of the lower flammable limit, Stoddard solvent is considered to be a potential fire and explosion hazard.
 8. For purposes of complying with 29 CFR 1910.309, the classification of hazardous locations as described in Article 500 of the National Electrical Code for Stoddard solvent shall be Class I Group D.
- B. Reactivity

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1. Conditions contributing to instability: Heat
2. Incompatibilities: Contact with strong oxidizing agents may cause fire 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

III. SPILL, LEAK AND DISPOSAL PROCEDURES

- A. 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. Remove to a safe place (such as a fume hood) and burn the paper. Large quantities can be collected and atomized in a suitable combustion chamber. Stoddard solvent may not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.
- B. Persons not wearing protective equipment should be restricted from areas of spills or leaks until cleanup has been completed.
- C. 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 sanitary landfill.
 2. By atomizing in a suitable combustion chamber.

IV. MONITORING AND MEASUREMENT PROCEDURES

- a. EXPOSURE ABOVE THE ACTION LEVEL: Measurements taken for the purpose of determining employee exposure under this section are best taken such that the average eight-hour exposure may be determined from a single eight-hour sample or two (2) 4-hour samples. Short term interval samples (up to 30 minutes) may also be used to determine average exposure level if a minimum of five (5) measurements are taken in a random manner over the eight-hour work shift. Random sampling means that any portion of the work shift has the same chance of being sampled as any other. The arithmetic average of all such random equal duration samples taken on one (1) work shift is an estimate of an employee's average level of exposure for that work shift. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee). Sampling and analyses may be performed by instruments such as detector tubes certified by NIOSH under 42 CFR Part 84, portable direct-reading instruments, gas and vapor adsorption tubes with subsequent chemical analyses or dosimeters. The method of measurement must determine the concentration of stoddard solvent to plus or minus 35%.
- b. EXPOSURE ABOVE THE PERMISSIBLE EXPOSURE: The monitoring under this section should be essentially the same as described under paragraph IV. a. Laboratories performing chemical analyses should be accredited in Industrial Hygiene Chemistry by the American Industrial Hygiene Association (AIHA). The method of measurement

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must determine the concentration of stoddard solvent to plus or minus 25%. Methods meeting these accuracy requirements are available from NIOSH.

V. MISCELLANEOUS PRECAUTIONS

- A. Store Stoddard solvent in tightly closed containers in a cool, well-ventilated area.
- B. High exposures to Stoddard solvent can occur when transferring the liquid from one container to another.
- C. Non-sparking tools must be used to open and close metal Stoddard solvent containers. These containers must be effectively grounded and bonded prior to pouring.
- D. Employers must advise employees of all plant areas and operations where exposure to Stoddard solvent could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to Stoddard solvent is likely to occur are: during its production; during its use as a solvent in dry cleaning, waterproofing cloth, degreasing metals, applying yarn size, in the manufacture and use of inks, stains, paints and varnishes, pesticides, waxes, resins and coatings.

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APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation.

II. TOXICOLOGY

Stoddard solvent vapor is a mild narcotic and a mucous membrane irritant. Since Stoddard solvent 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. Little is available on either animal or human exposures to Stoddard solvent, although observations on men exposed to the vapor of unleaded gasoline, a chemically similar but much more volatile mixture of hydrocarbons, showed itching and burning of the eyes at 500 ppm for one hour, irritation of the nose and throat at 900 ppm, and dizziness at 2,600 ppm. Prolonged skin exposure to Stoddard solvent results in drying and cracking due to defatting action.

III. SIGNS AND SYMPTOMS

Irritation of the eyes, nose and throat; dizziness, dermatitis from prolonged skin exposure; may produce dizziness.

IV. SPECIAL TESTS

None in common usage.

V. TREATMENT

Remove from exposure. Flush eyes with water and wash skin with soap and water. If swallowed, do not induce vomiting. Give artificial resuscitation if indicated. Recovery is usually rapid and complete.

