

CHEMETALL FOOTE CORPORATION

MATERIAL SAFETY DATA SHEET

LITHIUM HYDROXIDE ANHYDROUS

CFM 014

Page 1 of 8

SECTION 1		CHEMICAL PRODUCT AND COMPANY IDENTIFICATION
CHEMETALL FOOTE CORPORATION 348 HOLIDAY INN DRIVE KINGS MOUNTAIN, NC 28086 704-739-2501 (8 AM-5 PM M-F)	FOR EMERGENCY TRANSPORTATION INFORMATION, CALL CHEMTREC 1-800-424-9300	
SUBSTANCE: LITHIUM HYDROXIDE ANHYDROUS TRADE NAMES/SYNONYMS: None. PRODUCT CODE: CFM 014 PRODUCT USE: Used for a variety of industrial and research applications. CHEMICAL FAMILY: Inorganic Base FORMULA: LiOH CREATION DATE: 4/11/96		REVISION DATE: 0709/99 (see Section 16 for revision details)

SECTION 2		COMPOSITION, INFORMATION ON INGREDIENTS					
Component	CAS #	% w/w	Exposure Limits in Air				
			ACGIH-TLVs		OSHA-PELs		OTHER
			TWA mg/m ³	STEL mg/m ³	TWA mg/m ³	STEL mg/m ³	mg/m ³
Lithium Hydroxide Anhydrous (exposure limits are for Sodium Hydroxide, a compound with similar hazard properties)	1310-65-2	> 99	NE	2 (Ceiling)	2	NE	NIOSH REL: TWA = 2 (Ceiling) DFG MAKs: TWA = 2 (Ceiling, Measured as the Inhalable Fraction of the Aerosol) PEAK = 2 MAK, 5 min., momentary value (Ceiling, Measured as the Inhalable Fraction of the Aerosol)
NE = Not Established C = Ceiling Limit See Section 16 for Definition of other terms and acronyms used. NOTE: All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1993 format.							

SECTION 3	HAZARDS IDENTIFICATION
<p>EMERGENCY OVERVIEW: This is a white, crystalline solid. Lithium Hydroxide, anhydrous is caustic and can cause severe irritation and corrosive damage to the skin, eyes, and tissues of the respiratory system. Lithium Hydroxide, anhydrous may generate some heat when in contact with water. Lithium Hydroxide, anhydrous is not flammable. Emergency responders must wear personal protective equipment appropriate to the situation to which they are responding.</p>	
<p>SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE: In terms of anticipated occupational overexposure situations for employees, the main health effect from overexposure would be irritation or burns of contaminated skin, eyes, and tissues of the respiratory system.</p> <p>INHALATION: Inhalation of airborne dusts of Lithium Hydroxide, anhydrous dusts may severely irritate or damage the tissues of the eyes, nose, and respiratory system. Symptoms of such overexposure can include coughing, sneezing, and a sore throat. Inhalation of relatively large quantities of Lithium Hydroxide, anhydrous may damage the tissues of the respiratory system, which can lead to the development of breathing difficulty, chemical pneumonitis, and pulmonary edema (a potentially life-threatening accumulation of fluid in the lungs). Severe inhalation overexposure may be fatal.</p> <p>CONTACT WITH SKIN or EYES: Depending on the duration and concentration of overexposure, Lithium Hydroxide, anhydrous can cause severe irritation and corrosive damage to the skin and eyes. Symptoms of skin contact can include redness, irritation, pain, and burns that are slow to heal. Permanent scarring may occur. Repeated skin overexposure may cause dermatitis (dry, red skin). Symptoms of eye contact can include redness, irritation, pain, tearing, and blurred vision. Severe eye overexposure may cause permanent damage or blindness.</p> <p>SKIN ABSORPTION: Skin absorption is not a significant route of exposure for Lithium Hydroxide, anhydrous.</p> <p>INGESTION: Ingestion is not anticipated to be a significant route of occupational exposure. If Lithium Hydroxide, anhydrous is swallowed, it can irritate and burn the mouth, throat, and other tissues of the digestive system. Symptoms can include vomiting, diarrhea, and collapse. Vomiting (which can occur after ingestion of Lithium Hydroxide, anhydrous) may lead to aspiration, causing lung damage. In humans, ingestion of 10 grams of Lithium Hydroxide, anhydrous may be fatal. Severe ingestion overexposures can be fatal.</p>	

SECTION 3 HAZARDS IDENTIFICATION (Continued)

INJECTION: Injection of Lithium Hydroxide, anhydrous (via puncture with a contaminated object) can cause pain and irritation in addition to the wound.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in **Lay Terms**.

