Praxair Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name: Ozone from Air (MSDS No. P-6219-A)	**Trade Name:** Not applicable
Chemical Name: Mixture of ozone and air	**Synonyms:** Triatomic oxygen in air
Formula: Mixture of O_3 and Air	**Chemical Family:** Not applicable
Telephone: **Emergencies:** 1-800-645-4633* **CHEMTREC:** 1-800-424-9300* **Routine:** 1-800-PRAXAIR	**Company Name:** Praxair-Traligaz Ozone Company 11501 Goldcoast Drive Cincinnati, OH 45249-1643

** Call emergency numbers 24 hours a day only for spills, leaks, fire, exposure, or accidents involving this product. For routine information, contact your supplier, Praxair sales representative, or call 1-800-PRAXAIR (1-800-772-9247).*

2. Composition/Information on Ingredients

This MSDS applies to ozone mixtures produced by passing air through an electrical discharge tube or through ultraviolet radiation. For custom mixtures of this product, request an MSDS for each component. See section 16 for important information about mixtures.

INGREDIENT	CAS NUMBER	CONCEN-TRATION	OSHA PEL	ACGIH TLV-TWA
Ozone	10028-15-6	3% max	0.1 ppm	See section 3.
Air	133259-10-0	97% min.	None currently established	None currently established
Nitrogen Oxides	See section 3.	Trace	See section 3.	See section 3.

3. Hazards Identification

EMERGENCY OVERVIEW

DANGER! Toxic, oxidizing gas.
Harmful or fatal if inhaled.
May accelerate combustion.
Irritates and may damage eyes, skin, and respiratory system.
May cause drowsiness.
Symptoms may be delayed
Self-contained breathing apparatus and protective clothing must be worn by rescue workers.
Odor: Unpleasant, sulfur-like

Revised

THRESHOLD LIMIT VALUE: ***Ozone:*** 0.1 ppm TLV-TWA, light work; 0.08 ppm, moderate work; 0.05 ppm, heavy work; heavy, moderate, or light workloads ≤ 2 hr*, 0.20 ppm (ACGIH, 1999). ***Nitrogen oxides as by-products:*** Nitric oxide (NO, CAS# 10102-43-9), 25 ppm TLV-TWA (PEL 25 ppm); nitrogen dioxide (NO_2, CAS# 10102-44-0), 3 ppm TLV-TWA (PEL, 5 ppm ceiling); nitrous oxide (N_2O, CAS# 10024-97-2), 50 ppm TLV-TWA (PEL N/A); nitrogen pentoxide (N_2O_5, CAS# unk.), N/A. ***Acids:*** nitrous acid (HNO_2, CAS# 7782-77-6), N/A; nitric acid (HNO_3, CAS# 7697-37-2), 2 ppm TLV-TWA (PEL 2 ppm). TLV-TWAs should be used as a guide in the control of health hazards and not as fine lines between safe and dangerous concentrations.

**The symbol ≤ means "less than or equal to."*

EFFECTS OF A SINGLE (ACUTE) OVEREXPOSURE:

INHALATION–Exposure to ozone concentrations above the TLV of 0.1 ppm may irritate the nose and throat, and cause dryness. Pain or congestion in the chest may be accompanied by wheezing and coughing. At concentrations above 0.3 ppm for 30 minutes, particularly in exercising individuals, these symptoms are more likely. Eye irritation, headache, nausea, and alterations in pulmonary function (lung impairment and breathing difficulty) may also occur. At concentrations above 0.9 ppm, respiratory effects worsen and drowsiness may occur. Levels near 9 ppm may cause pneumonia, excessive sweating, decreased blood pressure, and weak and rapid pulse. Death may occur from prolonged exposure at 2 ppm or short exposures (1-4 hours) at 10 ppm.

SKIN CONTACT–Contact with ozone may irritate the skin. Nitrogen oxide by-products may combine with moisture in the skin and mucous membranes to form nitrogen acids, producing chemical burns.

