Material Safety Data Sheet

Material Name: Manganous Oxide ID: C1-221

* * * Section 1 - Chemical Product and Company Identification * * *

Chemical Name: Manganous Oxide, Technical Standard Grade
Product Use: For Commercial Use
Synonyms: C.I. 77726; Cassel Green; Manganese Green; Manganese Oxide (MnO); Manganese (II) Oxide; Manganese Protoxide; Manganosite; Natural Manganosite

Supplier Information

Chem One Ltd.
14140 Westfair East Drive
Houston, Texas 77041-1104

Phone #: (713) 896-9966
Fax #: (713) 896-7540
Emergency #: (800) 424-9300 or (703) 527-3887

General Comments: FOR COMMERCIAL USE ONLY; NOT TO BE USED AS A PESTICIDE.
NOTE: Emergency telephone numbers are to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure, or accident involving chemicals. All non-emergency questions should be directed to customer service.

* * * Section 2 - Composition / Information on Ingredients * * *

CAS #	Components	Percent
1344-43-0	Manganous Oxide	> 100%

By analysis, this material contains: Manganese 60-62% equivalent as Manganese Oxide 76-78%. Iron 4.5-5.5%, Manganese Dioxide 1-2%, Barium Oxide 0.1-1.8%.

Component Related Regulatory Information
This product may be regulated, have exposure limits or other information identified as the following: Manganese and inorganic compounds, as Mn and/or Manganese, Fume, as Mn (7439-96-5).

Component Information/Information on Non-Hazardous Components
This product is considered hazardous under 29 CFR 1910.1200 (Hazard Communication).

* * * Section 3 - Hazards Identification * * *

Emergency Overview
Product is as green to greenish-brown crystalline or powdered, odorless solid. May cause irritation of the skin, eyes, and upper respiratory tract. Inhalation of dusts may cause pneumonia or asthma; inhalation of fumes from heated product may cause metal fume fever. This product is not flammable or reactive under normal conditions of use and handling. Large quantities of dust may cause hazard of air/dust explosion. Use methods suitable for the surrounding fire. Firefighters should wear full protective equipment and clothing.

Hazard Statements
Caution! May cause irritation to eyes, skin and upper respiratory tract. Inhalation of dusts can cause pneumonia; inhalation of fumes if heated may cause metal fume fever.

Potential Health Effects: Eyes
This product may cause irritation to the eyes.

Potential Health Effects: Skin
This product may cause irritation to the skin, especially if contact is prolonged.

Potential Health Effects: Ingestion
No human information is available. May cause abdominal pain and nausea. Manganous oxide dust is absorbed through the digestive tract.

Potential Health Effects: Inhalation
Dusts and mists from solutions may cause mild to moderate irritation of the nose and throat. Chronic poisoning primarily involves the central nervous system, early symptoms include languor, sleepiness and weakness in the legs, a stolid mask-like appearance of the face, emotional disturbances such as uncontrollable laughter, a spastic gait with tendency to fall in walking, high incidence of pneumonia has been found in workers exposed to the dust or fume, men exposed to dusts showed a decrease in fertility. Chronic exposure to fumes from this material may cause metal fume fever. Symptoms of metal fume fever occur about 4 to 12 hours after exposure and usually last about 24 hours. Recovery is complete with no apparent permanent disability. The symptoms resemble the "flu" and include: sweating, shivering, headache, fever, chills, thirst, muscle aches, nausea, vomiting, weakness, and tiredness. A metallic or sweet taste in the mouth, dryness or irritation of the throat, and coughing may occur at the time of exposure to the metal fumes.

* * * Section 3 - Hazards Identification * * *

HMIS Ratings: Health Hazard: 1 **Fire Hazard:** 0 **Physical Hazard:** 0
Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe * = Chronic hazard

* * * Section 4 - First Aid Measures * * *

First Aid: Eyes
Immediately flush eyes with large amounts of room temperature water, occasionally lifting the lower and upper lids, for at least 15 minutes. If symptoms persist after 15 minutes of irrigation, seek medical attention.

