



New Jersey Department of Health and Senior Services

HAZARDOUS SUBSTANCE FACT SHEET

Common Name: **FLUORINE**

CAS Number: 7782-41-4

DOT Number: UN 1045 (Gas)

NA 9192 (Liquid)

RTK Substance number: 0937

Date: October 1986

Revision: March 1999

HAZARD SUMMARY

- * **Fluorine** can affect you when breathed in and by passing through your skin.
- * Contact can cause severe eye and skin irritation and burns leading to permanent eye damage.
- * Breathing **Fluorine** can irritate the nose and throat.
- * Breathing **Fluorine** can irritate the lungs causing coughing and/or shortness of breath. Higher exposures can cause a build-up of fluid in the lungs (pulmonary edema), a medical emergency, with severe shortness of breath.
- * Prolonged exposure can cause **Fluorine** to concentrate in the bones causing osteosclerosis (bone pain and fractures) which is recognizable by the density of the bones in x-rays and may be disabling. The teeth can become mottled.
- * Repeated exposure can cause nosebleeds, nausea, vomiting, loss of appetite, diarrhea and constipation.
- * **Fluorine** may damage the liver and kidneys.
- * These effects do NOT occur when **Fluorine** is used to treat drinking water to prevent cavities.
- * **Fluorine** is a HIGHLY REACTIVE CHEMICAL and a DANGEROUS EXPLOSION HAZARD.

IDENTIFICATION

Fluorine is a pale yellow to greenish gas or a cold liquid with a sharp, irritating odor. It is used as a rocket fuel and to make *Fluorides*, *Fluorocarbons* and other chemicals.

REASON FOR CITATION

- * **Fluorine** is on the Hazardous Substance List because it is regulated by OSHA and cited by ACGIH, DOT, NIOSH, HHAG, NFPA and EPA.
- * This chemical is on the Special Health Hazard Substance List because it is **REACTIVE**.
- * Definitions are provided on page 5.

HOW TO DETERMINE IF YOU ARE BEING EXPOSED

The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information and training concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard, 1910.1200, requires private employers to provide similar training and information to their employees.

- * Exposure to hazardous substances should be routinely evaluated. This may include collecting personal and area air samples. You can obtain copies of sampling results from your employer. You have a legal right to this information under OSHA 1910.1020.
- * If you think you are experiencing any work-related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.
- * **ODOR THRESHOLD = 0.035 ppm.**
- * The range of accepted odor threshold values is quite broad. Caution should be used in relying on odor alone as a warning of potentially hazardous exposures.

WORKPLACE EXPOSURE LIMITS

OSHA: The legal airborne permissible exposure limit (PEL) is **0.1 ppm** averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit is **0.1 ppm** averaged over a 10-hour workshift.

ACGIH: The recommended airborne exposure limit is **1 ppm** averaged over an 8-hour workshift and **2 ppm** as a STEL (short term exposure limit).

- * The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

WAYS OF REDUCING EXPOSURE

- * Where possible, enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
- * Wear protective work clothing.
- * On skin contact with liquid **Fluorine**, immediately submerge the affected body part in warm water.
- * Wash thoroughly immediately after exposure to **Fluorine** and at the end of the workshift.
- * Where exposure to cold equipment, vapors, or liquid may occur, employees should be provided with special clothing designed to prevent the freezing of body tissues.
- * Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of **Fluorine** to potentially exposed workers.

This Fact Sheet is a summary source of information of all potential and most severe health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

HEALTH HAZARD INFORMATION

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Fluorine**:

- * Contact can cause severe eye and skin irritation and burns leading to permanent eye damage.
- * Breathing **Fluorine** can irritate the nose and throat.
- * Breathing **Fluorine** can irritate the lungs causing coughing and/or shortness of breath. Higher exposures can cause a build-up of fluid in the lungs (pulmonary edema), a medical emergency, with severe shortness of breath.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Fluorine** and can last for months or years:

Cancer Hazard

- * According to the information presently available to the New Jersey Department of Health and Senior Services, **Fluorine** has not been tested for its ability to cause cancer in animals.

Reproductive Hazard

- * According to the information presently available to the New Jersey Department of Health and Senior Services, **Fluorine** has not been tested for its ability to affect reproduction.