SWALLOWING–A highly unlikely route of exposure. This product is a gas at normal temperature and pressure.

EYE CONTACT–Exposed persons may sense eye irritation at or above the TLV of 0.1 ppm ozone. Exposure to ozone at 2 ppm over 4 hours has caused eye irritation in rabbits. Nitrous oxide is moderately irritating to the eyes and nose at 50 ppm; 25 ppm is irritating to some people. Nitrogen oxide by-products may combine with moisture in the eyes to form nitrogen acids, producing chemical burns.

EFFECTS OF REPEATED (CHRONIC) OVEREXPOSURE: Prolonged, low-level (0.3 ppm) exposure to ozone may produce scarring and thickening of small air passages, resulting in chronic lung disease. People with existing lung disease may show earlier and more severe symptoms when exposed to ozone. An increased susceptibility to lung disease and infection may also occur.

OTHER EFFECTS OF OVEREXPOSURE: None known for ozone, but see section 16 for effects of nitrogen compounds produced by the breakdown of ozone.

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: People with existing lung disease may show earlier and more severe symptoms when exposed to ozone. An increased susceptibility to lung disease and infection may also occur.

SIGNIFICANT LABORATORY DATA WITH POSSIBLE RELEVANCE TO HUMAN HEALTH HAZARD EVALUATION: There is limited evidence that ozone in concentrations of over 1.5 ppm may be lethal to rodent embryos. Studies of mutagenic effects in humans have been equivocal.

CARCINOGENICITY: Ozone is not listed by NTP, OSHA, and IARC.

4. First Aid Measures

INHALATION: Immediately remove to fresh air. If not breathing, give artificial respiration. Rescuer should avoid inhaling air from victim. Get immediate medical attention.

SKIN CONTACT: Immediately flush skin with plenty of water while removing contaminated clothing and shoes. Get immediate medical attention.

SWALLOWING: An unlikely route of exposure. This product is a gas at normal temperature and pressure.

EYE CONTACT: Immediately flush eyes with plenty of cool water for at least 15 minutes. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are flushed thoroughly. Do not allow victim to rub eyes. Get immediate medical attention.

NOTES TO PHYSICIAN: *Keep victim under observation. Onset of breathing difficulties may be delayed for up to 6 hours. There is no specific antidote. Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient.*

5. Fire Fighting Measures

FLASH POINT (test method)**:**	Not applicable	
AUTOIGNITION TEMPERATURE:	Not applicable	
FLAMMABLE LIMITS IN AIR, % by volume**:**	**LOWER:** Not applicable	**UPPER:** Not applicable

EXTINGUISHING MEDIA: Ozone from air cannot catch fire. Use media appropriate for surrounding fire.

SPECIAL FIRE FIGHTING PROCEDURES: DANGER! Toxic, oxidizing gas. (See section 3.) Evacuate all personnel from danger area. Do not approach area without self-contained breathing apparatus and protective clothing. Immediately cool any cylinders with water spray from maximum distance. Remove ignition sources if without risk. Stop flow of gas if without risk, while continuing cooling water spray. Remove any gas cylinders from area of fire if without risk. Heat of fire can build pressure in gas cylinders and cause rupture. No part of any cylinder should be subjected to a temperature higher than 125°F (52°C). On-site fire brigades must comply with OSHA 29 CFR 1910.156.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Contact with flammables may cause fire or explosion. (See section 10.)

HAZARDOUS COMBUSTION PRODUCTS: Thermal decomposition of the nitric oxide by-product may produce highly toxic nitrogen oxides. (See section 10.)

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: DANGER! Toxic, oxidizing gas. (See section 3.) Immediately evacuate all personnel from danger area. Use self-contained breathing apparatus where needed. Toxic gas may spread. Remove all sources of ignition if without risk. Reduce gas with fog or fine water spray. Shut off flow if without risk. Ventilate area.

WASTE DISPOSAL METHOD: Prevent waste from contaminating the surrounding environment. Keep personnel away. Discard any product, residue, disposable container, or liner in an environmentally acceptable manner, in full compliance with federal, state, and local regulations. If necessary, call your local supplier for assistance.