First Aid: Skin
Remove all contaminated clothing. For skin contact, wash thoroughly with soap and water for at least 20 minutes. Seek immediate medical attention if irritation develops or persists.

First Aid: Ingestion
DO NOT INDUCE VOMITING, unless directed by medical personnel. Have victim rinse mouth thoroughly with water, if conscious. Never give anything by mouth to a victim who is unconscious or having convulsions. Contact a physician or poison control center immediately.

First Aid: Inhalation
Remove source of contamination or move victim to fresh air. Apply artificial respiration if victim is not breathing. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Administer oxygen if breathing is difficult. Get immediate medical attention.

First Aid: Notes to Physician
There is no specific antidote. Care is symptomatic and supportive.

* * * Section 5 - Fire Fighting Measures * * *

Flash Point: Not applicable
Method Used: Not applicable
Upper Flammable Limit (UFL): Not applicable
Lower Flammable Limit (LFL): Not applicable
Auto Ignition: Not available
Flammability Classification: Not applicable
Rate of Burning: Not applicable

General Fire Hazards
This material will not burn.

Hazardous Combustion Products
This product decomposes to form magnesium oxides .

Extinguishing Media
Use methods for the surrounding fire.

Fire Fighting Equipment/Instructions
Firefighters should wear full protective clothing including self contained breathing apparatus.

NFPA Ratings: Health: 1 **Fire:** 0 **Instability:** 0 **Other:** None.
Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe

* * * Section 6 - Accidental Release Measures * * *

Containment Procedures
Stop the flow of material, if this can be done without risk. Contain the discharged material. If sweeping of a contaminated area is necessary use a dust suppressant agent, which does not react with product (see Section 10 for incompatibility information).

Clean-Up Procedures
Prevent material from entering sewers or waterways. Put material in suitable, covered, labeled containers.

Evacuation Procedures
Evacuate the area promptly and keep upwind of the spilled material. Isolate the spill area to prevent people from entering. Keep materials that burn away from spilled material. In case of large spills, follow all facility emergency response procedures.

Special Procedures
Remove soiled clothing and launder before reuse. Avoid all skin contact with the spilled material. Avoid inhalation of dusts. Wear adequate personal protective equipment. Have emergency equipment readily available.

* * * Section 7 - Handling and Storage * * *

Handling Procedures

All employees who handle this material should be trained to handle it safely. Do not breathe dust. Avoid all contact with skin and eyes. Use this product only with adequate ventilation. Wash thoroughly after handling.

Storage Procedures

Keep container tightly closed when not in use. Store containers in a cool, dry location, away from direct sunlight, sources of intense heat, or where freezing is possible. Keep containers closed. Material should be stored in secondary containers or in a diked area, as appropriate. Store containers away from incompatible chemicals (see Section 10, Stability and Reactivity). Storage areas should be made of fire-resistant materials. Post warning and "NO SMOKING" signs in storage and use areas, as appropriate. Use corrosion-resistant structural materials, lighting, and ventilation systems in the storage area. Floors should be sealed to prevent absorption of this material. Inspect all incoming containers before storage, to ensure containers are properly labeled and not damaged.

Have appropriate extinguishing equipment in the storage area (i.e., sprinkler system, portable fire extinguishers). Empty containers may contain residual particulates; therefore, empty containers should be handled with care. Never store food, feed, or drinking water in containers which held this product. Keep this material away from food, drink and animal feed. Do not store this material in open or unlabeled containers. Limit quantity of material stored. Wipe down area of use periodically to avoid the accumulation of dusts.

