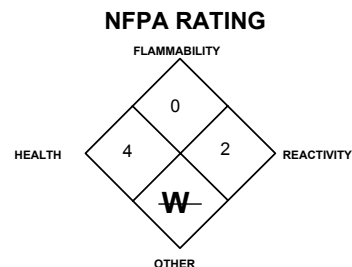




MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards



PART I *What is the material and what do I need to know in an emergency?*

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS: TUNGSTEN HEXAFLUORIDE - F₆W (FW₆)
Document Number: 001080

PRODUCT USE: For general analytical/synthetic chemical uses.

SUPPLIER/MANUFACTURER'S NAME: AIRGAS INC.
ADDRESS: 259 N. Radnor-Chester Road
 Suite 100
 Radnor, PA 19087-5283

BUSINESS PHONE: 1-610-687-5253
EMERGENCY PHONE: CHEMTREC: 1-800-424-9300
 International: 703-527-3887 (Call Collect)

DATE OF PREPARATION: May 17, 1998

2. COMPOSITION and INFORMATION ON INGREDIENTS

| CHEMICAL NAME | CAS # | mole % | EXPOSURE LIMITS IN AIR | | | | | |
|--|-----------|--------|---|----------|---|-----------------------------|----------|---|
| | | | ACGIH | | OSHA | | IDLH ppm | OTHER |
| | | | TLV ppm | STEL ppm | PEL ppm | STEL ppm | | |
| Tungsten Hexafluoride The following exposure limits are for fluorides (as F) and for tungsten, soluble compounds (as W) | 7783-82-6 | > 99% | For F: 2.5, A4 (Not Classifiable as a Human Carcinogen) For W: 1 | For W: 3 | For F: 2.5 For W: 1 (Vacated 1989 PEL) | For W: 3 (Vacated 1989 PEL) | NE | NIOSH REL: For F: TWA = 2.5 mg/m ³ For W: TWA = 1 STEL = 3 DFG MAK: For F: TWA = 2.5 mg/m ³ |
| Maximum Impurities | | < 1% | None of the trace impurities in this product contribute significantly to the hazards associated with the product. All hazard information pertinent to this product has been provided in this Material Safety Data Sheet, per the requirements of the OSHA Hazard Standard (29 CFR 1910.1200) and State equivalents standards. | | | | | |

NE = Not Established

See Section 16 for Definitions of Terms Used.

NOTE: All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1993 format.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: Tungsten Hexafluoride is an extremely toxic, corrosive, water-reactive, colorless, odorless, non-flammable gas, or pale-yellow liquid. Tungsten Hexafluoride is a powerful, corrosive irritant to skin, eyes and mucous membranes. Contact by all routes of exposure can lead to burns. The on-set of over-exposure symptoms may be delayed. Inhalation over-exposure to Tungsten Hexafluoride can lead to potentially fatal lung disorders. If involved in a fire Tungsten Hexafluoride will decompose to produce toxic fumes of fluorides. Tungsten Hexafluoride hydrolyzes very rapidly and violently, yielding hydrofluoric acid and tungsten oxyfluorides. Persons who respond to releases of this product must protect themselves from inhalation of the Tungsten Hexafluoride gas and mists, especially in areas which are downwind of the release. Extreme caution must be used when responding to releases.

SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE:

Tungsten Hexafluoride is toxic by all routes of over-exposure. Symptoms of exposure by all routes of exposure may be delayed.

INHALATION: Inhalation of Tungsten Hexafluoride can cause severe health effects, even at relatively low concentrations. This gas causes severe irritation of the nose and throat. Other symptoms of over-exposure to Tungsten Hexafluoride gas include coughing, excessive salivary and sputum formation, labored breathing, and sore throat. In some instances, unconsciousness and potentially fatal lung disorders (e.g., chemical pneumonitis and pulmonary edema) may occur. Symptoms of pulmonary edema can be delayed. Severe inhalation over-exposures can lead to hypocalcemia, a life-threatening lowering of serum calcium in the body, due to the formation of fluorides upon contact with the moisture in the lungs. Inhalation of this gas may be fatal.

Repeated Tungsten Hexafluoride overexposures by inhalation can result in emphysema and erosion of teeth and a condition known as fluorosis.