7. Handling and Storage

PRECAUTIONS TO BE TAKEN IN STORAGE: This mixture is produced and used in a closed system and is not stored.

PRECAUTIONS TO BE TAKEN IN HANDLING: This mixture is produced and used in a closed system and should not be handled.

8. Exposure Controls/Personal Protection

VENTILATION/ENGINEERING CONTROLS:

LOCAL EXHAUST–A corrosion-resistant system is acceptable so long as it maintains sufficient air flow to keep the ozone concentration below the TLV in the worker's breathing zone. (See SPECIAL.)

MECHANICAL (general)–Inadequate; see SPECIAL.

SPECIAL–Use only in a closed system. Corrosion-resistant, forced-draft fume hood is preferred.

OTHER–See SPECIAL.

RESPIRATORY PROTECTION: Select per OSHA 29 CFR 1910.134 and ANSI Z88.2. Use any NIOSH/MHSA-approved air-supplied respirator for concentrations up to 10 times the applicable permissible exposure limit. For concentrations from 10 to 100 times the PEL, use the above respirator fitted with a full facepiece, or use a self-contained breathing apparatus. For higher concentrations, a full-face, self-contained breathing apparatus operated in the pressure demand mode is required.

PROTECTIVE GLOVES: Wear plastic (not rubber) gloves wherever contact with product is possible.

EYE PROTECTION: Wear vapor-proof goggles and a face shield wherever contact with product is possible. Select per OSHA 29 CFR 1910.133.

OTHER PROTECTIVE EQUIPMENT: Protective clothing—plastic (not rubber)—and shoes whenever contact with product is possible—at a minimum, whenever the generator or process system is opened for any reason including routine inspection and maintenance. Select per OSHA 29 CFR 1910.132 and 1910.133. Regardless of protective equipment, never touch live electrical parts.

9. Physical and Chemical Properties

MOLECULAR WEIGHT:	48 (ozone component)
SPECIFIC GRAVITY (Air = 1) at 32°F (0°C) and 1 atm**:**	1.66 (ozone component)
SOLUBILITY IN WATER, wt/wt at 32°F (0°C) and 1 atm**:**	0.494 (ozone component)
BOILING POINT at 1 atm**:**	-168.34°F (-111.30°C) (ozone component)
MELTING POINT at 1 atm**:**	-313°F (-191.7°C) (ozone component)

APPEARANCE, ODOR, AND STATE: Colorless gas mixture at normal temperature and pressure; unpleasant, sulfur-like odor.

10. Stability and Reactivity

STABILITY: ☒ **Unstable** ☐ **Stable**

INCOMPATIBILITY (materials to avoid): Oxidizable materials, both organic and inorganic; hydrogen; iron, copper, chromium; water

HAZARDOUS DECOMPOSITION PRODUCTS: Nitric oxide, nitrogen dioxide, nitrogen pentoxide, nitrous oxide, nitrous acid, nitric acid

HAZARDOUS POLYMERIZATION: ☐ **May Occur** ☒ **Will Not Occur**

CONDITIONS TO AVOID: Avoid contact with all oxidizable materials, both organic and inorganic, including rubber. Ozone reacts with nonsaturated organic compounds to produce ozonides, which are unstable and may decompose with explosive violence. Ozone is an unstable gas that at normal temperatures decomposes to biatomic oxygen. At elevated temperatures and in the presence of certain catalysts such as hydrogen, iron, copper, and chromium, this decomposition may be explosive.

11. Toxicological Information

Ozone: Human inhalation: TC_{Lo}: 1860 ppb/75 min caused watering eyes, decreased pulse rate, falling blood pressure, and cough; 1 ppm caused cough, breathing difficulty, and other changes. Rat inhalation: TC_{Lo}: 1500 ppb/24 hr (17 to 20 days pregnancy) caused behavioral disorders in newborn; 1040 ppt/24 hr (6 to 9 days pregnancy) caused developmental abnormalities of the musculoskeletal system. LC_{50}: 4800 ppb/4-hrs (rat), LC_{50}: 12600 ppb/3-hrs (mouse), LC_{50}: 36ppm/3-hrs (rabbit).