Other Long-Term Effects

- * Prolonged exposure can cause **Fluorine** to concentrate in the bones causing osteosclerosis (bone pain and fractures) which is recognizable by the density of the bones in x-rays and may be disabling. The teeth can become mottled.
- * Repeated exposure can cause nosebleeds, nausea, vomiting, loss of appetite, diarrhea and constipation.
- * **Fluorine** may damage the liver and kidneys.
- * These effects do NOT occur when **Fluorine** is used to treat drinking water to prevent cavities.

MEDICAL

Medical Testing

Before beginning employment and at regular times after that, the following is recommended:

- * Urinary Fluoride level. Any result over **4 mg/liter** suggests overexposure.

If symptoms develop or overexposure is suspected, the following are recommended:

- * Consider chest x-ray after acute overexposure.
- * Liver and kidney function tests.
- * DEXA Bone Densitometry Scan (Dual Energy X-ray Absorptiometry).

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under OSHA 1910.1020.

Mixed Exposures

- * Because smoking can cause heart disease, as well as lung cancer, emphysema, and other respiratory problems, it may worsen respiratory conditions caused by chemical exposure. Even if you have smoked for a long time, stopping now will reduce your risk of developing health problems.

WORKPLACE CONTROLS AND PRACTICES

Unless a less toxic chemical can be substituted for a hazardous substance, **ENGINEERING CONTROLS** are the most effective way of reducing exposure. The best protection is to enclose operations and/or provide local exhaust ventilation at the site of chemical release. Isolating operations can also reduce exposure. Using respirators or protective equipment is less effective than the controls mentioned above, but is sometimes necessary.

In evaluating the controls present in your workplace, consider: (1) how hazardous the substance is, (2) how much of the substance is released into the workplace and (3) whether harmful skin or eye contact could occur. Special controls should be in place for highly toxic chemicals or when significant skin, eye, or breathing exposures are possible.

In addition, the following controls are recommended:

- * Where possible, automatically transfer **Fluorine** or pump liquid **Fluorine** from drums or other storage containers to process containers.
- * Before entering a confined space where **Fluorine** may be present, check to make sure that an explosive concentration does not exist.

Good **WORK PRACTICES** can help to reduce hazardous exposures. The following work practices are recommended:

- * Workers whose clothing has been contaminated by **Fluorine** should change into clean clothing promptly.
- * Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to **Fluorine**.
- * Eye wash fountains should be provided in the immediate work area for emergency use.
- * If there is the possibility of skin exposure, emergency shower facilities should be provided.
- * On skin contact with **Fluorine**, immediately wash or shower to remove the chemical. At the end of the workshift, wash any areas of the body that may have contacted **Fluorine**, whether or not known skin contact has occurred.
- * Do not eat, smoke, or drink where **Fluorine** is handled, processed, or stored, since the chemical can be swallowed. Wash hands carefully before eating, drinking, smoking, or using the toilet.

PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

OSHA 1910.132 requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Clothing

- * Avoid skin contact with **Fluorine**. Wear protective gloves and clothing. Safety equipment suppliers/manufacturers can provide recommendations on the most protective glove/clothing material for your operation.
- * Where exposure to cold equipment, vapors, or liquid may occur, employees should be provided with special clothing designed to prevent the freezing of body tissues.
- * All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- * Wear non-vented, impact resistant goggles when working with fumes, gases, or vapors.
- * Wear indirect-vent, impact and splash resistant goggles when working with liquids.
- * Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.

Respiratory Protection

IMPROPER USE OF RESPIRATORS IS DANGEROUS.

Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing and medical exams, as described in OSHA 1910.134.

- * Where the potential exists for exposure over **0.1 ppm**, use a MSHA/NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.
- * Exposure to **25 ppm** is immediately dangerous to life and health. If the possibility of exposure above **25 ppm** exists, use a MSHA/NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode.

HANDLING AND STORAGE

- * Prior to working with **Fluorine** you should be trained on its proper handling and storage.
- * **Fluorine** reacts with all chemicals except NEON, HELIUM and ARGON.
- * **Fluorine** reacts violently with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC); ORGANIC COMPOUNDS; COMBUSTIBLE MATERIALS (such as OIL and PAPER); HYDROGEN; BROMINE; IODINE; and CHEMICALLY ACTIVE METALS (such as POTASSIUM, SODIUM, MAGNESIUM and ZINC) resulting in ignition and/or explosions.