CONTACT WITH SKIN or EYES: Contact with the skin is corrosive and very irritating, possibly causing burns, due to the formation of hydrofluoric acid upon contact with moisture in the skin. Direct exposure to the skin from the gas or liquid can cause severe burns in seconds. Burns may not be immediately painful or visible. Depending on the nature of the exposure, the effects can be immediate or delayed. Burns caused by hydrofluoric acid can affect subcutaneous tissues, causing tissues to become blanched and bloodless. Gangrene of affected areas may follow. Minor contact with the eyes will cause tearing and irritation as Tungsten Hexafluoride is a lachrymator. Severe over-exposure to the eyes will cause burns, resulting in blindness.

SKIN ABSORPTION: Tungsten Hexafluoride can decompose upon contact with moisture to form hydrofluoric acid, which can penetrate the skin, causing destruction of the deep tissue layers, including bone tissue. This damage to the body's tissues may continue for days, as the fluoride ion reacts with the calcium in the skin and bone. Severe skin-contact exposures (especially when the skin contamination exceeds 160 cm²) can lead to hypocalcemia, a life-threatening lowering of serum calcium in the body.

INGESTION: While ingestion is highly unlikely, ingestion of Tungsten Hexafluoride can damage the tissues of the mouth, throat, esophagus, and other tissues of the digestive system. Ingestion of Tungsten Hexafluoride can be fatal. Additionally, aspiration by inhalation is possible, causing chemical pneumonia or death.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms. Overexposure to Tungsten Hexafluoride may cause the following health effects:

ACUTE: Tungsten Hexafluoride in gas or liquid form is extremely corrosive, and can burn and damage eyes, skin, mucous membranes, and any other exposed tissue. If inhaled, irritation of the respiratory system may occur, with coughing, and breathing difficulty. Over-exposure to this gas may cause the extremely dangerous condition of pulmonary edema (an accumulation of fluid in the lungs) and may be fatal. Though unlikely to occur during occupational use, ingestion of large quantities may be fatal. Severe exposure to Tungsten Hexafluoride can result in hypocalcemia, which can be fatal unless treated. Hypocalcemia is possible in all instances of inhalation or ingestion or whenever exposure has caused large areas of burns.

| HAZARDOUS MATERIAL INFORMATION SYSTEM | | | |
|---|---------------|---|---------------|
| HEALTH | (BLUE) | 4 | |
| FLAMMABILITY | (RED) | 0 | |
| REACTIVITY | (YELLOW) | 2 | |
| PROTECTIVE EQUIPMENT | | | X |
| EYES | RESPIRATORY | HANDS | BODY |
|  | SEE SECTION 8 |  | SEE SECTION 8 |
| For routine applications. | | | |

See Section 16 for Definition of Ratings

3. HAZARD IDENTIFICATION (Continued)

CHRONIC: Persistent irritation may result from repeated exposures to this gas. Repeated Tungsten Hexafluoride overexposures by inhalation can result in emphysema and erosion of tooth enamel. Though not anticipated to be a significant hazard associated with routine use of this gas, chronic ingestion of high concentrations of fluoride compounds in water supply can cause mottled enamel of teeth and osteosclerosis. Repeated over-exposure can lead to the condition fluorosis, which is a weakening and degeneration of bone structure. Damage may also occur to the heart, central nervous system and gastrointestinal system.

TARGET ORGANS: Respiratory system, skin, eyes, skeletal structure, cardiac and central nervous systems..

PART II *What should I do if a hazardous situation occurs?*

4. FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO TUNGSTEN HEXAFLUORIDE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus and Chemical Resistant Personal Protective equipment should be worn.

Remove victim(s) to fresh air as quickly as possible. 100% oxygen should be administered to victims of exposure to Tungsten Hexafluoride as soon as possible. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation, if necessary.

SKIN EXPOSURE: If Tungsten Hexafluoride gas or liquid contaminates the skin, immediately begin decontamination with running water. Minimum flushing is for 15 minutes. Calcium gluconate gel should be applied to affected areas. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Victim must seek immediate medical attention.

EYE EXPOSURE: If liquid is splashed into eyes, or if irritation of the eye develops after exposure to liquid or gas, open victim's eyes while under gentle running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes. Administer anesthetic eye drops after one minute of flushing if victim suffers from spasms to the eyes, in order to facilitate irrigation. Ice compresses should be applied when this is not irritating to the victim. An ophthalmologist should be sought as soon as possible.

Because of the special hazard of fluoride compounds, special treatment procedures are administered to victims of exposure to Tungsten Hexafluoride. Physicians should refer to Section 11 (Toxicological Information) for specific recommendations to physicians.