ACUTE: In terms of anticipated occupational overexposure situations for employees, the main health effect from overexposure would be irritation or burns of contaminated skin, eyes, and tissues of the respiratory system. Severe ingestion overexposures can be fatal.

CHRONIC: Repeated skin overexposure may cause dermatitis (dry, red skin).

TARGET ORGANS: Eyes, skin, mucous membranes.

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM RATING: Health Hazard = 3; Fire Hazard = 0; Reactivity Hazard = 1; PPE Rating = C; (see Section 16, Other Information).

SECTION 4 FIRST-AID MEASURES

Victims of chemical exposure must be taken for medical attention if any adverse effect occurs. Rescuers should be taken for medical attention if necessary. Take copy of label and MSDS to physician or health professional with victim.

SKIN EXPOSURE: If Lithium Hydroxide, anhydrous contaminates the skin, immediately begin decontamination with running water. Do not interrupt flushing. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Victims must seek immediate medical attention if adverse effect occurs.

EYE EXPOSURE: If Lithium Hydroxide, anhydrous contaminates the eyes, open victim's eyes while under gently running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes. Victims must seek immediate medical attention if any adverse effect occurs.

INHALATION: If Lithium Hydroxide, anhydrous is inhaled, remove victim to fresh air. If necessary, use artificial respiration to support vital functions. Remove or cover gross contamination to avoid exposure to rescuers.

INGESTION: If Lithium Hydroxide, anhydrous is swallowed, CALL PHYSICIAN OR POISON CONTROL CENTER FOR MOST CURRENT INFORMATION. DO NOT INDUCE VOMITING, unless directed by medical personnel. If conscious, have victim rinse mouth with water. Never induce vomiting or give diluents (milk or water) to someone who is unconscious, having convulsions, or unable to swallow.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing respiratory, skin, central nervous system, and kidney conditions can be aggravated by overexposure to Lithium Hydroxide, anhydrous.

RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and eliminate overexposure.

SECTION 5 FIRE-FIGHTING MEASURES

FLASH POINT: Not flammable.

AUTOIGNITION TEMPERATURE: Not applicable.

FLAMMABLE LIMITS (in air by volume): Not applicable.

FIRE EXTINGUISHING MATERIALS: Lithium Hydroxide, anhydrous is not flammable. Use fire extinguishing material appropriate for surrounding fires.

Water Spray: YES

Carbon Dioxide: YES

Foam: YES

Dry Chemical: YES

Halon: YES

Other: Any "ABC" Class

UNUSUAL FIRE AND EXPLOSION HAZARDS: Lithium Hydroxide, anhydrous is corrosive and presents a severe contact hazard to firefighters. When involved in a fire, Lithium Hydroxide, anhydrous may decompose and produce irritating fumes and toxic gases (lithium compounds).

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Not sensitive.

SPECIAL FIRE-FIGHTING PROCEDURES: Incipient fire responders should wear eye protection. Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. Move containers from fire area if it can be done without risk to personnel. If possible, firefighters should control runoff water to prevent environmental contamination.

NFPA RATING: Health Hazard = 3; Fire Hazard = 0; Reactivity Hazard = 1; (see Section 16, Other Information).

SECTION 6 ACCIDENTAL RELEASE MEASURES

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

The minimum Personal Protective Equipment recommended for response to non-incident releases should be **Level C: triple-gloves (rubber gloves and nitrile gloves over latex gloves), chemical resistant suit and boots, hard-hat, and air-purifying respirator with high-efficiency particulate filter. Self-Contained Breathing Apparatus would be worn in situations where the oxygen level is below 19.5 % or is unknown.** Sweep up or vacuum spilled Lithium Hydroxide, anhydrous carefully, avoiding the generation of dusts. Decontaminate the area thoroughly. If necessary, neutralize area with citric acid. Test area with litmus paper to insure neutralization is complete. Place all spill residue in a suitable container and seal. Dispose of in accordance with U.S. Federal, State, and local or Canadian solid waste disposal regulations (see Section 13, Disposal Considerations).