- * Store in tightly closed containers in a cool, well-ventilated area away from WATER and STEAM as *Ozone* and *Hydrofluoric Acid* are produced.
- * Wherever **Fluorine** is used, handled, manufactured, or stored, use explosion-proof electrical equipment and fittings.
- * Containers may explode if subjected to shock. Protect from physical damage.

QUESTIONS AND ANSWERS

- Q: If I have acute health effects, will I later get chronic health effects?
- A: Not always. Most chronic (long-term) effects result from repeated exposures to a chemical.
- Q: Can I get long-term effects without ever having short-term effects?
- A: Yes, because long-term effects can occur from repeated exposures to a chemical at levels not high enough to make you immediately sick.
- Q: What are my chances of getting sick when I have been exposed to chemicals?
- A: The likelihood of becoming sick from chemicals is increased as the amount of exposure increases. This is determined by the length of time and the amount of material to which someone is exposed.
- Q: When are higher exposures more likely?
- A: Conditions which increase risk of exposure include physical and mechanical processes (heating, pouring, spraying, spills and evaporation from large surface areas such as open containers), and "confined space" exposures (working inside vats, reactors, boilers, small rooms, etc.).
- Q: Is the risk of getting sick higher for workers than for community residents?
- A: Yes. Exposures in the community, except possibly in cases of fires or spills, are usually much lower than those found in the workplace. However, people in the community may be exposed to contaminated water as well as to chemicals in the air over long periods. This may be a problem for children or people who are already ill.

 The following information is available from:

New Jersey Department of Health and Senior Services
 Occupational Health Service
 PO Box 360
 Trenton, NJ 08625-0360
 (609) 984-1863
 (609) 292-5677 (fax)

Web address: <http://www.state.nj.us/health/eoh/odisweb/>

Industrial Hygiene Information

Industrial hygienists are available to answer your questions regarding the control of chemical exposures using exhaust ventilation, special work practices, good housekeeping, good hygiene practices, and personal protective equipment including respirators. In addition, they can help to interpret the results of industrial hygiene survey data.

Medical Evaluation

If you think you are becoming sick because of exposure to chemicals at your workplace, you may call personnel at the Department of Health and Senior Services, Occupational Health Service, who can help you find the information you need.

Public Presentations

Presentations and educational programs on occupational health or the Right to Know Act can be organized for labor unions, trade associations and other groups.

Right to Know Information Resources

The Right to Know Infoline (609) 984-2202 can answer questions about the identity and potential health effects of chemicals, list of educational materials in occupational health, references used to prepare the Fact Sheets, preparation of the Right to Know survey, education and training programs, labeling requirements, and general information regarding the Right to Know Act. Violations of the law should be reported to (609) 984-2202.

DEFINITIONS

ACGIH is the American Conference of Governmental Industrial Hygienists. It recommends upper limits (called TLVs) for exposure to workplace chemicals.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is assigned by the Chemical Abstracts Service to identify a specific chemical.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes irreversible damage to human tissue or containers.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

HHAG is the Human Health Assessment Group of the federal EPA.

IARC is the International Agency for Research on Cancer, a scientific group that classifies chemicals according to their cancer-causing potential.

A **miscible** substance is a liquid or gas that will evenly dissolve in another.

mg/m³ means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

MSHA is the Mine Safety and Health Administration, the federal agency that regulates mining. It also evaluates and approves respirators.

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NAERG is the North American Emergency Response Guidebook. It was jointly developed by Transport Canada, the United States Department of Transportation and the Secretariat of Communications and Transportation of Mexico. It is a guide for first responders to quickly identify the specific or generic hazards of material involved in a transportation incident, and to protect themselves and the general public during the initial response phase of the incident.

NCI is the National Cancer Institute, a federal agency that determines the cancer-causing potential of chemicals.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the Public Employees Occupational Safety and Health Act, a state law which sets PELs for New Jersey public employees.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

TLV is the Threshold Limit Value, the workplace exposure limit recommended by ACGIH.

The **vapor pressure** is a measure of how readily a liquid or a solid mixes with air at its surface. A higher vapor pressure indicates a higher concentration of the substance in air and therefore increases the likelihood of breathing it in.