Victim(s) must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Take copy of label and MSDS to physician or other health professional with victim(s).

5. FIRE-FIGHTING MEASURES

FLASH POINT: Not applicable.

AUTOIGNITION TEMPERATURE: Not applicable.

FLAMMABLE LIMITS (in air by volume, %):

Lower (LEL): Not applicable.

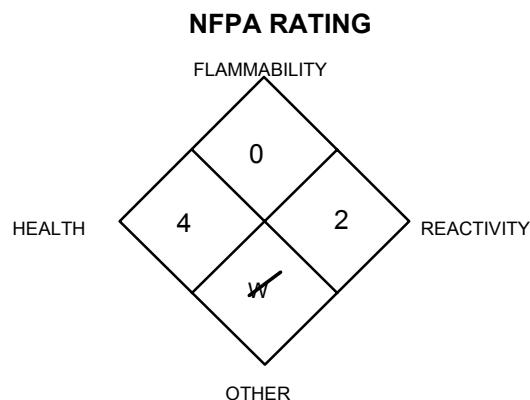
Upper (UEL): Not applicable.

FIRE EXTINGUISHING MATERIALS: Use extinguishing agent appropriate for surrounding materials in a fire. Use water spray to keep fire-exposed containers cool.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Tungsten Hexafluoride is very toxic via inhalation and skin contact, and will decompose upon contact with water to form hydrofluoric acid; therefore, this gas presents an extreme hazard to fire-fighters. In the event of fire, cool containers of this product with water to prevent failure. Do not direct water directly onto the Tungsten Hexafluoride release, in order to avoid hazardous decomposition products when in contact with water. When heated to decomposition, Tungsten Hexafluoride emits toxic fluoride compounds.

Explosion Sensitivity to Mechanical Impact: Not Sensitive.

Explosion Sensitivity to Static Discharge: Not Sensitive.



**See Section 16 for
Definition of Ratings**

5. FIRE-FIGHTING MEASURES (Continued)

SPECIAL FIRE-FIGHTING PROCEDURES: Incipient fire responders should wear eye protection. Structural fire fighters must wear Self-Contained Breathing Apparatus and full protective equipment. Chemically-resistant clothing may be necessary. Move fire-exposed containers if it can be done without risk to firefighters. Decontaminate all equipment used in fire-response with an appropriate, acid-neutralizing agent. If this product is involved in a fire, run-off water should be contained to prevent possible environmental damage.

6. ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE: Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a large spill, clear the affected area, protect people, and respond with trained personnel.

Minimum Personal Protective Equipment should be **Level A: triple-gloves (rubber gloves and nitrile gloves, over latex gloves), fully-encapsulating chemically resistant suit and boots, hard-hat, and Self Contained Breathing Apparatus**. Small releases of Tungsten Hexafluoride leaks can be detected by means of an atomizer or squeeze bottle filled with aqueous ammonia. A white cloud will show the location of the leak. Monitor the surrounding area for Tungsten Hexafluoride and oxygen levels.

The atmosphere must have at least less than the PEL (PEL = 2.5 mg/m³) of Tungsten Hexafluoride and greater than 19.5 percent oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus. Attempt to close the main source valve prior to entering the area. If this does not stop the release (or it is not possible to reach the valve), allow the gas to release in place or remove it to a safe area and allow the gas to be released there. If necessary neutralize areas and items contaminated with hydrofluoric acid mist with sodium bicarbonate or another neutralizer appropriate for acids. **DO NOT USE SAND, CLAY OR OTHER SILICATE-BASED CLEAN-UP MATERIALS.** Decontaminate all equipment used in the response thoroughly.

THIS IS AN EXTREMELY TOXIC, CORROSIVE, WATER-REACTIVE GAS. Protection of all personnel and the area must be maintained. All responders must be adequately protected from exposure.

PART III *How can I prevent hazardous situations from occurring?*

7. HANDLING and STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: All areas where Tungsten Hexafluoride is used should be monitored with very sensitive gas detection instruments. Detection of concentrations below 50% of the PEL (PEL = 2.5 mg/m³) should trigger immediate response and corrective action. Detection of higher levels should initiate an alarm calling for evacuation of all personnel with the potential to be exposed. Due to the extreme corrosivity and toxicity of Tungsten Hexafluoride and hydrofluoric acid which can be generated from this gas, all contaminated clothing should be removed and placed in a sealed container for proper disposal.