SECTION 7 HANDLING AND STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting Lithium Hydroxide, anhydrous ON YOU or IN YOU. Wash thoroughly after handling Lithium Hydroxide, anhydrous. Do not eat, drink, or smoke while handling this product. Remove contaminated clothing immediately. Use ventilation and other engineering controls to minimize potential exposure to Lithium Hydroxide, anhydrous.

STORAGE AND HANDLING PRACTICES: All employees who handle Lithium Hydroxide, anhydrous should be trained to handle it safely. Ensure containers of Lithium Hydroxide, anhydrous are properly labeled. Open containers slowly on a stable surface. Store containers in a cool, dry location, away from direct sunlight or sources of intense heat. Keep container tightly closed after use. Store away from incompatible materials (see Section 10, Stability and Reactivity). Inspect containers of Lithium Hydroxide, anhydrous for leaks or damage. Read instructions provided with the product prior to use. Empty containers may contain residual material; therefore, empty containers must be handled with care.

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain that application equipment is locked and tagged-out safely, as applicable. Collect all rinsates and dispose of according to applicable Federal, State, or local procedures.

SECTION 8 EXPOSURE CONTROLS, PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation, to ensure exposures are below limits provided in Section 2 (Composition and Information on Ingredients). Mechanical exhaust may be needed. Where there is any possibility that an employee's eyes may be exposed to Lithium Hydroxide, anhydrous, the employer should provide an eye wash fountain within the immediate work area for emergency use.

RESPIRATORY PROTECTION: Maintain airborne contaminant concentrations below exposure limits listed in Section 2 (Composition and Information on Ingredients). If respiratory protection is needed, use only protection authorized in 29 CFR 1910.134 or applicable State regulations. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply. NIOSH Respiratory protection guidelines for Sodium Hydroxide in air (a chemical with similar hazard properties), are provided as follows:

UP TO 10 mg/m³: Supplied Air Respirator (SAR) operated in a continuous-flow mode, full-facepiece respirator with high-efficiency particulate filter(s), powered air-purifying respirator with dust and mist filter(s), full-facepiece Self-Contained Breathing Apparatus (SCBA), or full-facepiece SAR.

EMERGENCY OR PLANNED ENTRY INTO UNKNOWN CONCENTRATIONS OR IDLH CONDITIONS: Positive pressure, full-facepiece SAR or positive pressure, full-facepiece SAR with an auxiliary positive pressure SAR.

ESCAPE: Full-facepiece respirator with high-efficiency particulate filter(s); or escape-type SCBA.

EYE PROTECTION: Splash goggles or safety glasses.

HAND PROTECTION: Wear neoprene gloves for routine industrial use.

BODY PROTECTION: Use body protection appropriate for task (e.g., Apron or Tyvek suit).

NOTE: Additional protection may be required for specific work situations in which Lithium Hydroxide, anhydrous is used. The potential exposure hazards for each work situation must be evaluated, per 29 CFR 1910.132 (Federal OSHA Personal Protective Equipment Standard/General requirements), to determine the appropriate personal protective equipment for the operation.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

RELATIVE VAPOR DENSITY (air = 1): Not applicable. EVAPORATION RATE (nBuAc = 1): Not applicable.

SPECIFIC GRAVITY (water = 1): 1.5

FREEZING/MELTING POINT: 471°C (800°F)

SOLUBILITY IN WATER @ 20°C: 13 g/100 cc

BOILING POINT: Decomposes @ 924°C (1695°F)

VAPOR PRESSURE, mm Hg @ 20°C: Not applicable.

pH: 14 (1.0 N Solution)

ODOR THRESHOLD: Not available.

COEFFICIENT OF OIL/WATER DISTRIBUTION (PARTITION COEFFICIENT): Not available.

APPEARANCE AND COLOR: White, crystalline solid.

HOW TO DETECT THIS SUBSTANCE (warning properties): Solid Lithium Hydroxide, anhydrous does not have any unique warning properties. Aqueous solutions of Lithium Hydroxide will turn litmus paper blue.