12. Ecological Information

No information is available on ecological effects. Ozone from air does not contain any Class I or Class II ozone-depleting chemicals. Ozone from air is not listed as a marine pollutant by DOT.

13. Disposal Considerations

WASTE DISPOSAL METHOD: See section 6.

14. Transport Information

DOT/IMO SHIPPING NAME: Not shipped

HAZARD CLASS:	Not applicable	**IDENTIFICATION NUMBER:**	Not applicable	**PRODUCT RQ:**	Not applicable

SHIPPING LABEL(s): Not applicable

PLACARD (when required): Not applicable

SPECIAL SHIPPING INFORMATION: Not applicable

15. Regulatory Information

The following selected regulatory requirements may apply to this product. Not all such requirements are identified. Users of this product are solely responsible for compliance with all applicable federal, state, and local regulations.

U.S. FEDERAL REGULATIONS:

EPA (ENVIRONMENTAL PROTECTION AGENCY)

CERCLA: COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980 (40 CFR Parts 117 and 302):

Reportable Quantity (RQ): None

SARA: SUPERFUND AMENDMENT AND REAUTHORIZATION ACT:

SECTIONS 302/304: Require emergency planning based on Threshold Planning Quantity (TPQ) and release reporting based on Reportable Quantities (RQ) of extremely hazardous substances (40 CFR Part 355):

Threshold Planning Quantity (TPQ): 100 lb (45.4 kg)
Extremely Hazardous Substances (40 CFR 355): 100 lb (45.4 kg)

SECTIONS 311/312: Require submission of MSDSs and reporting of chemical inventories with identification of EPA hazard categories. The hazard categories for this product are as follows:

IMMEDIATE: Yes
DELAYED: Yes
PRESSURE: Yes
REACTIVITY: Yes
FIRE: Yes

SECTION 313: Requires submission of annual reports of release of toxic chemicals that appear in 40 CFR Part 372.

The ozone component of this mixture requires reporting under Section 313.

40 CFR 68: RISK MANAGEMENT PROGRAM FOR CHEMICAL ACCIDENTAL RELEASE PREVENTION: Requires development and implementation of risk management programs at facilities that manufacture, use, store, or otherwise handle regulated substances in quantities that exceed specified thresholds.

None of the components of this mixture requires is listed as a regulated substance.

TSCA: TOXIC SUBSTANCES CONTROL ACT: The components of this mixture are listed on the TSCA inventory.

OSHA: OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION**:**

29 CFR 1910.119: PROCESS SAFETY MANAGEMENT OF HIGHLY HAZARDOUS CHEMICALS: Requires facilities to develop a process safety management program based on Threshold Quantities (TQ) of highly hazardous chemicals.

The ozone component of this mixture is listed in Appendix A as a highly hazardous chemical in quantities of 100 lb (45.4 kg) or greater.

STATE REGULATIONS:

CALIFORNIA: Ozone is not listed by California under the SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (Proposition 65).

PENNSYLVANIA: This product is subject to the PENNSYLVANIA WORKER AND COMMUNITY RIGHT-TO-KNOW ACT (35 P.S. Sections 7301-7320).

16. Other Information

Be sure to read and understand all labels and instructions supplied or associated with this product.

ADDITIONAL SAFETY AND HEALTH HAZARDS: The presence of nitrogen and oxygen in the corona discharge leads to the formation of small amounts of nitrogen oxides, mainly nitrogen pentoxide (N_2O_5) and nitrogen dioxide (NO_2). N_2O_5 is a yellowish white solid that sublimes at 86°F (30°C) into NO_2 and O_2. NO_2 is a reddish brown gas that liquefies at 68°F (20°C), forming a reddish brown liquid. In contact with moisture in the feed gas, N_2O_5 forms highly corrosive nitric acid (HNO_3). Generally, the nitric acid will settle on the wall of the ozone generator. Inspection and maintenance personnel must take care not to not to get this acid on their skin or clothing.

