

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND
SUPPORTING DOCUMENTATION FOR

*** PICRIC ACID ***

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for PICRIC ACID

basic text of this document contains the draft technical standard
ed by the Joint Review Committee of the NIOSH/OSHA Standards
ation Program and the supporting documentation for the substance
C ACID.

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

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

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Definitions. (1) "Permissible exposure" means exposure of employees to airborne concentrations of picric acid not in excess of 0.1 milligram per cubic meter, (mg/M3) averaged over an eight-hour work shift (time weighted average), as stated in 29 CFR 1910.1000, Table Z-1.

"Action level" means one half of the permissible exposure for picric acid.

Exposure determination and measurement. (1) Each employer who has a duty of employment in which picric acid is released into the workplace air shall determine if any employee may be exposed to airborne concentrations of picric acid 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 picric acid.

A written record of the determination shall be made and shall contain at least the following information:

Any information, observations, or calculations which may indicate employee exposure to picric acid;

(2) Any measurements of picric acid taken;

(3) Any employee complaints of symptoms which may be attributable to exposure to picric acid; and

(4) Date of determination, work being performed at the time, location of work site, name, and social security number of each employee involved.

If the employer determines that any employee may be exposed to picric acid at or above the action level, the exposure of the employee in each operation who is believed to have the greatest exposure shall be measured. The exposure measurement shall be representative of the maximum eight-hour time weighted average exposure of the employee.

If the exposure measurement taken pursuant to paragraph (b) (3) of this section reveals employee exposure to picric acid at or above the action level, the employer shall:

Identify all employees who may be exposed at or above the action level; and

(2) Measure the exposure of the employees so identified.

If an employee exposure measurement reveals that an employee is exposed to picric acid 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.

If an employee exposure measurement reveals that an employee is exposed to picric acid above the permissible exposure, the employer shall:

Measure the exposure monthly of the employee so exposed; and

(3) Institute control measures as required by paragraph (d) of this section; and

(4) Individually notify, in writing, within five days, every employee found to be exposed to picric acid above the permissible exposure. Each employee shall also be notified of the corrective action being taken to reduce the exposure to at or below the permissible exposure.

If two consecutive employee exposure measurements taken at least one month apart reveal that the employee is exposed to picric acid below the action level, the employer may terminate measurement for the employee.

For purposes of this paragraph, employee exposure is that which would exist if the employee were not using a respirator.

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Methods of measurement. (1) An employee's exposure shall be obtained by a combination of long term or short term samples which represents the employee's actual exposure averaged over an eight-hour work shift (See Appendix B (IV) of this section).

The method of measurement shall have an accuracy, to a confidence of 95 percent, of not less than that given in Table 1.

Table 1

Measurement	Required Accuracy
At or above the permissible exposure	$\pm 25\%$
Below the permissible exposure	
Above the action level	$\pm 35\%$
Below the action level	$\pm 50\%$

Compliance. (1) No employee shall be exposed to picric acid above the permissible exposure as defined in paragraph (a)(1) of this section.

Employee exposures to airborne concentrations of picric acid shall be controlled to at or below the permissible exposure by engineering and work practice controls.

Engineering and work practice controls shall be instituted to reduce exposures to at or below the permissible exposure, except to the extent such controls are not technically feasible.

Wherever engineering and work practice controls are not sufficient to reduce exposures to at or below the permissible exposure, they shall nevertheless be used to reduce exposure to the lowest level feasible and be supplemented by respirators in accordance with paragraph (d)(4) of this section.

Engineering controls. When mechanical ventilation is used to control exposure, measurements which demonstrate system effectiveness, for example, air velocity, static pressure, or air volume, shall be made at least every three months. Measurements of system effectiveness shall also be made within five days of any change in production, process, or control which might result in an increase in airborne concentrations of picric acid.

Compliance with the permissible exposure shall not be achieved by the use of respirators except:

During the time period necessary to install or implement engineering and work practice controls; or

In work situations in which engineering and work practice controls are technically not feasible; or

(2) To supplement engineering and work practice controls when such controls fail to reduce airborne concentrations of picric acid to at or below the permissible exposure; or

For operations which require entry into tanks or closed vessels; or
In emergencies.

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Where respirators are needed and permitted under this paragraph to protect an employee from exposure, the employer shall select and provide the appropriate respirator from Table 2 and shall ensure that the employee uses the respirator provided. When an employee informs his employer that he is experiencing eye irritation from picric acid while wearing a respirator listed in Table 2, the employer shall provide and ensure that the employee uses an equivalent respirator with a full facepiece, helmet or hood.

TABLE 2 RESPIRATORY PROTECTION FOR PICRIC ACID

CONDITION	PERMISSIBLE RESPIRATORY PROTECTION
particulate concentration 1/1000 or less	Any dust and mist respirator except single-use.
1/100 or less	Any dust and mist respirator, except single-use respirator or quarter-mask. Any fume respirator or high efficiency particulate filter respirator. Any supplied-air respirator. Any self-contained breathing apparatus.
1/100 or less	A high efficiency particulate filter respirator with a full facepiece. Any supplied-air respirator with a full facepiece, helmet or hood. Any self-contained breathing apparatus with a full facepiece.
1/100 or less	A powered air-purifying respirator with a full facepiece and a high efficiency particulate filter. A Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure mode or with a full facepiece, helmet or hood operated in continuous-flow mode.
greater than 1/1000 or less and from 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

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operated in pressure-demand or other positive pressure mode.

Fighting

Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.

Any dust and mist respirator, except single use.