SECTION 10 STABILITY AND REACTIVITY

STABILITY: Stable. Lithium Hydroxide, anhydrous may react with carbon dioxide in air to form lithium carbonate.

DECOMPOSITION PRODUCTS: Thermal decomposition of the components of Lithium Hydroxide, anhydrous include lithium compounds and caustic vapors.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Lithium Hydroxide, anhydrous is not compatible with strong acids. Lithium Hydroxide, anhydrous is corrosive to aluminum, lead, and zinc.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Mixing Lithium Hydroxide, anhydrous with incompatible chemicals.

SECTION 11 TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following toxicology data are currently available for Lithium Hydroxide.

LC₅₀ (Inhalation-Rat) = 960 mg/m³/ 4 hours

LDLo (Oral-Mouse) = 200 mg/kg

LDLo (Subcutaneous-Mouse) = 300 mg/kg

Eye Irritation: In animal tests, solutions of Lithium Hydroxide are similar to solutions of sodium hydroxide, which can cause severe corrosive eye damage.

Short-Term Inhalation: In one study, rats were exposed to an aerosol, which was primarily Lithium Hydroxide, but may have contained up to 25 percent lithium carbonate. The exposure was to 570-1500 mg/m³ for four hours. The rats developed breathing difficulties and became less energetic. In addition, they showed symptoms of severe irritation (coughing, choking, bleeding around the eyes and nose) and lost weight. Some rats died, especially at high concentration levels. Examination of the rats revealed lesions in the airways and lungs.

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

IRRITANCY OF PRODUCT: Lithium Hydroxide is expected to cause severe irritancy and corrosive damage to the skin, eyes, and any other contaminated tissue.

SENSITIZATION TO THE PRODUCT: Lithium Hydroxide is not known to be a sensitizer with prolonged or repeated use.

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

Mutagenicity: Lithium Hydroxide is not reported to cause mutagenic effects in humans.

Embryotoxicity: Lithium Hydroxide is not reported to produce embryotoxic effects in humans

Teratogenicity: Lithium Hydroxide is not reported to cause teratogenic effects in humans.

Reproductive Toxicity: Lithium Hydroxide is not reported to cause reproductive effects in humans.

A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generational 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.

ACGIH BIOLOGICAL EXPOSURE INDICES (BEIs): Currently there are no ACGIH Biological Exposure Indices (BEIs) associated with Lithium Hydroxide.

SECTION 12 ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.

ENVIRONMENTAL STABILITY: Lithium Hydroxide may react with carbon dioxide in air to form lithium carbonate.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Due to its corrosivity, Lithium Hydroxide can be harmful or fatal to contaminated plants and animals.

EFFECT OF CHEMICAL ON AQUATIC LIFE: Due to its corrosivity, Lithium Hydroxide can be harmful or fatal to aquatic plants and animals in contaminated bodies of water.

ACUTE AQUATIC TOXICITY: No data available.

DEGRADABILITY: No data available.

LOG BIOCONCENTRATION FACTOR (BCF): No data available.

LOG OCTANOL/WATER PARTITION COEFFICIENT: No data available.

SECTION 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. Lithium Hydroxide, anhydrous, if unaltered by use, may be disposed of by treatment at a permitted facility or as advised by your local solid waste regulatory authority.

EPA WASTE NUMBER: D002 (Characteristic/Corrosivity), applicable to wastes consisting only of Lithium Hydroxide, anhydrous.

SECTION 14 TRANSPORT INFORMATION

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

PROPER SHIPPING NAME: Lithium hydroxide, solid

HAZARD CLASS NUMBER and DESCRIPTION: 8 (Corrosive Material)

UN IDENTIFICATION NUMBER: UN 2680

PACKING GROUP: II

DOT LABEL(S) REQUIRED: CORROSIVE

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996): 154

MARINE POLLUTANT: Lithium Hydroxide is not designated as a DOT Marine Pollutant (49 CFR 172.101, Appendix B).

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS MATERIAL IS CONSIDERED AS DANGEROUS GOODS. Consult Transport Canada regulations for exact shipping name.

INTERNATIONAL AIR TRANSPORT ASSOCIATION DANGEROUS GOODS REGULATIONS: Use the following information for international shipments via air transport.