* * * Section 8 - Exposure Controls / Personal Protection * * *

Exposure Guidelines

A: General Product Information

No exposure guidelines have been established. There are exposure limits for, Manganese and Inorganic compounds, as Mn and Manganese fume (CAS # 7439-96-5)

B: Component Exposure Limits

The exposure limits given are for Manganese and Inorganic compounds, as Mn and Manganese fume:

ACGIH: TWA = 0.2 mg/m^3 (compounds and fumes)

OSHA: TWA = 1 mg/m^3 (fume) vacated 1989 PEL, 5 mg/m^3 (ceiling) (compounds) vacated 1989 PEL
STEL = 3 mg/m^3 (compounds and fume)

NIOSH RELs TWA = 1 mg/m^3 (compounds and fume)
STEL = 3 mg/m^3 (compounds and fume)
IDLH = 500 mg/m^3 (compounds and fume)

DFG MAKs: TWA = 0.5 mg/m^3 TWA (inhalable fraction) (compounds and fume)
PEAK = 3•MAK, 15 min., average value, 1-hr interval

Engineering Controls

Use general mechanical ventilation. Local exhaust is suggested for use, where possible, in enclosed or confined spaces.

PERSONAL PROTECTIVE EQUIPMENT

The following information on appropriate Personal Protective Equipment is provided to assist employers in complying with OSHA regulations found in 29 CFR Subpart I (beginning at 1910.132). Please reference applicable regulations and standards for relevant details.

Personal Protective Equipment: Eyes/Face

Wear safety glasses with side shields or chemical goggles. If necessary, refer to U.S. OSHA 29 CFR 1910.133.

Personal Protective Equipment: Skin

Wear appropriate work gloves for type of operation. If necessary, refer to U.S. OSHA 29 CFR 1910.138.

Personal Protective Equipment: Respiratory

None required where adequate ventilation conditions exist. If airborne concentration is high, use an appropriate respirator or dust mask. If respiratory protection is needed, use only protection authorized in the U.S. Federal OSHA Standard (29 CFR 1910.134), applicable U.S. 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 is required under OSHA's Respiratory Protection Standard (1910.134-1998).

Personal Protective Equipment: General

Use good hygiene practices when handling this material including changing and laundering work clothing after use. Have a safety shower or eye-wash fountain available. Wash hands thoroughly after handling material. Do not eat, drink, or smoke in work areas.

* * * Section 9 - Physical & Chemical Properties * * *

Physical Properties: Additional Information

The data provided in this section are to be used for product safety handling purposes. Please refer to Product Data Sheets, Certificates of Conformity or Certificates of Analysis for chemical and physical data for determinations of quality and for formulation purposes.

Appearance:	Green to greenish-brown crystals/powder	**Odor:**	Odorless
Physical State:	Solid	**pH:**	Not applicable.
Vapor Pressure:	Not available.	**Vapor Density:**	Not applicable
Boiling Point:	Not applicable	**Freezing/Melting Point:**	1650°C (3002 °F)
Solubility (H20):	Insoluble	**Specific Gravity:**	5.0-5.46.
Percent Volatile:	Not applicable	**Particle Size:**	200-325 mesh
Softening Point:	Not applicable	**Evaporation Rate:**	Not applicable
Viscosity:	Not applicable	**Bulk Density (loose):**	56-75 lb/ft^3
Chemical Formula:	MnO	**Molecular Weight:**	70.94

* * * Section 10 - Chemical Stability & Reactivity Information * * *

Chemical Stability

Under normal conditions of temperature and pressure, Manganous Oxide is stable.

Chemical Stability: Conditions to Avoid

Avoid high temperatures, excessive heat, incompatible materials.

Incompatibility:

Calcium hypochlorite, fluorine.

Hazardous Decomposition

Magnesium oxides.

Hazardous Polymerization

Will not occur.

* * * Section 11 - Toxicological Information * * *

Acute Toxicity

A: General Product Information

Acute exposure may cause mild skin, respiratory and eye irritation. Chronic exposure to dusts may lead to pneumonitis and manganese toxicity.

Inhalation exposures of rabbits to Manganous Oxide dust 4 hours/day for 3 to 6 months at levels of 10 to 20 mg/m^3 resulted in decreased hemoglobin and erythrocytes in the blood; manganese pneumonitis did not occur, but fibrotic changes in the lung resembling those in silicosis were observed.