Any escape self-contained breathing apparatus.

Respirators shall be approved by the Mining Enforcement and Safety Administration (formerly Bureau of Mines) or by the National Institute for Occupational Safety and Health under the provisions of 30 CFR Part 11.

The employer shall institute a respiratory protection program in accordance with § 1910.134(b), (d), (e), and (f).

Fire and safety. (1) The employer shall familiarize himself with information contained in the Substance Technical Guidelines (Appendix B of this section) for picric acid.

For the purpose of compliance with § 1910.109, picric acid shall be classified as a Class A explosive.

Sources of ignition such as smoking or open flames are prohibited when picric acid is handled, used, or stored.

Picric acid shall be stored so as not to come in contact with water, concrete and metals such as copper, zinc, lead and their salts and

Personal protective equipment. (1) Employers shall provide and ensure that employees use appropriate protective clothing and equipment necessary to prevent skin contact with solid picric acid or liquids containing picric acid where skin contact may occur. Face shields shall comply with § 1910.133(a)(2), (a)(4), (a)(5), and (a)(6).

Employers shall ensure that employees whose clothing may have become contaminated with picric acid change into uncontaminated clothing before leaving the work premises.

Employers shall ensure that clothing which may have become contaminated with picric acid is placed in closed containers for storage until it can be discarded or until the employer provides for the removal of picric acid from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the picric acid, the employer shall inform the person performing the operation of the hazardous properties of picric acid.

Employers shall ensure that non-impervious clothing which becomes contaminated with picric acid be removed promptly and not reworn until the picric acid is removed from the clothing.

Employers shall provide and ensure that employees use safety goggles which comply with § 1910.133(a)(2)-(a)(6) where solid picric acid or liquids containing picric acid may contact the eyes.

Spills and disposal. In the event that picric acid is spilled the employer shall immediately eliminate potential sources of ignition, provide adequate ventilation, and then clean up the spill.

Sanitation. (1) Employers shall ensure that all employees avoid skin contact with solid picric acid or liquids containing picric

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wash any areas of the body which may have contacted picric acid at the end of each work day.

Employers shall ensure that employees whose skin becomes contaminated with picric acid promptly wash or shower with soap or mild detergent and water to remove any picric acid from the skin.

Employers shall ensure that employees do not eat or smoke in areas where solid picric acid or liquids containing picric acid are handled, used or stored.

Employers shall ensure that employees who handle solid picric acid or liquids containing picric acid wash their hands thoroughly with soap or detergent and water before eating, smoking or using toilet facilities.

Training and information. (1) Each employer who has a workplace in which picric acid is present shall keep a copy of this regulation with Appendices A, B and C at the workplace. This material shall be made readily available to affected employees.

Each employer who has employees exposed to picric acid above the action level without regard to the use of respirators, or employees who may have skin or eye contact with picric acid or liquids containing picric acid, or employees who work where picric acid presents a fire or explosion hazard, shall annually:

1. Inform affected employees of the information contained in the Material Safety Data Sheet for picric acid (Appendix A of this section);

2. Advise affected employees as to the signs and symptoms of exposure to picric acid.

3. Instruct affected employees to advise the employer of the development of signs and symptoms of overexposure to picric acid which are listed in Appendix A of the section;

4. Provide training to ensure that employees understand the conditions of safe use, emergency procedures, and the correct use of protective equipment relative to picric acid.

Medical surveillance. (1) The employer shall provide procedures as required by this paragraph. All medical procedures shall be performed by or under the supervision of a physician at no cost to the employee.

Preplacement medical examinations. The employer shall make available to each employee who is exposed, or will be exposed, to picric acid or liquids containing picric acid or airborne concentrations of picric acid at or above the action level, without regard to the use of respirators, a preplacement medical examination which must include the following:

1. A medical history and physical examination with emphasis on the head, eyes, blood, liver and skin;

2. Urinalysis to include at least specific gravity, albumin, glucose and microscopic on centrifuged sediment;

3. A profile of liver function.

Periodic medical examination. The employer shall make available to each employee exposed to picric acid or liquids containing picric acid or airborne concentrations of picric acid at or above the action level, without regard to the use of respirators, twelve months from the date of the employee's first exposure, and every twelve months thereafter, a periodic medical examination which must include the following:

1. A medical history and physical examination with emphasis on the head, eyes, blood, liver and skin;

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Urinalysis to include at least specific gravity, albumin, glucose
microscopic on centrifuged sediment;

i) A profile of liver function.

Alternative medical procedures. If the examining physician chooses
an alternative medical specified in paragraphs (j)(2) and (j)(3) of
this section, the employer may accept such alternative medical procedures
meeting the requirements of this section provided that the employer:

Obtains a statement from the examining physician setting forth the
alternative medical procedures, the rationale for substitution, and
evidence that they will be equally effective;

Informs each exposed worker of the fact that alternative medical
procedures to those required in paragraphs (j)(2) and (j)(3) of this
section are to be made available.

Interim medical examination. The employer shall provide an interim
medical examination for the employee if the employee informs the employer
of the signs or symptoms of exposure to picric acid which are listed in
Appendix A which the employee suspects are caused by exposure to picric
acid.

Informing the physician. The employer shall provide to the physician
conducting any medical examination required by this section the following
information:

A copy of this regulation with Appendixes A, B, and C for picric
acid.

A description of the affected employee's duties as they relate to
exposure to picric acid;

A description of any personal protective equipment and respirators
required to be used;

The results of any measurements which may indicate the affected
employee's exposure;

The affected employee's anticipated exposure level; and

Upon request of the physician, any available information from
previous medical examinations of the affected employee.