Avoid all contact with this gas. All employees who handle this material should be trained to handle it safely. It is highly suggested that persons work with Tungsten Hexafluoride in pairs within sight and sound of each other, but in different areas. Avoid breathing the gas or sprays or mists generated by Tungsten Hexafluoride. Wash hands after handling chemicals. Do not eat or drink while handling chemicals. All work practices should minimize the release of Tungsten Hexafluoride.

- Workers who handle Tungsten Hexafluoride should wear protective clothing, as listed in Section 8 (Exposure Controls and Personal Protection).
- Instant-acting showers should be available in the event of an emergency.
- Special eye-wash fountains or similar equipment should be available for eye irrigation.
- Proper respiratory protection equipment must be provided and workers using such equipment must be carefully trained in its operation and limitations.
- Precautions must always be taken to prevent suck-back of foreign materials into the cylinder by using a check-valve, or vacuum break, since suckback may cause dangerous pressure changes within the cylinder.

STORAGE AND HANDLING PRACTICES: Cylinders should be stored in dry, well-ventilated areas away from sources of heat. Compressed gases can present significant safety hazards. Store containers away from heavily trafficked areas and emergency exits. Post "No Smoking or Open Flames" signs in storage or use areas. Cylinders of Tungsten Hexafluoride should be stored away from organic or combustible materials. Personnel using Tungsten Hexafluoride should be protected by a gas cabinet enclosure or barricade and remote control valves, operated from outside the barrier or enclosure.

7. HANDLING and STORAGE (Continued)

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: Protect cylinders against physical damage. Store in cool, dry, well-ventilated, fireproof area, away from flammable materials and corrosive atmospheres. Store away from heat and ignition sources and out of direct sunlight. Do not store near elevators, corridors or loading docks. Do not allow area where cylinders are stored to exceed 52°C (125°F). Avoid storing products by incompatible chemicals. Do not store containers where they can come into contact with moisture. Cylinders should be stored upright and be firmly secured to prevent falling or being knocked over. Cylinders can be stored in the open, but in such cases, should be protected against extremes of weather and from the dampness of the ground to prevent rusting. Never tamper with pressure relief devices in valves and cylinders. The following rules are applicable to situations in which cylinders are being used:

Before Use: Move cylinders with a suitable hand-truck. Do not drag, slide or roll cylinders. Do not drop cylinders or permit them to strike each other. Secure cylinders firmly. Leave the valve protection cap in-place until cylinder is ready for use.

During Use: Use designated CGA fittings and other support equipment. Do not use adapters. Do not heat cylinder by any means to increase the discharge rate of the product from the cylinder. Use check valve or trap in discharge line to prevent hazardous backflow into the cylinder. Do not use oils or grease on gas-handling fittings or equipment.

After Use: Close main cylinder valve. Replace valve protection cap. Mark empty cylinders "EMPTY".

NOTE: Use only DOT or ASME Code containers. Earth-ground and bond all lines and equipment associated with this product. Close valve after each use and when empty. Cylinders must not be recharged except by or with the consent of owner. For additional information refer to the Compressed Gas Association Pamphlet P-1, *Safe Handling of Compressed Gases in Containers*. Additionally, refer to CGA Bulletin SB-2 "Oxygen Deficient Atmospheres".

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain application equipment is locked and tagged-out safely. Always use product in areas where adequate ventilation is provided.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation. A hood with forced ventilation is preferable. Because of the high hazard associated with Tungsten Hexafluoride, stringent control measures such as a gas cabinet enclosure or isolation may be necessary. Ductwork should be constructed of non-metallic material, or should be lined to resist corrosion. If appropriate, install automatic monitoring equipment to detect the level of Tungsten Hexafluoride.

RESPIRATORY PROTECTION: Maintain exposure levels of Tungsten Hexafluoride below the levels listed in Section 2 (Composition and Information on Ingredients) and oxygen levels above 19.5% in the workplace. Use supplied air respiratory protection if Tungsten Hexafluoride levels exceed exposure limits or during emergency response to a release of this product. If respiratory protection is required, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), equivalent U.S. State standards, or those of Canada and its Provinces. The following NIOSH respiratory protection recommendations are for Fluorides.

CONCENTRATION

RESPIRATORY EQUIPMENT

Up to 1 ppm:

Supplied Air Respirator (SAR)

Up to 2.5 ppm:

Supplied Air Respirator operated in continuous-flow mode.