B: Component LD50/LC50 (CAS # 1344-43-0)

LD_{50} (Subcutaneous-Mouse) 1 gm/kg

C: Component TDLo/TCLo (CAS # 1344-43-0)

TDLo (Subcutaneous-Monkey) 2 gm/kg/22 weeks-intermittent: Brain and Coverings: other degenerative changes; Biochemical: Neurotransmitters or modulators (putative): catecholamine levels in CNS, Neurotransmitters or modulators (putative): dopamine in striatum; TDLo (Subcutaneous-Mouse) 6000 mg/kg/12 days-intermittent.

D: Component LDLo/LCLo (CAS # 1344-43-0)

No data available.

E: Component LD/LC (CAS # 1344-43-0)

LD (Intratracheal-Rat) > 50 mg/kg

Carcinogenicity

A: General Product Information

Information not available.

B: Component Carcinogenicity

As a Manganese and Inorganic compound, Manganous Oxide is listed by the EPA as EPA-D (Not Classifiable as to Human Carcinogenicity). Manganous Oxide is not listed by ACGIH, IARC, NIOSH, NTP, or OSHA.

* * * Section 11 - Toxicological Information (Continued) * * *

Epidemiology

Information not available.

Neurotoxicity

Male macaque monkeys treated with repeated subcutaneous injections of Manganous Oxide produced signs of manganese neurotoxicity. After 5 months of treatment with approximately 8 g Mn, the monkeys became hypoactive and had an unsteady gait and tremor. Histopathological examination of the brains of these monkeys revealed a severe loss of neurons in the globus pallidus, whereas the rest of the brain was normal. In another study, both rats and monkeys were exposed to an aerosol of manganese tetraoxide produced by the combustion of MMT. After 9 months of exposure, no alterations of pulmonary function or visible signs of neurotoxicity were seen in either species, even in groups exposed to a concentration of 1152 $\mu g/m^3$. It is not clear why the monkeys used in this study were not affected because other studies have shown that non-human primates develop neurotoxicity when exposed to high levels of manganese.

Mutagenicity

No information available.

Teratogenicity

No information available.

Reproductive Toxicity

In a study of female rats, exposed to high levels of manganese, prenatal exposure to manganese resulted in faster maternal retrieval of offspring and depressed rearing frequency and exploratory behavior. Although both pre-mating and gestational exposure caused depressed activity in offspring, gestational exposure is more effective. Furthermore, continued exposure to manganese, via suckling, intensified the depression. These results indicate that prenatal and neonatal exposure of mice to high levels of manganese can have significant behavioral consequences, but the significance of these findings for humans is unclear.

Other Toxicological Information

A role of manganese in the development of bronchial asthma has been found in an epidemiologic study of miners, attributing to manganese the properties of a weak chemical allergen. Of the men examined 67.6% had worked in the mines more than 10 years. Allergic diseases of the respiratory tract were found in 8% of the workers, including 7.5% with bronchial asthma or asthmatic bronchitis, and 0.5% with rhinitis; extra-respiratory allergic diseases, eczema and urticaria, were found in 2.1%. Of 21 suffering form bronchial asthma, 10 displayed initial symptoms after recovering from acute respiratory infection while working in manganese production. The disease began gradually, but exacerbation of the condition distinctly correlated with the effect of the mine dust. The etiologic relation of manganese to bronchial asthma was shown by the disappearance of symptoms during the holidays and redevelopment after returning to work. Confirmation of the etiologic role of manganese was made by specific clinical allergenic and immunologic studies (patch tests of the delayed type, promotive inhalation test, and determination of specific damage to basophils). In common with the specific development of allergic states, it was found that bronchial asthma developed rarely (1.6%) in working areas with high manganese dust concentration. With low dust concentration, at or slightly above the Soviet MAK of 0.3 mg manganese/m^3, the number of patients was considerably higher (7.5%), a finding in agreement with reduction in intensity of the skin reaction in guinea pigs with increased sensitizing doses. Further establishment of the role of manganese in bronchial asthma was found from a comparison study of persons exposed to manganese in mining operations.