Where a medical examination is required by paragraphs (j)(2), (j)(3),
(j)(5) of this section, following such examination the employer shall
obtain from the examining physician a written opinion which conforms with
paragraph (j)(8) of this section.

Physician's written opinion. i) the physician's written opinion by
the examining physician shall specifically state:

Whether the employee has any detected medical condition which would
place the employee at increased risk of material impairment of the
employee's health from exposure to picric acid;

Any recommended limitations upon the employee's exposure to picric
acid, including limitations upon the use of personal protective equipment
and respirators;

That the employee has been informed by the physician of any detected
medical conditions which require further medical examination or treatment.

The physician's written opinion shall not reveal specific medical
findings or diagnoses unrelated to the employee's employment.

The employer shall provide the employee with a copy of the
physician's written opinion.

Results of tests. Where a preplacement or periodic medical
examination is required by paragraphs (j)(2) or (j)(3) of this section,

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When such examination the employer shall obtain from the examining physician for inclusion in the employee's medical record:

A recording of the liver function tests and urinalysis;

Where alternative medical procedures have been performed in accordance with paragraph (j)(4) of this section, a recording of such alternative procedures.

No employee shall be exposed to picric acid in such a way as would place the employee at increased risk of material impairment of his health from such exposure. The employer shall base this decision on any information available, including the physician's written opinion.

No medical procedure which would be performed pursuant to paragraphs (j)(1) or (j)(3) of this section need be performed if records of a previous procedure performed within the past six months are acceptable to the examining physician.

If an employee refuses any required medical examination, the employer shall inform the employee of the possible health consequences of refusal and obtain a signed statement from the employee indicating that the employee understands the risk involved by refusal to be examined.

The employer shall provide emergency medical treatment for any employee injured through exposure to picric acid.

Recordkeeping. (1) Exposure determination. (i) The employer shall maintain an accurate record of all determinations required to be made pursuant to paragraph (b)(1) of this section.

This record shall include the written determination required in paragraph (b)(2) of this section.

This record shall be maintained until replaced by a more recent record.

Exposure measurements. (i) The employer shall keep an accurate record of all measurements taken to determine employee exposure to picric acid.

This record shall include:

The date of measurement;

Operations involving exposure to picric acid which are being monitored;

Sampling and analytical method used and evidence of their accuracy;

Number, duration, and results of samples taken; and

Name, social security number and exposure of the employee monitored.

This record shall be maintained until replaced by a more recent record but in no event for less than one year.

Mechanical ventilation. (i) When mechanical ventilation is used as an engineering control, the employer shall maintain an accurate record of measurements demonstrating the effectiveness of such ventilation required by paragraph (d)(3) of this section.

This record shall include:

Date of measurement;

Type of measurement taken;

Result of measurement.

These records shall be maintained for at least one year.

Employee training and information. (i) The employer shall keep an accurate record of all employee training and information required by paragraph (i) of this section.

This record shall include:

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Date of training;
Name and social security number of employee trained;
Content or scope of training provided.

(i) This record shall be maintained until replaced by a more recent one.

Medical surveillance. (i) The employer shall keep an accurate record of employee medical surveillance required by paragraph (j) of this section.

(i) This record shall include:

The name and social security number of the employee;
Results of tests required by paragraph (j)(2) and (j)(3) of this section and results of any tests conducted pursuant to paragraphs (j)(4) of this section;

Any employee medical complaints relative to exposure to picric acid;
A copy of information provided to the physician pursuant to paragraph (j)(ii), (j)(iii), (j)(iv), (j)(v), and (j)(vi) of this section.

Physician's written opinion; and

A signed statement of any refusal to be examined.

(i) This record shall be maintained for the duration of and for five years after termination of the employment of the affected employee.

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 of Labor for Occupational Safety and Health and the Director of the National Institute for Occupational Safety and Health.

(i) Each employee or former employee shall have access to the exposure measurement and exposure measurement records required to be maintained by this section which indicate his own exposure to picric acid.

(i) Employee medical records required to be maintained by this section shall be made available upon written request to a physician designated by the employer or former employee.

Employee observation of measurement. (1) The employer shall give each employee or his representative an opportunity to observe any measurement of exposure to picric acid which is conducted pursuant to this section.

When observation of measurement of employee exposure to picric acid requires entry into an area where the use of personal protective devices, including respirators, is required, the observer shall be provided with and trained to use such equipment and comply with all other applicable safety procedures.

Without interfering with the measurement, observers shall be entitled

to receive an explanation of the measurement procedure.

(i) Visually observe all steps related to the measurement of the airborne concentration of picric acid that are being performed at the place of exposure; and

(i) Record the results obtained.

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The information contained in the following appendix for picric acid is neither intended, by itself, to create any additional obligations nor otherwise imposed, nor detract from any existing obligation. To the extent the information supplements this regulation for picric acid, it is advisory in nature.