Up to 5 ppm:

Full-facepiece SCBA, or full-facepiece Supplied Air Respirator.

Up to 25 ppm:

Positive-pressure, full-facepiece Supplied Air Respirator.

Emergency or Planned Entry into Unknown Concentration or IDLH Conditions: Positive-pressure, full facepiece SCBA or positive pressure, full-facepiece SAR with an auxiliary positive pressure SCBA.

Escape

Gas mask or mouth-piece respirator with Tungsten Hexafluoride cartridges or escape-type SCBA should be used.

The IDLH concentration for fluoride is 25 ppm.

EYE PROTECTION: Splash goggles or safety glasses and face shield.

HAND PROTECTION: Wear mechanically-resistant gloves when handling cylinders of Tungsten Hexafluoride. Wear chemical resistant gloves appropriate for use with Tungsten Hexafluoride for industrial use. Use triple gloves for spill response (see Section 6, Accidental Release Measures).

BODY PROTECTION: Use body protection appropriate for task. An apron or other impermeable body protection is suggested. Full-body chemical protective clothing is recommended for emergency response procedures.

9. PHYSICAL and CHEMICAL PROPERTIES

VAPOR DENSITY: Not established.

LIQUID DENSITY @ boiling point: 215 lb/ft³ (3430 kg/ m³)

SPECIFIC VOLUME (ft³/lb): Not established.

SPECIFIC GRAVITY, LIQUID @ boiling point: 3.43

SOLUBILITY IN WATER: Hydrolyzes violently

VAPOR PRESSURE: 2 psig.

COEFFICIENT WATER/OIL DISTRIBUTION: Not available.

pH: Not applicable to the gas. Hydrofluoric acid mist, which can be generated from this product, is corrosive and is formed by the gas on contact with moisture.

APPEARANCE AND COLOR: Tungsten Hexafluoride is an odorless, colorless, gas, or pale-yellow liquid.

HOW TO DETECT THIS SUBSTANCE (warning properties): Lacrymation may act as a distinctive warning property associated with this product. Monitoring systems must be used for detection of this gas. Small leaks may be detected by holding a small, open bottle of concentrated ammonium hydroxide solution near the site of the leak and observing the formation of a small dense white cloud of fumes. Wet blue litmus paper will turn pink upon exposure to a leak of Tungsten Hexafluoride.

EVAPORATION RATE (nBuAc = 1): Not applicable.

FREEZING POINT: 2.3°C (36°F)

BOILING POINT @ 1 atm: 17.5°C (63.5°F)

ODOR THRESHOLD: Not applicable.

EXPANSION RATIO: Not applicable.

10. STABILITY and REACTIVITY

STABILITY: Normally stable. Tungsten Hexafluoride hydrolyzes very readily and violently in the presence of water.

DECOMPOSITION PRODUCTS: When heated, Tungsten Hexafluoride emits hydrogen fluoride. When exposed to water or moisture, Tungsten Hexafluoride decomposes to hydrofluoric acid and tungsten oxyfluorides.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Tungsten Hexafluoride reacts with water to produce hydrofluoric acid.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Avoid exposing cylinders to extremely high temperatures, which could cause the cylinders to rupture. Avoiding exposing this product to incompatible chemicals and moisture.

PART IV *Is there any other useful information about this material?*

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: Currently, no toxicological data are available for Tungsten Hexafluoride.

SUSPECTED CANCER AGENT: Tungsten Hexafluoride is not found on the following lists: FEDERAL OSHA Z LIST, IARC, NTP, and CAL/OSHA and therefore is neither considered to be nor suspected to be a cancer-causing agent by these agencies.

IRRITANCY OF PRODUCT: Tungsten Hexafluoride is severely irritating to contaminated tissue.

SENSITIZATION OF PRODUCT: Tungsten Hexafluoride is not known to be a sensitizer to humans upon prolonged or repeated contact.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of Tungsten Hexafluoride on the human reproductive system.

Mutagenicity: No human mutagenic effects have been described for Tungsten Hexafluoride.

Embryotoxicity: No human embryotoxic effects have been described for Tungsten Hexafluoride.

Teratogenicity: No human teratogenic effects have been described for Tungsten Hexafluoride.

Reproductive Toxicity: No human reproductive effects have been described for Tungsten Hexafluoride.