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. GENERAL

Most reported effects of Stoddard solvent are caused by its narcotic and irritant properties. It is important that the physician becomes familiar with plant operating conditions in which exposure to Stoddard solvent occurs. Those with skin disease may not tolerate the wearing of protective clothing and those with chronic respiratory disease may not tolerate the wearing of negative pressure respirators.

B. PREPLACEMENT

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Routine medical histories and physical examination are not required. However, the employer must screen employees for history of certain medical conditions (listed below) which might place the employee at increased risk from Stoddard solvent exposure. Only those giving a positive history of these conditions must be referred for further medical examinations.

1. Skin disease -- Stoddard solvent is a defatting agent and can cause dermatitis on prolonged exposure. Persons with preexisting skin disorders may be more susceptible to the effects of this agent.
2. Liver disease -- Although Stoddard solvent is not known as a liver toxin in humans, the importance of this organ in the biotransformation and detoxification of foreign substances should be considered before exposing persons with impaired liver function.
3. Kidney disease -- Although Stoddard solvent is not known as a kidney toxin in humans, the importance of this organ in the elimination of toxic substances justifies special consideration in those with impaired renal function.
4. Chronic respiratory disease -- 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.

C. PERIODIC EXAMINATIONS

Routine periodic examinations are not required. However, if the employer becomes aware of an employee with the above listed conditions, he must refer such employee for further medical examination.

References

1. American Conference of Governmental Industrial Hygienists: "Stoddard Solvent," (3d ed., 2d printing), Documentation of the Threshold Limit Values for Substances in Workroom Air, Cincinnati, 1974, pp. 233-235.

2. Patty, Frank A.: Industrial Hygiene and Toxicology, Vol. II - Toxicology (2d ed. revised), Interscience Publishing Company, New York, 1963, pp. 1195-1201.

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

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REFERENCES AND SOURCES
STODDARD SOLVENT

1910.93

- (d) Methods of Compliance - Open surface tank classification based on boiling point of 320 F (lower end of boiling range) and guidelines found in ANSI Z9.1 - 1971, "Practices for Ventilation and Operation of Open Surface Tanks," p. 19.
- (e) Fire and Safety
 - (1) Electrical - Classification based on "Fire Hazard Classification of Chemical Vapors Relative to Explosion-proof Electrical Equipment," H. Carhart et al., National Academy of Sciences, 1973, report to U. S. Coast Guard, report no. CG-D-92-74, p. 26
- (f) Personal Protective Equipment, and, (h) Sanitation
 - General: Documentation in Support of TLV; and Patty, "Ind. Hyg. and Tox."
 - Eye: Grant, "Toxicology of the Eye"
 - Skin: Patty, "Ind. Hyg. and Tox."; and Sax, "Dangerous Properties of Ind. Materials"
 - Ingestion: Sax, "Dangerous Properties of Ind. Materials"

COMMENTS

General: The Documentation in Support of TLV's states that Stoddard solvent is a petroleum fraction which for toxicological purposes can be considered to be a mixture of 85 percent nonane and isodecane and 15 percent trimethyl benzene. However, it is noted that the trimethyl benzenes in actuality only make up 25 - 40 percent of the 15 percent of the mixture which contains aromatic hydrocarbons. It is also stated that this fraction has a flash point of 102 - 110 deg. F and a boiling range of 150 - 200 deg. C. Patty says that "pharmacologically and toxicologically, these mixtures are qualitatively comparable with heptanes and octanes." Given the above and the fact that the flash point of benzene is 12 deg. F and its boiling point is 80.1 deg. C, benzene would not be expected to be a major contaminant.

Eye - Classification: 2

Output statement numbers: 10

Exceptions: None

Grant reports in general for mixtures of hydrocarbons that various liquid hydrocarbons of petroleum cause little or no injury on direct external contact with the eye. In particular, kerosene Deo-base, Stoddard solvent, and petroleum oil on rabbit and human corneas are essentially innocuous. Liquid petrolatum and purified deodorized kerosene such as used for insecticide solvent can be applied to human eyes without causing discomfort or signs of irritation.