APPENDIX A

SUBSTANCE SAFETY DATA SHEET
FOR PICRIC ACID

SUBSTANCE IDENTIFICATION

- A. Substance: Picric acid
- B. Permissible Exposure: 0.1 milligram of picric acid per cubic meter of air (mg/M3) averaged over an eight-hour work shift.
- C. Appearance and Odor: Odorless yellow solid or paste

HEALTH HAZARD DATA

- A. Ways in which the chemical affects your body: Picric acid 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. Exposure to picric acid dust and fume may cause eye and skin irritation. The dust and solutions of picric acid may cause an allergic skin rash. The skin and hair may be stained yellow. Inhalation of high concentrations of dust have caused unconsciousness, weakness, muscle pain and kidney problems. Swallowing picric acid may cause a bitter taste, headache, dizziness, nausea, vomiting, and diarrhea. High doses may cause destruction of the red blood cells and damage to the kidneys and liver with blood in the urine. High doses such as this may color the skin and other tissues yellow and cause yellow tinted vision.
 - 2. Reporting Signs and Symptoms: You should inform your employer if you develop any signs or symptoms and suspect that they are caused by exposure to picric acid.

EMERGENCY FIRST AID PROCEDURES

- A. Eye Exposure: If picric acid or liquids containing picric acid get into your eyes, wash your eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. If irritation is present after washing, get medical attention immediately. Contact lenses should not be worn when working with this chemical.
- B. Skin Exposure: If picric acid or liquids containing picric acid get on your skin, promptly wash the contaminated skin using soap or mild detergent and water. If picric acid or liquids containing picric acid penetrate through your clothing, remove the clothing promptly and wash the skin

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using soap or mild detergent and water. If irritation persists after washing, get medical attention.

- C. Breathing: If you or any other person breathes in large amounts of picric acid 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.
- D. Swallowing: When picric acid or liquids containing picric acid have been swallowed and the person is conscious, give the person large quantities of water immediately. After the water has been swallowed, try to get the person to vomit by having him touch the back of his throat with his finger. Do not make an unconscious person vomit. 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 emergency rescue equipment before the need arises.

RESPIRATORS AND PROTECTIVE CLOTHING

- A. Respirators: Respirators are not the best way to control exposure to picric acid. You can only be required to wear them for routine use if your employer is in the process of installing controls or 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) or 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 there use is required. If you experience difficulty breathing while wearing a respirator, tell your employer.
- B. Protective Clothing: You must wear appropriate protective clothing and equipment to prevent skin contact with picric acid or liquids containing picric acid where skin contact may occur. Replace or repair impervious clothing that has developed leaks.
- C. Eye Protection: You must wear splash-proof safety goggles where liquids containing picric acid may contact your eyes. You must wear dust-resistant safety goggles where solid picric acid may contact your eyes.

PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

- A. Picric acid is an explosive and may detonate when heated.
- B. Picric acid must be stored in accordance with CFR 1910.109 away from heat, plaster, concrete, away from heat, plaster, concrete, metals such as copper, zinc, lead and their salts and bases.
- C. Sources of ignition such as smoking and open flames are prohibited wherever picric acid is handled, used or stored.

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- D. If your work clothing may have become contaminated with picric acid, you must change into uncontaminated clothing before leaving the work premises.
- E. You must promptly remove any non-impervious clothing that becomes contaminated with picric acid and this clothing must not be reworn until the picric acid is removed from the clothing.
- F. If your skin becomes contaminated with picric acid, you must promptly wash or shower with soap or mild detergent and water to remove the picric acid from your skin.
- G. If you are subject to skin contact with picric acid or liquids containing picric acid, at the end of each work day you must wash any areas of your body that may have contacted picric acid.
- H. You must not eat or smoke in areas where picric acid or liquids containing picric acid are handled, processed or stored.
- I. If you handle picric acid or liquids containing picric acid, you must wash your hands thoroughly with soap or mild detergent and water before eating, smoking or using toilet facilities.
- J. Fire extinguishers, where provided, must be readily available and you should know where they are and how to operate them.
- K. Ask your supervisor where picric acid is used in your work area and for any additional safety and health rules.

ACCESS TO INFORMATION

- A. Each year your employer is required to inform you of the information contained in this Substance Safety Data Sheet for picric acid. In addition, your employer must instruct you in the safe use of picric acid, emergency procedures, and the correct use of protective equipment.
- B. Your employer is required to determine whether you are being exposed to picric acid. You or your representative have the right to observe employee exposure measurements and to record the results obtained. If your employer determines that you are being overexposed, he is required to inform you of the exposure and the actions which are being taken to reduce your exposure.
- C. Your employer is required to keep records of your exposure and medical examinations. Your employer is required to keep exposure data for at least one year and to keep medical data during your employment, and for a period of five years following your termination of employment. Your employer is required to make the exposure data available to you upon your request. Your employer is also required to release your medical records to your physician upon your written request.
- D. Your employer must give you a copy of the physicians written opinion for any physical examination required by this standard.

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APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES
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PHYSICAL AND CHEMICAL DATA

A. Substance Identification

1. Synonyms: 2,4,6-Trinitrophenol; lyddite; pertite; shimose; melinite
2. Formula: $\text{HOC}_6\text{H}_2(\text{NO}_2)_3$
3. Molecular weight: 229.1

B. Physical Data

1. Boiling point (760 mm Hg): Greater than 300 C (572 F); explodes
2. Specific gravity (water = 1): 1.6 - 1.76
3. Vapor density (air = 1 at boiling point of picric acid): Not applicable
4. Melting point: 132 C (252 F)
5. Vapor pressure at 20 C (68 F): Much less than 1 mm Hg
6. Solubility in water, by weight at 20 C (68 F): 1.4
7. Evaporation rate (butyl acetate = 1): Not applicable
8. Appearance and odor: Odorless yellow solid or paste

FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point: 150 C (302 F) (closed cup)
2. Autoignition temperature: 300 C (572 F) (approx.)
3. Impact Sensitivity (Minimum fall of a 2 kg weight to cause at least one explosion in ten trials): 82 cm
4. Explosion Temperature: (Temperature required to cause explosion in five seconds): 322 C (612 F).
5. Flammable limits in air, % by volume: Not available
6. Extinguishing media: Water. Do not attempt to extinguish massive fires.
7. 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. Fires involving picric acid should be fought from an explosion-resistant location because of the possibility of detonation of picric acid. In advanced or massive fires, the area should be evacuated.
8. Unusual fire and explosion hazards: Picric acid is an explosive. Picric acid may be detonated when heated.