PROPER SHIPPING NAME: Lithium hydroxide, solid

HAZARD CLASS NUMBER and DESCRIPTION: 8 (Corrosive Material)

UN IDENTIFICATION NUMBER: UN 2680

PACKING GROUP: II

LABEL(S) REQUIRED: Corrosive

PACKING INSTRUCTIONS: Passenger Aircraft: 814 Cargo Aircraft: 816

EMERGENCY RESPONSE CONTACT FOR AN INCIDENT DURING TRANSPORTATION:

CHEMTREC 1-800-424-9300 or 1-703-527-3887

SECTION 15 REGULATORY INFORMATION

U.S. SARA REPORTING REQUIREMENTS: Lithium Hydroxide, anhydrous is not subject to the reporting requirements of the Comprehensive Environmental Response, Compensation, and Liability Act and Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act.

CERCLA SECTION 103 (40 CFR 302.4): No

SARA SECTION 302 (40 CFR 355.30): No

SARA SECTION 304 (40 CFR 355.40): No

SARA SECTION 313 (40 CFR 372.65): No

SECTION 15 REGULATORY INFORMATION

U.S. SARA THRESHOLD PLANNING QUANTITY: There are no specific Threshold Planning Quantities for this product. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lb (4,540 kg) may apply, per 40 CFR 370.20.

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

CANADIAN DSL/NDSL STATUS: Lithium Hydroxide Anhydrous is on the DSL/NDSL.

U.S. TSCA INVENTORY STATUS: Lithium Hydroxide Anhydrous is listed on the TSCA Inventory.

U.S. TSCA 12(b) EXPORT NOTIFICATION: TSCA 12(b) Notification is not required, per 40 CFR 707, for Lithium Hydroxide Anhydrous.

OTHER U.S. FEDERAL REGULATIONS: Not applicable.

U.S. STATE REGULATORY INFORMATION: Lithium Hydroxide, anhydrous is covered under specific State regulations, as denoted below:

Alaska - Designated Toxic and Hazardous Substances: No.

California - Permissible Exposure Limits for Chemical Contaminants: No.

Florida - Substance List: No.

Illinois - Toxic Substance List: No.

Kansas - Section 302/313 List: No.

Massachusetts - Substance List: No.

Michigan - Critical Materials Register: Lithium Compounds.

Minnesota - List of Hazardous Substances: No.

Missouri - Employer Information/Toxic Substance List: No.

New Jersey - Right to Know Hazardous Substance List: : Lithium Hydroxide.

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

Pennsylvania - Hazardous Substance List: No.

Rhode Island - Hazardous Substance List: No.

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): Lithium Hydroxide, anhydrous is not on the California Proposition 65 lists.

ANSI STANDARD LABELING (Precautionary Statements): **DANGER! CORROSIVE. CAUSES SEVERE EYE AND SKIN BURNS. HARMFUL OR FATAL IF INHALED OR INGESTED.** Avoid contact with skin, eyes, and clothing. Wash thoroughly after handling. Use in well-ventilated area. Do not take internally. Wear gloves, goggles, and appropriate body protection. Keep container closed. **FIRST AID:** In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult give oxygen. If ingested, do not induce vomiting. Seek medical attention. **IN CASE OF FIRE:** Use water fog, dry chemical, CO₂, or "alcohol" foam. **IN CASE OF SPILL:** Absorb spilled product with inert material. Neutralize residue with neutralizer suitable for caustic materials. Place in a suitable container. Avoid contact with strong acids. Consult Material Safety Data Sheet before use.

CANADIAN WHMIS SYMBOLS: **Class E Corrosive;** (see final page of this document).

SECTION 16 OTHER INFORMATIONREVISIONS MADE IN 1999:

Section 2: DFG MAK added

Section 3: Subheading TARGET ORGANS added.

Section 4: Indicated in each subheading that medical attention should be sought when adverse effect occurs. Removed suggestion to give milk or water to victims of ingestion, to be consistent with current first aid procedures.