An ACGIH review suggests that a 60-minute exposure of humans to 100 ppm nitrogen dioxide (NO_2) leads to pulmonary edema with possible subacute or chronic lesions in the lungs, and 25 ppm leads to respiratory irritation and chest pain. Whenever there is exposure to unusual amounts of nitrogen dioxide, the exposed persons should be under medical supervision for a period of 72 hours to detect the earliest signs of pulmonary edema. The odor of NO_2 is perceptible for some persons at 0.11 ppm and for most at 0.22 ppm. Dark adaptation and the ability to perceive dim lights is impaired by as little as 0.074 ppm. Exposure to 0.7 to 2 ppm for 10 minutes causes increased resistance to the flow of air in the respiratory tract.

OTHER HAZARDOUS CONDITIONS OF HANDLING, STORAGE, AND USE: ***Toxic, oxidizing gas.*** Harmful or fatal if inhaled. Do not breathe gas. Do not get vapors or liquid in eyes, on skin, or on clothing. (See section 3.) Have safety showers and eyewash fountains immediately available. ***Use piping and equipment adequately designed to withstand pressures to be encountered.*** Use only in a closed system constructed of corrosion-resistant materials. ***Never work on a pressurized system.*** If there is a leak, shut the system down. Blow down the system and purge it per instructions, in an environmentally safe manner and in compliance with all federal, state, and local laws, then repair the leak. ***Do not eat, drink, or smoke*** in areas where ozone is used. Wash hands and face thoroughly to clean them of any residual before eating, drinking, smoking, using the toilet, or applying cosmetics.

NOTE: *Prior to using any plastics, confirm their compatibility with ozone by-products.*

MIXTURES: When you mix two or more gases or liquefied gases, you can create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an industrial hygienist or other trained person when you evaluate the end product. Remember, gases and liquids have properties that can cause serious injury or death.

HAZARD RATING SYSTEMS:

NFPA RATINGS:		**HMIS RATINGS:**	
HEALTH	= 3	HEALTH	= 3
FLAMMABILITY	= 0	FLAMMABILITY	= 0
REACTIVITY	= 1	REACTIVITY	= 1
SPECIAL	= OX		

Ask your supplier about free Praxair safety literature. Further safety information can be found in the following pamphlets published by the Compressed Gas Association, Inc. (CGA), 1725 Jefferson Davis Highway, Arlington, VA 22202-4102, Telephone (703) 412-0900.

P-1 *Safe Handling of Compressed Gases in Containers*
— *Handbook of Compressed Gases, Third Edition*

Praxair asks users of this product to study this MSDS and become aware of product hazards and safety information. To promote safe use of this product, a user should (1) notify employees, agents, and contractors of the information in this MSDS and of any other known product hazards and safety information, (2) furnish this information to each purchaser of the product, and (3) ask each purchaser to notify its employees and customers of the product hazards and safety information.

The opinions expressed herein are those of qualified experts within Praxair, Inc. We believe that the information contained herein is current as of the date of this Material Safety Data Sheet. Since the use of this information and the conditions of use of the product are not within the control of Praxair, Inc., it is the user's obligation to determine the conditions of safe use of the product.

Praxair MSDSs are furnished on sale or delivery by Praxair or the independent distributors and suppliers who package and sell our products. To obtain current Praxair MSDSs for these products, contact your Praxair sales representative or local distributor or supplier. If you have questions regarding Praxair MSDSs, would like the form number and date of the latest MSDS, or would like the names of the Praxair suppliers in your area, phone or write the Praxair Call Center (**Phone:** 1-800-PRAXAIR; **Address:** Praxair Call Center, Praxair, Inc., PO Box 44, Tonawanda, NY 14150-7891).

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