"More volatile derivatives, high-test gasoline in particular cause smarting and pain on splash contact with the eye, but only slight transient corneal epithelial disturbance." He adds that butane injected into the anterior chamber of rabbits as a gas caused no disturbance.

For solvents, Grant states "A splash of a chemically inert solvent usually causes immediate stinging and smarting pain, and

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may cause loss of some or all of the corneal epithelium, particularly if it is a good fat solvent, but as a general rule it does not damage the corneal stroma underlying the epithelium. Even if all the epithelium is lost from the cornea as a result of splash of ordinary organic solvents, it generally regenerates in a few days without residual permanent damage. While the epithelium is missing, the stroma may be slightly swollen and the posterior surface of the eye may appear wrinkled."

A classification of 2 is concluded appropriate to prevent the possible effects cited.

Skin - Classification: 2

Output statement numbers: 2, 7b, 16g, 16i, 20a

Exceptions: None

Patty and numerous other sources agree that the ingredients of this material are fat solvents and that repeated or prolonged contact will dry and defat the skin resulting in irritation and dermatitis. Sax agrees. There is no indication in the literature that any of the ingredients would be readily absorbed through the skin.

Stoddard solvent has a vapor pressure of about 2 mm Hg at 20 degrees C. It has a flash point between 102-140 degrees F and is insoluble in water.

A classification of 2 is concluded to be appropriate. However, because of the probable innocuous effects of infrequent contact with small amounts, statements numbered 16 are used instead of those numbered 17 and statement 20a is not used.

Ingestion - Classification: 0

Output statement numbers: None

Exceptions: None

Since benzene is unlikely to be a contaminant of this material, Stoddard solvent is given a hazard classification of 0. Sax lists the acute local effects of ingestion to be of moderate toxic hazard. The acute systemic toxic hazard considered only to be slight.

SUBSTANCE TECHNICAL GUIDELINES
STODDARD SOLVENT

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification

1. Synonyms: dry cleaning safety solvent; mineral spirits
2. Formula: C_9H_{20} (approximately 15 per cent aromatic hydrocarbons)
3. Molecular weight: 144 (approximately)

B. Physical Data

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

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8. Appearance and odor: Colorless liquid with a kerosene-like odor
II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point: 38.7 - 60 C (102 - 140 F) (closed cup)
2. Autoignition temperature: 226 - 260 C (440 - 500 F)
3. Flammable limits in air, % by volume: Lower: 0.8
4. Extinguishing media: Carbon dioxide, dry chemical, foam
5. Special fire-fighting procedures: Do not use a solid stream of water since a stream will scatter and spread the fire. Use water spray to cool containers exposed to a fire.
6. Unusual fire and explosion hazards: Stoddard solvent is a combustible liquid. At elevated temperatures its vapors can form explosive mixtures with air. All ignition sources must be controlled where Stoddard solvent is used, handled or stored in a manner that could create a potential fire or explosion hazard. Stoddard solvent vapors are heavier than air and may travel along the ground and be ignited by sparks or open flames at locations remote from the site at which Stoddard solvent is handled.
7. For purposes of complying with the requirements of 29 CFR 1910.106, Stoddard solvent is classified as a Class II combustible liquid. For example, 2000 ppm, approximately one-fourth of the lower flammable limit, is one situation in which Stoddard solvent is considered to be a potential fire and explosion hazard.
8. For purposes of complying with 29 CFR 1910.309, the classification of hazardous locations as described in Article 500 of the National Electrical Code for Stoddard solvent shall be Class I Group D.

B. Reactivity

1. Conditions contributing to instability: Heat.
2. Incompatibilities: Contact with strong oxidizing agents may cause fire 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.