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All ignition sources must be controlled where picric acid is used, handled or stored.

9. For purposes of conforming with the requirements of 29 CFR 1910.109, picric acid is classified as a Class A explosive.

B. Reactivity

1. Conditions contributing to instability: Explodes above 300 C (572 F).
2. Incompatibilities: Contact with copper, lead, zinc and other metals (or with their salts) can form salts of picric acid that are initiators and much more sensitive to shock than picric acid itself. Shock-sensitive salts also include ammonium salts and calcium salts; the calcium salt may form when picric acid comes into contact with plaster or concrete.
3. Hazardous decomposition products: Toxic gases and vapors (such as oxides of nitrogen and carbon monoxide) may be released in a fire involving picric acid.
4. Special precautions: Protect from shock.

SPILL AND DISPOSAL PROCEDURES

- A. If picric acid is spilled, the following steps should be taken:

1. Remove all ignition sources.
2. Ventilate area of spill.
3. Attempt to reclaim spilled material; however, do not sweep or burn unless this is supervised by explosives experts.

- B. Persons not wearing protective equipment should be restricted from areas of spills until cleanup has been completed.

- C. Waste disposal methods: Picric acid may be disposed of only by explosives experts.

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 eight-hour exposure may be determined from a single eight-hour sample or 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 (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, dosimeters, or gas and vapor adsorption tubes with subsequent chemical analysis. The method of measurement must determine the concentration of picric acid to plus or minus 35%.

- B. EXPOSURE ABOVE THE PERMISSIBLE EXPOSURE: The monitoring and measurements under this section should be essentially the same as described above. More than three (3) measurements should be taken during the work shift so that increased confidence may be placed in the judgement that the employee has or has not, in fact, been exposed in excess of the

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permissible limit. Samples should be collected as described in paragraph IV. A. Laboratories performing chemical analyses should be accredited in Industrial Hygiene Chemistry by the American Industrial Hygiene Association. The method of measurement must determine the concentration of picric acid to plus or minus 25%.

C. METHODS: Methods meeting these accuracy requirements are available from the National Technical Information Service, U. S. Department of Commerce, Springfield, Virginia 22161 under the title "NIOSH Analytical Methods for Set 2" (Order number XXXXXXXXXX).

D. QUALIFIED PERSONS: Since many of the duties relating to employee protection are dependent on the results of monitoring and measuring procedures, employers should assure that the evaluation of employee exposures is performed by a competent industrial hygienist or other technically qualified person.

MISCELLANEOUS PRECAUTIONS

A. Store picric acid in accordance with CFR 1910.109.

B. Wherever possible, add water to at least a 10% level to decrease explosive property.

C. Do not allow picric acid to remain in contact with mortar or cement because of danger of forming shock-sensitive calcium salt.

D. Employers should advise employees of all areas and operations where their exposure to picric acid could occur.

COMMON OPERATIONS

Common operations in which exposure to picric acid is likely to occur are: During its production and its use; in pyrotechnics and (on a small scale) in organic chemistry synthesis (the major use as a military explosive ended about 50 years ago); during the manufacture of electric batteries, colored glass, leather, and medicinal products; and during its use in metal-etching, and dyeing and printing of textiles.

The information contained in the following appendix is neither intended, by itself, to create any additional obligations nor otherwise add to or detract from any existing obligations and to the extent the information supplements this regulation for picric acid, it is advisory in nature.

APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

ROUTE OF ENTRY

Inhalation; skin absorption.

TOXICOLOGY

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Picric acid dust causes sensitization dermatitis. This usually occurs on the face especially around the mouth and the sides of the nose; the condition progresses from edema, through the formation of papules and vesicles, to ultimate desquamation. The skin and hair of workers handling picric acid are stained yellow. Inhalation of high concentrations of the dust by 1 worker caused temporary coma followed by weakness, myalgia, anuria, and later polyuria. Following ingestion of 2.5 g of picric acid, which has a bitter taste, there may be headache, dizziness, nausea, vomiting, diarrhea, yellow coloration of the skin, hematuria, and albuminuria; high doses cause destruction of erythrocytes, hemorrhagic nephritis, and hepatitis. High doses which cause systemic intoxication will color all tissues yellow, including the conjunctiva and ocular humor, and cause apparent yellow tinted vision. Corneal injury is stated to have resulted from a splash of a solution of picric acid into the eyes; dust or fume may cause eye irritation which may be aggravated by sensitization.

SIGNS AND SYMPTOMS

Irritation; sensitization dermatitis, especially on the face and neck; yellow-stained hair and skin; weakness, myalgia, anuria, polyuria; ingestion causes bitter taste, gastroenteritis, hepatitis, hematuria, albuminuria, nephritis.

SPECIAL TESTS

None in common usage.

TREATMENT

Remove from exposure. Immediately flush eyes with water and wash skin with soap or mild detergent and water. If swallowed and the person is conscious, immediately administer water orally and induce vomiting. Give artificial resuscitation and administer oxygen if indicated.

SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

GENERAL

Most reported effects of picric acid are caused by its capability to produce sensitization dermatitis; systemic intoxication is rare. Skin absorption is known to occur. It is important that the physician become familiar with plant operating conditions in which exposure to picric acid 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.

PREPLACEMENT

The following medical procedures must be made available to each employee who is exposed to picric acid:

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1. A complete history and physical examination -- The purpose is to detect preexisting conditions that might place the exposed employee at increased risk, and to establish a baseline for future health monitoring. Persons with a history of asthma, allergies, or known sensitization to picric acid may be at increased risk from exposure. Examination of the kidneys, liver, and blood should be stressed. The skin should be examined for evidence of chronic disorders.
2. Urinalysis -- Since kidney damage has been observed in humans exposed to picric acid, a urinalysis shall be obtained to include at a minimum specific gravity, albumin, glucose and a microscopic on centrifuged sediment.
3. Liver function tests -- Since liver damage has been observed in humans exposed to picric acid, a profile of liver function shall be obtained by using a medically acceptable array of biochemical tests.

PERIODIC EXAMINATIONS

The above medical examinations are to be repeated on an annual basis.

REFERENCES

American Conference of Governmental Industrial Hygienists: "Picric Acid: Documentation of the Threshold Limit Values for Substances in Workplace Air (3d ed., 2d printing), Cincinnati, 1974, pp. 212-213.

Harris, A.H., et al: "Hematuria Due to Picric Acid Poisoning at a Shipyard in Japan," American Journal of Public Health, 66:727-733, 1976.

Schwartz, L.: "Dermatitis from Explosives," Journal of the American Medical Association, 125:186-190, 1944.

International Labour Office: Encyclopaedia of Occupational Health and Safety, Vol II, L-Z, McGraw Hill Book Company, New York, 1974, pp. 1068.

Grant, W. Morton: Toxicology of the Eye (2d ed.), Charles C. Thomas, Springfield, Illinois, 1974, pp. 832-833, 1191, 1194, 1196-1197, 1200.

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Sunderman, F.W., et al: "Studies of the Effects of Ammonium Picrate on Mice and Certain Experimental Animals," Journal of Industrial Hygiene and Toxicology, 27:241-248, 1945.

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REFERENCES AND SOURCES

PICRIC ACID

1910.1000

Personal Protective Equipment, and, (h) Sanitation

Eye: Grant, "Toxicology of the Eye;" International Labour Office;"
"Encyclopedia of Occupational Health and Safety"

Skin: American Conference of Governmental Industrial Hygienists,
"Documentation of the Threshold Limit Values for Substances
in Workroom Air;" Jacobs, "Poisoning;" International Labour
Office, "Encyclopedia of Occupational Health and Safety"

Ingestion: Grant, "Toxicology of the Eye;" Gleason, "Clinical
Toxicology of Commercial Products;" Deichmann and Gerarde,
"Toxicology of Drugs and Chemicals;" International Labour
Office, "Encyclopedia of Occupational Health and Safety"

COMMENTS

Eye - Classification: 2 and 6

Output statement numbers: 10 and 12 combined

Exceptions: None

According to Grant, "Picric acid dust . . . causes irritation of
the eyes of men and animals, and this may be aggravated by
sensitization. Corneal injury is said to have resulted from
accidental squirt of picric acid solution in the eye. Experi-
mentally, a solution of picric acid injected into the corneal
stroma of rabbit eyes has been found to be injurious even when
the solution is neutralized to the range of pH 7 to 9."

The ILO states, "the effects of picric acid on the eyes
include irritation, corneal injury and strange visual
effects, e.g. yellow appearance of objects, and yellow
colouring of the tissues."

None of the sources indicate that a splash in the eye
can cause irreversible effects. The substance is, therefore,
assigned classifications of 2 and 6.

Skin - Classification: 2 and 6

Output statement numbers: 2, 5b, 6 modified, 15, 17i, 17g, 20a

Exceptions: See below

The ACGIH report that "exposure in industry is by skin
contact . . . of the dust of picric acid or its salts.

Skin contact with the dry powder of picric acid . . . causes
sensitization dermatitis among workers exposed to it,
according to Schwartz. The face is usually involved, especially
around the mouth and sides of the nose. Edema, papules, vesicles,
and finally, desquamation develops."

According to Jacobs, "picric acid will stain the skin
and hair yellow and will cause dermatitis if permitted to
remain on the skin for some time. Cases of dermatitis have been
known to occur even from the use of medicinal ointments
containing trinitrophenol. Some of the symptoms exhibited
by picric acid poisoning are inflammation of the skin,
resembling dermatitis due to poison ivy, accompanied by
constitutional disturbances such as headache, loss of appetite,
nose bleed, and fever." Grant also notes that picric acid
has been known to cause "generalized allergic reactions of the

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skin" following contact with solutions of 0.5% to 3% as an antiseptic, but the ILO notes this occurs only when in contact with "hypersensitive skin."

According to the ILO, "in industry, . . . the main health problem has been the occurrence (sic) of skin disease, and systemic poisoning is rare. It causes sensitisation dermatitis similar to that produced by ammonium picrate. Workers handling picric acid or its salts have the skin and hair dyed a yellowish colour."

Picric acid has a vapor pressure at 20 degrees C of much less than 1 mm of Hg. Its flash point is 302 degrees F and has a melting point of 252 degrees F. Its solubility in water is 1.4%.

There is no doubt that skin contact with this compound results in dermatitis or allergic reactions. Classifications of 2 and 6 are concluded to provide sufficient protection, if statement 15 is specified and statements 5b and a modified 6 are used is modified to prevent skin contact where it may occur.

