Occupational Health Guideline for Octane

INTRODUCTION

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

SUBSTANCE IDENTIFICATION

- Formula: C_8H_{18}
- Synonyms: Normal octane
- Appearance and odor: Colorless liquid with a gasoline-like odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for octane is 500 parts of octane per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 2350 milligrams of octane per cubic meter of air (mg/m³). NIOSH has recommended that the permissible exposure limit be reduced to 75 ppm (350 mg/m³) averaged over a work shift of up to 10 hours per day, 40 hours per week, with a ceiling level of 385 ppm (1800 mg/m³) averaged over a 15-minute period. The NIOSH Criteria Document for Alkanes should be consulted for more detailed information.

HEALTH HAZARD INFORMATION

- **Routes of exposure**

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

- **Effects of overexposure**

1. Short-term Exposure: Overexposure to octane may cause irritation of the eyes, nose, and skin, and drowsiness. Exposure to higher air concentrations may cause unconsciousness and death.

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

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

- **Recommended medical surveillance**

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

1. Initial Medical Examination:

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

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

—Liver disease: Although octane 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.

—Kidney disease: Although octane 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.

—Chronic respiratory disease: In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of octane might cause exacerbation of symptoms due to its irritant properties.

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

- **Summary of toxicology**

Octane vapor is a mild narcotic and mucous membrane irritant. Mice exposed at concentrations of 6600 to 13,700 ppm demonstrated signs of narcosis in 30 to 90 minutes. The narcotic concentration is approximately 8000 ppm, while the fatal concentration for animals is

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near 13,500 ppm. Repeated or prolonged skin contact with the liquid results in drying and cracking skin due to defatting action. No chronic systemic effects have been reported in humans. Aspiration may cause chemical pneumonia.

CHEMICAL AND PHYSICAL PROPERTIES

- **Physical data**
  1. Molecular weight: 114.2
  2. Boiling point (760 mm Hg): 126 C (258 F)
  3. Specific gravity (water = 1): 0.7
  4. Vapor density (air = 1 at boiling point of octane): 3.9
  5. Melting point: −56.7 C (−70 F)
  6. Vapor pressure at 20 C (68 F): 11 mm Hg
  7. Solubility in water, g/100 g water at 20 C (68 F): 0.04 (approximately)
  8. Evaporation rate (butyl acetate = 1): Data not available
- **Reactivity**
  1. Conditions contributing to instability: Heat
  2. Incompatibilities: Contact with strong oxidizing agents may cause fires and explosions.
  3. Hazardous decomposition products: Toxic gases and vapors (such as carbon monoxide) may be released in a fire involving octane.
  4. Special precautions: Octane will attack some forms of plastics, rubber, and coatings.
- **Flammability**
  1. Flash point: 13.3 C (56 F) (closed cup)
  2. Autoignition temperature: 220 C (428 F)
  3. Flammable limits in air, % by volume: Lower: 1.0; Upper: 6.5
  4. Extinguishant: Foam, dry chemical, carbon dioxide
- **Warning properties**
  1. Odor Threshold: Summer and May both report an odor threshold of 150 ppm for octane.
  2. Eye Irritation Level: According to the *Handbook of Organic Industrial Solvents*, "irritation occurs as exposure exceeds threshold limit."
  3. Evaluation of Warning Properties: Because of its low thresholds of odor and irritation, octane is treated as a material with good warning properties.

MONITORING AND MEASUREMENT PROCEDURES

- **Eight-Hour Exposure Evaluation**

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

- **Ceiling Evaluation**

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

- **Method**

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

RESPIRATORS

- Good industrial hygiene practices recommend that engineering controls be used to reduce environmental concentrations to the permissible exposure level. However, there are some exceptions where respirators may be used to control exposure. Respirators may be used when engineering and work practice controls are not technically feasible, when such controls are in the process of being installed, or when they fail and need to be supplemented. Respirators may also be used for operations which require entry into tanks or closed vessels, and in emergency situations. If the use of respirators is necessary, the only respirators permitted are those that have been approved by the Mine Safety and Health Administration (formerly Mining Enforcement and Safety Administration) or by the National Institute for Occupational Safety and Health.
- In addition to respirator selection, a complete respiratory protection program should be instituted which includes regular training, maintenance, inspection, cleaning, and evaluation.

PERSONAL PROTECTIVE EQUIPMENT

- Employees should be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing necessary to prevent repeated or prolonged skin contact with liquid octane.
- Any clothing which becomes wet with liquid octane should be removed immediately and not reworn until the octane is removed from the clothing.
- Clothing wet with liquid octane should be placed in closed containers for storage until it can be discarded or

until provision is made for the removal of octane from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the octane, the person performing the operation should be informed of octane's hazardous properties.

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

• Where there is any possibility that employees' eyes may be exposed to octane, an eye-wash fountain should be provided within the immediate work area for emergency use.

SANITATION

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

COMMON OPERATIONS AND CONTROLS

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

Operation	Controls
Use in preparation of gasoline, rocket fuel, and of fuel cells, and in combustion studies	General dilution ventilation; local exhaust ventilation
Use as an industrial solvent as lacquer diluent, phosphate manufacture, and preparation of liquid soaps and detergents	General dilution ventilation; local exhaust ventilation
Use in azeotropic mixtures for printing ink manufacture, and separation distillation	General dilution ventilation; local exhaust ventilation
Use as an additive and solvent in polymer manufacture	General dilution ventilation; local exhaust ventilation
Use in manufacture of benzene, toluene, and xylene aromatics	Process enclosure; local exhaust ventilation; personal protective equipment
Use in laboratory procedures and studies	Local exhaust ventilation; general dilution ventilation; personal protective equipment
Use as a blowing agent for foam rubber used in rocket propellants	Process enclosure; local exhaust ventilation; personal protective equipment

EMERGENCY FIRST AID PROCEDURES

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

• **Eye Exposure**

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

• **Skin Exposure**

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

• **Breathing**

If a person breathes in large amounts of octane, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.

• **Swallowing**

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

• **Rescue**

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

SPILL, LEAK, AND DISPOSAL PROCEDURES

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

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

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

• Waste disposal method:

Octane may be disposed of by atomizing in a suitable combustion chamber.

REFERENCES

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RESPIRATORY PROTECTION FOR OCTANE

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

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