A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An embryotoxin is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing dermatitis, other skin conditions, and respiratory disorders may be aggravated by over-exposure to Tungsten Hexafluoride. Additionally, over-exposures may aggravate dental problems, heart conditions, bone disorders, and eye problems, as well as disorders involving the "Target Organs", as listed in Section 3 (Hazard Information), may be aggravated by overexposure to Hydrogen Fluoride.

11. TOXICOLOGICAL INFORMATION (Continued)

RECOMMENDATIONS TO PHYSICIANS: The following information is to assist physicians in the treatment of exposure to fluoride compounds.

For Inhalation Exposure: Administer 100% oxygen at half-hour intervals for three to four hours for victims of minor inhalation exposure. For serious inhalation exposure, 100% oxygen administration should begin immediately, under positive pressure (<4 cm) for half-hour periods for at least six hours until breathing is easy and the color of the skin and mucous membranes is normal.

For Skin Contact: For skin contamination, all areas of exposure should be flushed with copious quantities of water, followed by an iced aqueous or alcoholic solution of 0.13% benzalkonium chloride, iced 70% alcohol, or an ice-cold saturated solution of magnesium sulfate. If the area of burn cannot be drenched or immersed in solution, apply cold compresses containing the materials of the solution. After the iced solution treatment, application of a paste of powdered magnesium oxide and glycerin should be administered. The paste should be applied daily for several days. The prevention of serious burns can be prevented by infiltration of the skin and subcutaneous tissues with a 10% calcium gluconate solution, along with a local anesthetic. Care should be taken to see that all medical personnel providing treatment wear chemical impervious gloves. In cases of severe overexposure (more than 160 cm²), there is a potential for hypocalcemia. Therefore, systemic administration of calcium gluconate may be necessary. Frequent monitoring of serum calcium, cardiac, renal, and hepatic functions is necessary.

For Eye Contact: Exposed eyes should be flushed for 15 minutes and the following additional treatment should be provided: Treat with a continuous drip of 1 percent calcium gluconate in normal, sterile saline. No oils or ointments should be used.

ACGIH BIOLOGICAL EXPOSURE INDICES (BEIs): Biological Exposure Indices (BEIs) are applicable for Fluorides, as follows.

| CHEMICAL DETERMINANT | SAMPLING TIME | BEI |
|----------------------------------|---|---|
| FLUORIDES •Fluorides in urine | <ul style="list-style-type: none">• Prior to shift• End of shift | <ul style="list-style-type: none">•3 mg/g creatinine• 10 mg/g creatinine |

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: Tungsten Hexafluoride hydrolyzes very readily and violently in the presence of water and reacts with a wide variety of other substances. All work practices should be aimed at eliminating environmental contamination.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Due to the corrosive nature of this product, animals exposed to this product will experience tissue damage, burns, and may be killed. Plants contaminated with this product may be adversely affected or destroyed.

EFFECT OF CHEMICAL ON AQUATIC LIFE: Tungsten Hexafluoride will form hydrofluoric acid in water, and even low concentrations in water will be detrimental to aquatic life. If a release this product occurs near a river or other body of water, the release has the potential to kill fish and other aquatic life.

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate U.S. Federal, State, and local regulations or with regulations of Canada and its Provinces. Return cylinders with residual product to Airgas, Inc. Do not dispose of locally.

14. TRANSPORTATION INFORMATION

THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME: Tungsten hexafluoride
HAZARD CLASS NUMBER and DESCRIPTION: 2.3 (Poison Gas)
UN IDENTIFICATION NUMBER: UN 2196
PACKING GROUP: Not applicable.
DOT LABEL(S) REQUIRED: Poison Gas, Corrosive
NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996): 125

SPECIAL PROVISION: Tungsten Hexafluoride is poisonous by inhalation. Shipments must be properly described as "Poison Inhalation Hazard - ZONE B".

14. TRANSPORTATION INFORMATION (Continued)

MARINE POLLUTANT: Hydrogen Fluoride is not classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B).

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS MATERIAL IS CONSIDERED AS DANGEROUS GOODS. Use the above information for the preparation of Canadian Shipments. NOTE: 102 (Poison-Inhalation Hazard).

15. REGULATORY INFORMATION

ADDITIONAL U.S. REGULATIONS:

U.S. SARA REPORTING REQUIREMENTS: Tungsten Hexafluoride is not subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act.

U.S. SARA THRESHOLD PLANNING QUANTITY: Not applicable.

U.S. CERCLA REPORTABLE QUANTITY (RQ): Not applicable.

U.S. TSCA INVENTORY STATUS: Tungsten Hexafluoride is listed on the TSCA Inventory.