Section 8: Subheading of Respiratory Protection up-dated to include equipment requirements under OSHA regarding IDLH conditions. NIOSH/OSHA RECOMMENDATIONS FOR SODIUM HYDROXIDE CONCENTRATIONS IN AIR added

Section 9: Corrected solubility value and added boiling point data

Section 11: Toxicological data added

Section 12: Subheading LOG OCTANOL/WATER PARTITION COEFFICIENT added

Section 14: IATA Information added

Section 15: CANADIAN DSL/NDSL and U.S. TSCA 12b EXPORT NOTIFICATION. Canadian WHMIS information up-dated.

The information in this Material Safety Data Sheet is based on data that Chemetall Foote Corporation believes to be reliable as of the MSDS date of revision. Chemetall Foote Corporation makes no warranty or representation of any kind that the MSDS does not contain errors. The data in this MSDS relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process. It is intended for use by persons having technical skill and at their own discretion and risk. Since conditions of use are outside the control of Chemetall Foote Corporation, there are no warranties, expressed or implied, and Chemetall Foote Corporation assumes no liability in connection with the use of this information. Nothing herein is to be taken as a license to operate under or a recommendation to infringe on any patents. Any use of these data and information must be determined by the user to be in accordance with Federal, State and local laws and regulations.

SECTION 16 OTHER INFORMATION (Continued)**PREPARED BY:**

CHEMICAL SAFETY ASSOCIATES, Inc.
9163 Chesapeake Drive, San Diego, CA 92123-1002
619/565-0302

DEFINITIONS OF TERMS: A large number of abbreviations and acronyms appear on a MSDS. Some of these that 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 that establishes exposure limits. **TLV** - Threshold Limit Value - an airborne concentration of a substance that 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 on 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 become unstable at elevated temperatures or which react slightly with water); **2** (materials that are unstable but do not detonate or which react violently with water); **3** (materials that detonate when initiated or react explosively with water); **4** (materials that detonate at normal temperatures or pressures).

NATIONAL FIRE PROTECTION ASSOCIATION: Health Hazard: **0** (material that 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 on short exposure could cause serious temporary or residual injury); **4** (materials that under very short exposure causes death or major 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:




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. Data from several sources are used to evaluate the cancer-causing potential of the material. 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 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. **BEI** - 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.

REGULATORY INFORMATION:

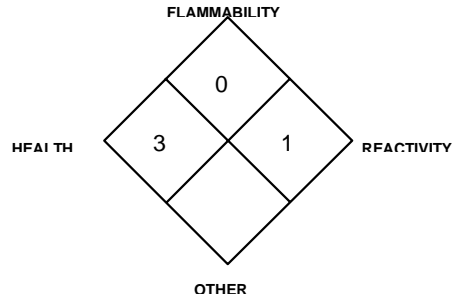
This section explains the impact of various laws and regulations on the material. **EPA** is the U.S. Environmental Protection Agency. **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **DOT** and **TC** are the U.S. Department of Transportation and the Transport Canada, respectively. Superfund Amendments and Reauthorization Act (**SARA**); the Canadian Domestic/Non-Domestic Substances List (**DSL/NDSL**); the U.S. Toxic Substance Control Act (**TSCA**); Marine Pollutant status according to the **DOT**; the Comprehensive Environmental Response, Compensation, and Liability Act (**CERCLA or Superfund**); and various state regulations.

GRAPHICAL REPRESENTATION OF HAZARDS

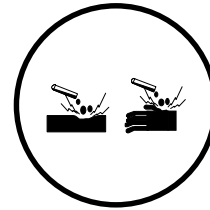
HAZARDOUS MATERIAL IDENTIFICATION SYSTEM RATING

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM			
HEALTH		(BLUE)	3
FLAMMABILITY		(RED)	0
REACTIVITY		(YELLOW)	1
PROTECTIVE EQUIPMENT			C
EYES	RESPIRATORY	HANDS	BODY
	SEE SECTION 8		
For routine industrial applications			

NATIONAL FIRE PROTECTION SYSTEM RATING



WHMIS SYMBOL
Class E: Corrosive



See Section 16 for Definition of Ratings



AGA GAS, INC. (216) 642-6600
6055 ROCKSIDE WOODS BLVD
P.O. BOX 94737
CLEVELAND, OH 44101-4737

MATERIAL
SAFETY
DATA SHEET

No. 53

PRODUCT NAME Oxygen	CAS # 7782-44-7
TRADE NAME AND SYNONYMS Oxygen; Oxygen, compressed (D.O.T.)	DOT I.D. No.: UN 1072
CHEMICAL NAME AND SYNONYMS Oxygen	DOT Hazard Class: Division 2.2
ISSUE DATES AND REVISIONS Revised January 1995	Formula O ₂
	Chemical Family: Oxidizer