Ingestion - Classification: 1 and 5

Output statement numbers: 19, 20a

Exceptions: None

According to Grant, "ingestion . . . of picric acid is said to have induced strange visual effects. Experimental ingestion of 0.3 gm has been reported to cause objects to have a yellowish appearance, but not significantly to disturb the perception of other colors. The effect has been described as beginning in two minutes, reaching maximum at thirty minutes, and lasting not more than two hours."

Gleason reports "severe poisoning from ingestion of 1 to 2 gms. Severe gastroenteritis, intravascular hemolysis, hemorrhagic nephritis and sometimes hepatitis. Increased metabolism like dinitrophenol. Headache, progressive stupor, coma," and in severe cases of poisonings, death occurs. Deichmann and Gerarde also mention "kidney and liver injury."

The ILO says that following the ingestion of picric acid, symptoms of poisoning are "acute gastroenteritis, toxic hepatitis, nephritis, haematuria, and other urinary symptoms may occur. The skin and conjunctivae become yellow, mostly due to the acid but rarely due to jaundice. Death, if it follows, is due to renal lesions and anuria."

Classifications of 1 and 5 are concluded to be appropriate.

SUBSTANCE TECHNICAL GUIDELINES

References cited for this document include:

National Fire Protection Association, "Fire Protection Guide on Hazardous Materials," 5th edition, 1975 (NFPA)
Flinn Marietta Chemicals, Sodyeco Division, Technical Data Sheet and Material Safety Data Sheet (MM)
Lange's Handbook of Chemistry, 11th edition (Lange)
Mothmer, "Encyclopedia of Chemical Technology," 2nd edition, Vol. 8, p. 617 (K-O)
Baskin, A. D. - Handling Guide for Potentially Hazardous Commodities (Baskin)
Sources of data items used:

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- A.
 - 1. Synonyms: Lange, K-0
 - 2. Formula: NFPA-49
 - 3. Molecular weight: Lange
- B.
 - 1. Boiling point: MM, K-0
 - 2. Specific gravity: MM, K-0
 - 3. Vapor density: Not applicable
 - 4. Melting point: MM
 - 5. Vapor pressure: K-0
 - 6. Solubility in water: K-0
 - 7. Evaporation rate: Not applicable
 - 8. Appearance and odor: MM
- A.
 - 1. Flash point: MM
 - 2. Autoignition temperature: NFPA-49
 - 3. Flammable limits: Not available
 - 4. Extinguishing media: NFPA-49, MM
 - 5. Special fire fighting procedures: NFPA-49
 - 6. Unusual fire and explosion hazards: NFPA-49
- B.
 - 1. Conditions contributing to instability: MM
 - 2. Incompatibilities: NFPA-49, NFPA-491M
 - 3. Hazardous decomposition products: K-0
 - 4. Special precautions: K-0
- A. Steps if released or spilled: Paskin
- C. Waste disposal method: Paskin
- Miscellaneous precautions: NFPA-49, NFPA-491M, MM

USE/EXPOSURE AND CONTROL DOCUMENT

ences used in the preparation of this document include:

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- (Fairhall)
- , G. G., "The Condensed Chemical Dictionary," 8th edition, Van Nostrand,
- (Hawley)
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- ety," Geneva, 1972 (ILO)
- R. and Othmer, D., "Encyclopedia of Chemical Technology," Interscience
- ishers, Division of John Wiley, 1st edition, 1954 (Chem Tech);
- edition, 1972 (K-0)
- Index of Chemicals and Drugs," Merck and Co., Inc., Rahway, N. J.,
- edition, 1968 (Merck)
- c Acid," Material Safety Data Sheet, Martin Marietta Chemicals,
- eco Division, Charlotte, N. C., (Martin Marietta)
- tz, L., Tulipan, L. and Birmingham, D. J., "Occupational Diseases
- he Skin," Leo and Febiger, 1957 (Schwartz)

ences for Specific Use/Exposure

- Schwartz, Chem Tech
- ADL estimate
- ILO, Fairhall
- Hawley, Merck
- Fairhall, Hawley
- Hawley, ILO
- ILO, Chem Tech
- Chem Tech, Merck
- Fairhall, Merck, ILO
- Chem Tech, Merck

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Merck, ILO

ences for Specific Control Methods
and Martin Marietta were the only two references used in all the
specific Control Methods.

RESPIRATOR TABLE DOCUMENTATION

ANCE: Picric acid

L. STANDARD: 0.1 mg/M3

Irritation Level: The ILO states that "the effects of picric acid on the eyes include irritation, corneal injury and strange visual effects, e.g. yellow appearance of objects, and yellow colouring of the tissues." Grant also states that "picric acid dust or fumes cause irritation of the eyes of men and animals, and this may be aggravated by sensitization." No quantitative information is available concerning the air concentrations which produce these effects, however. Since information is not available concerning the threshold of eye irritation, half facepiece respirators are permitted at or below a concentration of 1 mg/m3. If eye irritation occurs, however, full facepiece respirators must be worn.