III. SPILL, LEAK AND DISPOSAL PROCEDURES

A. 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. Remove to a safe place (such as a fume hood) and burn the paper. Large quantities can be collected and atomized in a suitable combustion chamber. Stoddard solvent may not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

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- B. Persons not wearing protective equipment should be restricted from areas of spills or leaks until cleanup has been completed.
- C. 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.
- IV. MONITORING AND MEASUREMENT PROCEDURES
 - a. EXPOSURE ABOVE THE ACTION LEVEL: Measurements taken for the purpose of determining employee exposure under this section are best taken such that the average eight-hour exposure may be determined from a single eight-hour sample or two (2) 4-hour samples. Short term interval samples (up to 30 minutes) may also be used to determine average exposure level if a minimum of five (5) measurements are taken in a random manner over the eight-hour work shift. Random sampling means that any portion of the work shift has the same chance of being sampled as any other. The arithmetic average of all such random equal duration samples taken on one (1) work shift is an estimate of an employee's average level of exposure for that work shift. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee). Sampling and analyses may be performed by instruments such as detector tubes certified by NIOSH under 42 CFR Part 84, portable direct-reading instruments, gas and vapor adsorption tubes with subsequent chemical analyses or dosimeters. The method of measurement must determine the concentration of stoddard solvent to plus or minus 35%.
 - b. EXPOSURE ABOVE THE PERMISSIBLE EXPOSURE: The monitoring under this section should be essentially the same as described under paragraph IV.
 - a. Laboratories performing chemical analyses should be accredited in Industrial Hygiene Chemistry by the American Industrial Hygiene Association (AIHA). The method of measurement must determine the concentration of stoddard solvent to plus or minus 25%. Methods meeting these accuracy requirements are available from NIOSH.
- V. MISCELLANEOUS PRECAUTIONS
 - A. Store Stoddard solvent in tightly closed containers in a cool, well-ventilated area.
 - B. High exposures to Stoddard solvent can occur when transferring the liquid from one container to another.
 - C. Non-sparking tools must be used to open and close metal Stoddard solvent containers. These containers must be effectively grounded and bonded prior to pouring.
 - D. Employers should advise employees of all plant areas and operations where exposure to Stoddard solvent could occur.
- VI. COMMON OPERATIONS

Common operations in which exposure to Stoddard solvent is likely to occur are: During its production; during its use as a solvent in dry cleaning, waterproofing cloth, degreasing metals, applying yarn size, in the manufacture and use of inks, stains, paints and varnishes, pesticides, waxes, resins and coatings.

RESPIRATOR TABLE DOCUMENTATION

SUBSTANCE: Stoddard solvent

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D. O. L. STANDARD: 500 ppm

WARNING PROPERTIES:

Odor Threshold: Staub gives an odor threshold of 30 ppm for Stoddard solvent (mineral spirits). According to the preliminary draft of the AIHA Hygienic Guide for Stoddard solvent, "most Stoddard solvent have a petroleum odor that is perceptible (sic) at about 1 ppm."

Eye Irritation Level: Grant states that "the vapor of Stoddard solvent is perceptively irritating to human eyes at 400 ppm."

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 standard, therefore, Stoddard solvent is treated as a material with good warning properties. Gas sorbent respiratory equipment is permitted.

IDLH: 5000 ppm

Basis for IDLH Value: The chosen IDLH is based upon the report in the preliminary draft of the Hygienic Guide for Stoddard solvent that the atmospheric concentration immediately hazardous to life "is probably between 5000 - 10,000 when high temperature or other factors make these concentrations attainable Exposure to levels approaching 5000 ppm should be avoided."

Other Toxicological Information: The preliminary draft for Stoddard solvent like all petroleum distillates, is a central nervous system depressant. Symptoms include dizziness, headache, intoxication with euphoria leading to convulsions, and unconsciousness. It is not known what airborne levels are needed to cause unconsciousness. Nose and throat irritation may be the first sign of potentially hazardous inhalation exposure." Concerning the short exposure tolerance, the draft of the Hygienic Guide states that members of a 6 person panel "experience slight dizziness and olfactory fatigue (at 470 ppm for 15 minutes). Earlier human inhalation studies using gasoline showed similar results at about 500 ppm with intoxication and beginning of anesthesia upon breathing 2600 ppm for 1 hour. Gasoline concentrations of 10,000 ppm cause dizziness and drunkenness in about 5 minutes with unconsciousness and death likely in exposures much over 5 minutes. (The) atmospheric concentration immediately hazardous to life (is) unknown. Based on the human studies with gasoline cited above, it is probably between 5000 - 10,000 ppm when high temperature or other factors make these concentrations attainable. Animal studies show that 5000 ppm is an immediate threat to life for cats and dogs, but not for rats. Until the metabolism of Stoddard solvent in man is understood, exposure to levels approaching 5000 ppm should be avoided."