HEALTH HAZARD DATA

TIME WEIGHTED AVERAGE EXPOSURE LIMIT

None established (ACGIH 1994-1995). Oxygen is the "vital element" in the atmosphere in which we live and breathe (Continued on Page 4)

SYMPTOMS OF EXPOSURE

Breathing high concentrations (greater than 75 molar percent) causes symptoms of hyperoxia which includes cramps, nausea, dizziness, hypothermia, amblyopia, respiratory difficulties, bradycardia, fainting spells, and convulsions capable of leading to death.

For additional information on hyperoxia, see Compressed Gas Association's Pamphlet P-14.

TOXICOLOGICAL PROPERTIES

The property is that of hyperoxia which leads to pneumonia. Concentrations between 25 and 75 molar percent present a risk of inflammation of organic matter in the body.

Oxygen is not listed in the IARC, NTP or by OSHA as a carcinogen or potential carcinogen.

Persons in ill health where such illness would be aggravated by exposure to oxygen should not be allowed to work with or handle this product.

RECOMMENDED FIRST AID TREATMENT

PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO OXYGEN. RESCUE PERSONNEL SHOULD BE COGNIZANT OF EXTREME FIRE HAZARD ASSOCIATED WITH OXYGEN-RICH ATMOSPHERES.

Conscious persons should be assisted to an uncontaminated area and breathe fresh air. They should be kept warm and quiet. The physician should be informed that the victim is experiencing (has experienced) hyperoxia.

Unconscious persons should be moved to, an uncontaminated area and given assisted respiration. When breathing has been restored, treatment should be as above. Continued treatment should be symptomatic and supportive.

Information contained in this material safety data sheet is offered without charge for use by technically qualified personnel at their discretion and risk. All statements, technical information and recommendations contained herein are based on tests and data which we believe to be reliable, but the accuracy or completeness thereof is not guaranteed and no warranty of any kind is made with respect thereto. This information is not intended as a license to operate under or a recommendation to practice or infringe any patent of this Company or others covering any process, composition of matter or use. Since the Company shall have no control of the use of the product described herein, the Company assumes no liability for loss or damage incurred from the proper or improper use of such product.

OXYGEN

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES

Oxygen vigorously accelerates combustion. Contact with all flammable materials should be avoided. Some materials which are not flammable in air will burn in pure oxygen or oxygen-enriched atmospheres.

PHYSICAL DATA

BOILING POINT -297.3°F (-182.9°C)	LIQUID DENSITY AT BOILING POINT 71.23 lb/ft ³ (1141 kg/m ³)
VAPOR PRESSURE 70°F (21.1°C) Above the critical temp. of -181.1°F (-118.4°C)	GAS DENSITY AT 700F. 1 atm .0828 lb/ft ³ (1.326 kg/m ³)
SOLUBILITY IN WATER Slightly	FREEZING POINT -361.8°F (-218.8°C)
EVAPORATION RATE N/A (Gas)	SPECIFIC GRAVITY (AIR=1) @ 70°F (21.1°C) = 1.11
APPEARANCE AND ODOR Colorless, odorless gas	

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) N/A	AUTO IGNITION TEMPERATURE N/A	FLAMMABLE LIMITS % BY VOLUME (See Page 4) LEL N/A UEL N/A
EXTINGUISHING MEDIA Copious quantities of water for fires with oxygen as the oxidizer.		ELECTRICAL CLASSIFICATION Nonhazardous
SPECIAL FIRE FIGHTING PROCEDURES If possible, stop the flow of oxygen which is supporting the fire. If cylinders are involved in a fire, safely relocate or keep cool with water spray.		
UNUSUAL FIRE AND EXPLOSION HAZARDS Vigorously accelerates combustion.		