100 mg/M3

Is for IDLH Value: Since there are no acute inhalation toxicity data available upon which to base an IDLH concentration for picric acid, the chosen IDLH has been estimated from information concerning the oral toxicity of picric acid given in the Documentation of TLV's. According to the Documentation, "the ingestion of one or two grams in man causes severe poisoning."

r Toxicological Information: The Documentation of TLV's states that "picric acid (2,4,6-trinitrophenol) is toxic, and the ingestion of one or two grams in man causes severe poisoning. Exposure in industry is by skin contact or by inhalation of the dust of picric acid or its salts. The toxicology is of practical importance in the manufacture of munitions. Skin contact with the dry powder of picric acid or ammonium picrate powder causes sensitization dermatitis among workers exposed to it, according to Schwartz. The face is usually involved, especially around the mouth and sides of the nose. Edema, papules, vesicles, and finally, desquamation develops. The systemic poisoning following the absorption of picric acid causes symptoms of headache, vertigo, nausea, vomiting and diarrhea. Yellow coloration of the skin and conjunctiva may occur and there may be darkened or port wine-colored urine and albuminuria. Toxic doses cause destruction of the erythrocytes and produce gastroenteritis, hemorrhagic nephritis and acute hepatitis. So far as systemic poisoning from picric acid in industry is concerned, Perkins and Koelsch stated that this substance was not a severe industrial poison. Sunderman and associates made a study of the health hazards of exposure to ammonium picrate dust in a plant where 71 individuals were exposed at concentrations of 0.0088 to 0.1947 mg/M3. Dermatitis developed only among workers least exposed. This lends support to the opinion that desensitization or adaptation may occur following exposure similar to that occurring with tetryl.

"As is the case with other industrial skin poisons, it is difficult to set an arbitrary limit of permissible air exposure.

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Since the effects on the skin are marked in concentrations far below those associated with systemic poisoning resulting from administration by mouth, a threshold limit value of 0.1 mg/M3 is recommended."

The ILO states that "following ingestion of picric acid, which has an intense bitter taste, acute gastroenteritis, toxic hepatitis, nephritis, haematuria, and other urinary symptoms may occur. The skin and conjunctivae become yellow, mostly due to the acid but partly due to jaundice. Yellow vision may develop. Death, if it follows, is due to renal lesions and anuria. Rarely, jaundice and coma with convulsions precede death. Headache and vertigo with nausea and vomiting and skin rashes occur after absorption from the body surface."

PRESSURE AT 20 C: Much less than 1 mm Hg

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USE/EXPOSURE AND CONTROL DOCUMENT

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Use/Exposure	Principal Route of Entry	Currently Used Control Methods
Inhalation of dust and skin contact with dust during manufacture and handling of explosives in munitions manufacture (including ammonium picrate and use as a pressed charge for boosting and a bursting charge)	A,B,D	Material substitution; process enclosure; local exhaust ventilation; personal protective equipment (gloves, goggles, protective clothing, respiratory protective devices)
Inhalation of dust and skin contact with dust during synthesis and handling of substance	A,B,D	Material substitution; process enclosure; local exhaust ventilation; personal protective equipment (gloves, goggles, protective clothing, respiratory protective devices)
Inhalation of dust and skin contact with dust during synthesis of dyes and dye intermediates (including picramic acid and nigrosine and induline dyes)	A,B,D	Material substitution; process enclosure; local exhaust ventilation; personal protective equipment (gloves, goggles, protective clothing, respiratory protective devices)
Inhalation of dust and skin contact with dust during dyeing and printing of textiles	A,B,D	Material substitution; process enclosure; local exhaust ventilation; personal protective equipment (gloves, goggles, protective clothing, respiratory protective devices)
Inhalation of dust and skin contact with dust during manufacture of medicinal products (including butescin picrate, astringents, and germicides)	A,B,D	Material substitution; process enclosure; local exhaust ventilation; personal protective equipment (gloves, goggles, protective clothing, respiratory protective devices)
Inhalation of dust and skin contact with dust during etching of metal including printing plates of copper, steel	A,B,D	Material substitution; process enclosure; local exhaust ventilation; personal protective equipment (gloves, goggles, protective clothing,

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or other metal)

respiratory protective
devices)

Inhalation of dust and
skin contact with dust
during manufacture of
pyrotechnics and com-
pounds for pyrotechnics
(including use as a
color intensifier in
commercial pyrotechnics,
use as an oxidizer in
matches, and synthesis
of potassium picrate)

A,B,D

Material substitution; pro-
cess enclosure; local
exhaust ventilation; personal
protective equipment (gloves,
goggles, protective clothing,
respiratory protective
devices)

Inhalation of dust and
skin contact with dust
during use as a reagent
in identification, isola-
tion, and purification
of other compounds
(including quantitative
determination of naphtha-
lene and estimation of
potassium)

A,B,D

Material substitution; pro-
cess enclosure; local
exhaust ventilation; personal
protective equipment (gloves,
goggles, protective clothing,
respiratory protective
devices)

Inhalation of dust and
skin contact with dust
during leather processing

A,B,D

Material substitution; pro-
cess enclosure; local
exhaust ventilation; personal
protective equipment (gloves,
goggles, protective clothing,
respiratory protective
devices)

Inhalation of dust and
skin contact with dust
during manufacture of
colored glass

A,B,D

Material substitution; pro-
cess enclosure; local
exhaust ventilation; personal
protective equipment (gloves,
goggles, protective clothing,
respiratory protective
devices)

Inhalation of dust and
skin contact with dust
during manufacture of
electric batteries

A,B,D

Material substitution; pro-
cess enclosure; local
exhaust ventilation; personal
protective equipment (gloves,
goggles, protective clothing,
respiratory protective
devices)

A -- Inhalation

B -- Skin and eye contact resulting

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- in localized irritation
- C -- Ingestion
- D -- Skin contact resulting in
absorption and subsequent
systemic poisoning