* * * Section 12 - Ecological Information * * *

Ecotoxicity

No information available.

Environmental Fate

No potential for food chain concentration.

* * * Section 13 - Disposal Considerations * * *

US EPA Waste Number & Descriptions

A: General Product Information

As shipped, product is not considered a hazardous waste by the EPA.

B: Component Waste Numbers

No EPA Waste Numbers are applicable for this product's components.

Disposal Instructions

Review federal, provincial, and local government requirements prior to disposal. Disposal by controlled incineration or secure landfill may be acceptable.

* * * Section 14 - Transportation Information * * *

NOTE: The shipping classification information in this section (Section 14) is meant as a guide to the overall classification of the product. However, transportation classifications may be subject to change with changes in package size. Consult shipper requirements under I.M.O., I.C.A.O. (I.A.T.A.) and 49 CFR to assure regulatory compliance.

US DOT Information

Shipping Name: Not Regulated
Hazard Class: Not Classified
UN/NA #: Not Classified
Packing Group: None
Required Label(s): None

50th Edition International Air Transport Association (IATA):

For Shipments by Air transport: This information applies to air shipments both within the U.S. and for shipments originating in the U.S., but being shipped to a different country.

UN/NA #: UN 3077
Proper Shipping Name: Environmentally Hazardous Substance, solid, n.o.s. (Manganous Oxide)
Hazard Class: 9 (Miscellaneous Dangerous Goods)
Packing Group: III
Passenger & Cargo Aircraft Packing Instruction: 911
Passenger & Cargo Aircraft Maximum Net Quantity: 400 kg
Limited Quantity Packing Instruction (Passenger & Cargo Aircraft): Y911
Limited Quantity Maximum Net Quantity (Passenger & Cargo Aircraft): 30 kg G
Cargo Aircraft Only Packing Instruction: 911
Cargo Aircraft Only Maximum Net Quantity: 400 kg
Excepted Quantities: E1
Special Provisions: A97, A158
ERG Code: 9L

Limited Quantity Shipments: Shipments for air must be marked with the Proper Shipping Name Environmentally Hazardous Substance, solid, n.o.s. (Manganous Oxide) and shall be marked with the UN Number (3077) preceded by the letters "UN", placed within a diamond. The width of the line forming the diamond shall be at least 2 mm; the number shall be at least 6 mm high. The total weight of each outer packaging cannot exceed 30 kg.

Excepted Quantities: The maximum quantity of this material per inner receptacle is limited to 30 g per receptacle and the aggregate quantity of this material per completed package does not exceed 1kg. The inner receptacles must be securely packed in an intermediate packaging with cushioning material to prevent movement in the inner receptacles and packed in a strong outer box with a gross mass not to exceed 29kg. The completed package must meet a drop test. The requirements are found in 2.7.6.1. The package must not be opened or otherwise altered until it is no longer in commerce. For air transportation no shipping paper is required. The package must be legibly marked with the following marking:

NOTE: The "*" must be replaced by the primary hazard class, or when assigned, the division of each of the hazardous materials contained in the package. The "**" must be replaced by the name of the shipper or consignee if not shown elsewhere on the package. The symbol shall be not less than 100 mm x 100 mm and must be durable and clearly visible.

International Maritime Organization (I.M.O.) Classification

Manganous Oxide is not regulated under I.M.O.

* * * Section 15 - Regulatory Information * * *

US Federal Regulations

A: General Product Information

No additional information.

B: Component Information

As a manganese compound, Manganous Oxide is a SARA Section 313 (40 CFR 372.65) compound; the SARA 313 Category Code is N450. This material is a CERCLA (40 CFR 302.4) compound, but has no specific CERCLA RQ assigned. This material is not listed under SARA Section 302 (40 CFR 355 Appendix A).

Manganous Oxide (1344-43-0)

CERCLA: Final RQ = Not Applicable

SARA 302 (EHS TPQ) There are no specific Threshold Planning Quantities for Manganous Oxide. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lbs. (4,540 kg) therefore applies, per 40 CFR 370.20.