REACTIVITY DATA

STABILITY Unstable		CONDITIONS TO AVOID None
Stable	X	
INCOMPATIBILITY (Materials to avoid) All flammable materials		
HAZARDOUS DECOMPOSITION PRODUCTS None		
HAZARDOUS POLYMERIZATION May Occur		CONDITIONS TO AVOID None
Will Not Occur	X	

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED Evacuate all personnel from affected area. Use appropriate protective equipment. If leak is in user's equipment, be certain to purge piping with an inert gas prior to attempting repairs. If leak is in container or container valve, contact your closest supplier location or call the emergency telephone number listed herein.
WASTE DISPOSAL METHOD Do not attempt to dispose of waste or unused quantities. Return in the shipping container properly labeled, with any valve-outlet plugs or caps secured and valve protection cap in place to your supplier. For emergency disposal assistance, contact your closest supplier location or call the emergency telephone number listed herein.

SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)		Positive pressure air line with mask or self-contained breathing apparatus should be available for emergency use.	
VENTILATION See Local Exhaust	LOCAL EXHAUST To prevent accumulation above 25 molar percent	SPECIAL	N/A
	MECHANICAL (Gen.)	OTHER	N/A
PROTECTIVE GLOVES As required; any material			
EYE PROTECTION Safety goggles or glasses			
OTHER PROTECTIVE EQUIPMENT Safety shoes, safety shower			

SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION	
DOT Shipping Name: Oxygen, compressed DOT Hazard Class: Division 2.2 DOT Shipping Label: Nonflammable Gas, Oxidizer I.D. No.: UN 1072	
SPECIAL HANDLING RECOMMENDATIONS	
<p>Use only in well-ventilated areas. Valve protection caps and valve outlet threaded plugs must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure (<3,000 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.</p> <p>For additional handling recommendations, consult Compressed Gas Association's Pamphlets P-1, P-14, and G-4.</p>	
SPECIAL STORAGE RECOMMENDATIONS	
<p>Protect cylinders from physical damage. Store in cool, dry, well-ventilated area away from heavily trafficked areas and emergency exits and away from full or empty stored cylinders which contain flammable products. Do not allow the temperature where cylinders are stored to exceed 125F (52C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in - first out" inventory system to prevent full cylinders being stored for excessive periods of time.</p> <p>For additional storage recommendations, consult Compressed Gas Association's Pamphlets P-1, P-14, and G-4.</p>	
SPECIAL PACKAGING RECOMMENDATIONS	
<p>Carbon steels and low alloy steels are acceptable for use at lower pressures. For high pressure applications use stainless steels, copper and its alloys, nickel and its alloys, brass, bronze, silicon alloys, Monel®, Inconel®, or beryllium. Lead and silver or lead and tin alloys are good gasketing materials. Teflon® and Kel-F® are the preferred nonmetal gaskets.</p> <p>Special Note: It should be recognized that the ignition temperature of metals and nonmetals in pure oxygen service decreases with increasing oxygen pressure.</p>	
OTHER RECOMMENDATIONS OR PRECAUTIONS	
<p>Oxygen should not be used as a substitute for compressed air in pneumatic equipment since this type generally contains flammable lubricants. Equipment to contain oxygen must be "cleaned for oxygen service." See Compressed Gas Association Pamphlet G-4.1.</p> <p>Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder which has not been filled by the (Continued on Page 4)</p>	

*Various Government Agencies (i.e. Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation, handling, storage or use of this product which will not be reflected in this data sheet. The customer should review these regulations to ensure that he is in full compliance.

OXYGEN

HEALTH HAZARD DATA

TIME WEIGHTED AVERAGE EXPOSURE LIMIT: (Continued)

(approximately 21 molar % of the atmosphere). OSHA 1993 PEL (8 Hr. TWA) None listed.

SPECIAL PRECAUTIONS

OTHER RECOMMENDATIONS OR PRECAUTIONS: (Continued)

owner or with his (written) consent is a violation of Federal Law (49CFR).

Always secure cylinders in an upright position before transporting them. NEVER transport cylinders in trunks of vehicles, enclosed vans, truck cabs or in passenger compartments. Transport cylinders secured in open flatbed or in open pick-up type vehicles.

Reporting under SARA, Title III, Section 313 not required.

NFPA 704 NO. for oxygen = 1 0 0 OX