OTHER U.S. FEDERAL REGULATIONS: Tungsten Hexafluoride is not subject to the reporting requirements of CFR 29 1910.1000. Information is provided for Fluorides and Tungsten (soluble compounds). Depending on specific operations involving the use of Tungsten Hexafluoride, the regulations of the Process Safety Management of Highly Hazardous Chemicals may be applicable (29 CFR 1910.119). Tungsten Hexafluoride is not listed in Appendix A of this regulation; however, it is recommended that the guidelines of the OSHA Technical Bulletin, "Water-Reactive Chemicals, Hazardous Materials not Covered Under 29 CFR 1910.119", be followed. The bulletin states that a process safety analysis should be done for all materials with catastrophic potential, even if they are not covered by the Process Safety Standard.

U.S. STATE REGULATORY INFORMATION: Tungsten Hexafluoride is covered under specific State regulations, as denoted below:

Alaska - Designated Toxic and Hazardous Substances: Fluoride, as F.

California - Permissible Exposure Limits for Chemical Contaminants: No

Florida - Substance List: No.

Illinois - Toxic Substance List: Fluorides and Inorganic Fluoride Compounds.

Kansas - Section 302/313 List: No.

Massachusetts - Substance List: No.

Michigan - Critical Materials Register: No.

Minnesota - List of Hazardous Substances: Fluoride, as F

Missouri - Employer Information/Toxic Substance List: Tungsten Hexafluoride.

New Jersey - Right to Know Hazardous Substance List: Tungsten Hexafluoride.

North Dakota - List of Hazardous Chemicals, Reportable Quantities: No.

Pennsylvania - Hazardous Substance List: No.

Rhode Island - Hazardous Substance List: Fluoride, as F.

Texas - Hazardous Substance List: No.

West Virginia - Hazardous Substance List: No.

Wisconsin - Toxic and Hazardous Substances: No.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): Tungsten Hexafluoride is not on the California Proposition 65 lists.

CGA LABELING (For Compressed Gas):

DANGER: POISONOUS, CORROSIVE, WATER-REACTIVE, HIGH PRESSURE GAS.
CAN CAUSE EYE, SKIN BURNS, AND RESPIRATORY TRACT BURNS.
CAN CAUSE KIDNEY DAMAGE.

Do not breath gas.

Store and use with adequate ventilation, and use in closed systems.

Do not get in eyes, on skin or clothing.

Close valve after each use and when empty.

Use with equipment cleaned of compatible materials of construction and rated for cylinder pressure.

Use in accordance with the Material Safety Data Sheet.



POISON

CALL A PHYSICIAN



15. REGULATORY INFORMATION (Continued)

FIRST-AID:

IF INHALED, remove to fresh air. If not breathing, give artificial respiration. (Rescuer may receive chemical burns as a result of giving mouth-to-mouth). If breathing is difficult, give oxygen. Call a physician.

IN CASE OF CONTACT, immediately flush eyes or skin with water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician. Wash clothing before reuse. (Discard contaminated shoes).

DO NOT REMOVE THIS PRODUCT LABEL.

ADDITIONAL CANADIAN REGULATIONS:

CANADIAN DSL INVENTORY: Tungsten Hexafluoride is listed on the DSL Inventory.

OTHER CANADIAN REGULATIONS: Not applicable.

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS: Tungsten Hexafluoride is on the CEPA First Priorities Substances List ("Toxic" Category, as an Inorganic Fluoride).

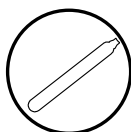
CANADIAN WHMIS SYMBOLS:

Class A: Compressed Gas

Class D1A: Material Causing Serious and Immediate Effects

Class E: Corrosive

Class F: Dangerously Reactive Material



16. OTHER INFORMATION

PREPARED BY:

CHEMICAL SAFETY ASSOCIATES, Inc.
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619/565-0302

The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. AIRGAS, Inc. assumes no responsibility for injury to the vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, AIRGAS, Inc. assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.

DEFINITIONS OF TERMS

A large number of abbreviations and acronyms appear on a MSDS. Some of these which are commonly used include the following:

CAS #: This is the Chemical Abstract Service Number which uniquely identifies each constituent. It is used for computer-related searching.

EXPOSURE LIMITS IN AIR:

ACGIH - American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits. **TLV** - Threshold Limit Value - an airborne concentration of a substance which represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour Time Weighted Average (**TWA**), the 15-minute Short Term Exposure Limit, and the instantaneous Ceiling Level (**C**). Skin absorption effects must also be considered.