Patty notes that the toxicology of Stoddard solvent is qualitatively comparable to that of heptane.

LEL: 8000 ppm

VAPOR PRESSURE AT 20 C: 2 mm Hg

SATURATED CONCENTRATION AT 20 C: Approximately 2630 ppm

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USE/EXPOSURE AND CONTROL DOCUMENT
STODDARD SOLVENT

Use/Exposure	Principal Route of Entry	Currently Used Control Methods
1. Inhalation of vapor and skin contact with liquid during extensive use as a solvent in the dry cleaning industry, particularly during transfer of cleaned garments to the extractor, during solvent extraction, during spot cleaning, and in solvent recovery plants (sludge removal is particularly hazardous)	A,B	Local exhaust ventilation; good personal hygiene practices; personal protection equipment (gloves, goggles) for solvent recovery plants process enclosure and local exhaust ventilation
2. Inhalation of vapor and skin contact with liquid during use as a solvent in the paint and varnish industry, both in the manufacture and application of these products (enamels, interior paints, industrial stains and varnishes, undercoatings - for brushing, rolling, spraying)	A,B	General dilution ventilation; local exhaust ventilation; personal protective equipment (gloves, goggles); good personal hygiene; process enclosure (spray booths)
3. Inhalation of vapor and skin contact with liquid during use as a solvent for printing inks and in textile printing	A,B	General dilution ventilation; local exhaust ventilation; personal protective equipment (gloves, goggles)
4. Inhalation of vapor and skin contact with liquid during manufacture and use of aerosol sprays (used as solvent for paints, varnishes, insecticides)	A,B	General dilution ventilation; local exhaust ventilation; personal protective equipment (gloves, goggles)
5. Inhalation of vapor and skin contact with liquid during manufacture and use of sprays for pesticides, herbicides, household cleaners, silicone compounds (used as solvent)	A,B	General dilution ventilation; local exhaust ventilation; personal protective equipment (gloves, goggles)
6. Inhalation of vapor and skin contact with liquid	A,B	General dilution ventilation; local exhaust venti-

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during use as a solvent and thinner in protective coating materials (asphalts, rubber coatings, resins, waxes, lacquers, wood preservatives)

lation; personal protective equipment (gloves, goggles)

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|-----|--|-----|--|
| 7. | Inhalation of vapor and skin contact with liquid during use in metal cleaning, in metal degreasing, and in leather (hide) degreasing | A,B | Process enclosure; adequate exhaust ventilation; personal protective equipment (gloves, goggles); good personal hygiene practice |
| 8. | Inhalation of vapor and skin contact with liquid during use as a general solvent (in fabric waterproofing, processing of synthetic yarns, extraction of fats and oils, "tackifying" agent for rubber, in rubber cements, polishes) | A,B | Local exhaust ventilation; general dilution ventilation; good personal hygiene personal protective equipment (gloves, goggles) |
| 9. | Inhalation of vapor and skin contact with liquid during manufacture of Stoddard solvent at refineries (exposure at solvent processing units, in filling tank cars, drums and other containers) | A,B | Process enclosure; local exhaust ventilation; personal protective equipment (gloves, goggles) |
| 10. | Inhalation of vapor and skin contact with liquid during cleaning and maintaining of storage tanks | A,B | Local exhaust ventilation; personal protective equipment (gloves, respiratory protection devices) |
- A -- Inhalation
B -- Skin contact resulting in localized irritation
C -- Ingestion
D -- Skin contact resulting in absorption and subsequent systemic poisoning

----- JES2 JOB STATISTICS -----

1,313 CARDS READ

0 SYSOUT PRINT RECORDS

0 SYSOUT PUNCH RECORDS

0.00 MINUTES EXECUTION TIME

[illegible][illegible]