C: Sara 311/312 Tier II Hazard Ratings:

Component	CAS #	Fire Hazard	Reactivity Hazard	Pressure Hazard	Immediate Health Hazard	Chronic Health Hazard
Manganous Oxide	1344-43-0	No	No	No	Yes	No

State Regulations

A: General Product Information

Other state regulations may apply.

* * * Section 15 - Regulatory Information * * *

US Federal Regulations (continued)

Other Regulations

A: General Product Information

Manganous Oxide is listed as a hazardous air pollutant (HAP) generally known or suspected to cause serious health problems. The Clean Air Act, as amended in 1990, directs EPA to set standards requiring major sources to sharply reduce routine emissions of toxic pollutants. EPA is required to establish and phase in specific performance based standards for all air emission sources that emit one or more of the listed pollutants. Manganous oxide is included on this list.

B: Component Analysis - Inventory

Component	CAS #	TSCA	DSL	EINECS
Manganous Oxide	1344-43-0	Yes	Yes	Yes

C: Component Information (Canada)

No components are listed in the WHMIS IDL

Component	CAS #	Minimum Concentration
Manganous Oxide	1344-43-0	No disclosure limit

ANSI Labeling (Z129.1):

CAUTION! MAY CAUSE IRRITATION TO EYES, SKIN AND UPPER RESPIRATORY TRACT. INHALATION OF DUSTS CAN CAUSE PNEUMONIA; INHALATION OF FUMES IF HEATED MAY CAUSE METAL FUME FEVER. Avoid contact with skin, eyes, or clothing. Do not taste or swallow. Avoid breathing dusts and particulates. Use only with adequate ventilation. Wash thoroughly after handling. Wear gloves, goggles, faceshields, suitable body protection, and NIOSH-approved respiratory protection, as appropriate. **FIRST-AID:** In case of contact, immediately flush skin or eyes with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. If inhaled, remove to fresh air. If ingested, do not induce vomiting. Get medical attention. **IN CASE OF FIRE:** Use water fog, dry chemical, CO_2, or "alcohol" foam. **IN CASE OF SPILL:** Absorb spill with inert material. Place residue in suitable container. Consult Material Safety Data Sheet for additional information.

* * * Section 16 - Other Information * * *

Other Information

Chem One Ltd. ("Chem One") shall not be responsible for the use of any information, product, method, or apparatus herein presented ("Information"), and you must make your own determination as to its suitability and completeness for your own use, for the protection of the environment, and for health and safety purposes. You assume the entire risk of relying on this Information. In no event shall Chem One be responsible for damages of any nature whatsoever resulting from the use of this product or products, or reliance upon this Information. By providing this Information, Chem One neither can nor intends to control the method or manner by which you use, handle, store, or transport Chem One products. If any materials are mentioned that are not Chem One products, appropriate industrial hygiene and other safety precautions recommended by their manufacturers should be observed. Chem One makes no representations or warranties, either express or implied of merchantability, fitness for a particular purpose or of any other nature regarding this information, and nothing herein waives any of Chem One's conditions of sale. This information could include technical inaccuracies or typographical errors. Chem One may make improvements and/or changes in the product (s) and/or the program (s) described in this information at any time. If you have any questions, please contact us at Tel. 713-896-9966 or E-mail us at Safety@chemone.com.

Key/Legend

EPA = Environmental Protection Agency; TSCA = Toxic Substance Control Act; ACGIH = American Conference of Governmental Industrial Hygienists; IARC = International Agency for Research on Cancer; NIOSH = National Institute for Occupational Safety and Health; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration

Contact Person: Sue Palmer-Koleman, PhD **Contact Phone:** (713)-896-9966

Revision Log

10/18/07 4:20 PM SEP Updated IATA Section 14
10/15/08 8:59 AM DLY Changed Chem One Physical Address, Section 1
12/07/10 4:08 PM SEP Update IATA

This is the end of MSDS #C1-221