OSHA - U.S. Occupational Safety and Health Administration.

PEL - Permissible Exposure Limit - This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (**Federal Register**: 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "Vacated 1989 PEL," is placed next to the PEL which was vacated by Court Order. **IDLH** - Immediately Dangerous to Life and Health - This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent injury. **The DFG** - **MAK** is the Republic of Germany's Maximum Exposure Level, similar to the U.S. PEL. **NIOSH** is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration (**OSHA**). **NIOSH** issues exposure guidelines called Recommended Exposure Levels (**RELs**). When no exposure guidelines are established, an entry of **NE** is made for reference.

HAZARD RATINGS:

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM: **Health Hazard:** **0** (minimal acute or chronic exposure hazard); **1** (slight acute or chronic exposure hazard); **2** (moderate acute or significant chronic exposure hazard); **3** (severe acute exposure hazard; onetime overexposure can result in permanent injury and may be fatal); **4** (extreme acute exposure hazard; onetime overexposure can be fatal). **Flammability Hazard:** **0** (minimal hazard); **1** (materials that require substantial pre-heating before burning); **2** (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); **3** (Class IB and IC flammable liquids with flash points below 38°C [100°F]); **4** (Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]). **Reactivity Hazard:** **0** (normally stable); **1** (material that can become unstable at elevated temperatures or which can react slightly with water); **2** (materials that are unstable but do not detonate or which can react violently with water); **3** (materials that can detonate when initiated or which can react explosively with water); **4** (materials that can detonate at normal temperatures or pressures).

NATIONAL FIRE PROTECTION ASSOCIATION: **Health Hazard:** **0** (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); **1** (materials that on exposure under fire conditions could cause irritation or minor residual injury); **2** (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); **3** (materials that can on short exposure could cause serious temporary or residual injury); **4** (materials that under very short exposure causes death or major residual injury). **Flammability Hazard and Reactivity Hazard:** Refer to definitions for "Hazardous Materials Identification System".

FLAMMABILITY LIMITS IN AIR:

Much of the information related to fire and explosion is derived from the National Fire Protection Association (**NFPA**). **Flash Point** - Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air. **Autoignition Temperature:** The minimum temperature required to initiate combustion in air with no other source of ignition. **LEL** - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source. **UEL** - the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.

TOXICOLOGICAL INFORMATION:

Human and Animal Toxicology: Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: **LD₅₀** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC₅₀** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** concentration expressed in parts of material per million parts of air or water; **mg/m³** concentration expressed in weight of substance per volume of air; **mg/kg** quantity of material, by weight, administered to a test subject, based on their body weight in kg. Other measures of toxicity include **TDLo**, the lowest dose to cause a symptom and **TCLo** the lowest concentration to cause a symptom; **TDo**, **LDLo**, and **LDo**, or **TC**, **TCo**, **LCLo**, and **LCo**, the lowest dose (or concentration) to cause lethal or toxic effects. **Cancer Information:** The sources are: **IARC** - the International Agency for Research on Cancer; **NTP** - the National Toxicology Program, **RTECS** - the Registry of Toxic Effects of Chemical Substances, **OSHA** and **CAL/OSHA**. **IARC** and **NTP** rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. **Other Information:** **BEI** - ACGIH Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV. **Ecological Information:** **EC** is the effect concentration in water. **BCF** = Bioconcentration Factor, which is used to determine if a substance will concentrate in lifeforms which consume contaminated plant or animal matter. **Tm** = median threshold limit; Coefficient of Oil/Water Distribution is represented by **log K_{ow}** or **log K_{oc}** and is used to assess a substance's behavior in the environment.

REGULATORY INFORMATION:

This section explains the impact of various laws and regulations on the material. **U.S.:** **EPA** is the U.S. Environmental Protection Agency. **DOT** is the U.S. Department of Transportation. **SARA** is the Superfund Amendments and Reauthorization Act. **TSCA** is the U.S. Toxic Substance Control Act. **CERCLA (or Superfund)** refers to the Comprehensive Environmental Response, Compensation, and Liability Act. Labeling is per the American National Standards Institute (**ANSI Z129.1**). **CANADA:** **CEPA** is the Canadian Environmental Protection Act. **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **TC** is Transport Canada. **DSL/NDL** are the Canadian Domestic/Non-Domestic Substances Lists.