1. Product And Company Identification

Supplier
Colonial Metals, Inc.
Building 20
505 Blue Ball Road
Elkton, MD 21921 United States

Company Contact: Michael Doss - Dir. of Regulatory Affairs
Telephone Number: 410-398-7200
FAX Number: 410-398-2918
E-Mail: mdoss@colonialmetals.com
Web Site: www.colonialmetals.com

Manufacturer
Colonial Metals, Inc.
Building 20
505 Blue Ball Road
Elkton, MD 21921 United States

Company Contact: Michael Doss - Dir. of Regulatory Affairs
Telephone Number: 410-398-7200
FAX Number: 410-398-2918
E-Mail: mdoss@colonialmetals.com
Web Site: www.colonialmetals.com

Supplier Emergency Contacts & Phone Number
Chemtrac: 800-424-9300
World Wide - Call COLLECT to U.S: 703-527-3887

Manufacturer Emergency Contacts & Phone Number
Chemtrac: 800-424-9300
World Wide - Call COLLECT to U.S: 703-527-3887

Issue Date: 08/05/2013

Product Name: Osmium (VIII) Oxide
Chemical Name: Osmium Tetroxide, Osmic acid, Osmic Anhydrate, Osmium (VIII) Oxide
CAS Number: 20816-12-0
Chemical Family: Platinum Group Metal Salts
Chemical Formula: OsO4
RCRA Number: P087
MSDS Number: 4008
Product Code: 4008

Synonyms
Osmic Acid, Osmium (VIII) Oxide, Osmic acid anhydride

2. Composition/Information On Ingredients

<table>
<thead>
<tr>
<th>Ingredient Name</th>
<th>CAS Number</th>
<th>Percent Of Total Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osmium Tetroxide/Osmium Oxide</td>
<td>20816-12-0</td>
<td>99.9</td>
</tr>
</tbody>
</table>

EMERGENCY OVERVIEW

THE SUBSTANCE CAN BE ABSORBED INTO THE BODY BY INHALATION OF ITS VAPORS, BY INHALATION OF ITS AEROSOL AND BY INGESTION. A HARMFUL CONTAMINATION OF AIR CAN BE REACHED VERY QUICKLY ON EVAPORATION OF THIS SUBSTANCE AT 20 DEGREE C. CONTACT WITH COMBUSTIBLE MATERIAL MAY CAUSE FIRE.

OSHA Hazards
Oxidizing, Target Organ Effect, Highly toxic by inhalation, Highly toxic by ingestion, Highly toxic by skin absorption,
EMERGENCY OVERVIEW - Continued

Respiratory sensitiser, Corrosive

Target Organs
Eyes, Central nervous system, Male reproductive system, Kidney

Other hazards which do not result in classification
Lachrymator.

GHS Classification
Acute toxicity, Inhalation (Category 1)
Acute toxicity, Dermal (Category 2)
Acute toxicity, Oral (Category 2)
Skin corrosion (Category 1B)
Serious eye damage (Category 1)
Respiratory sensitization (Category 1)

GHS Label elements, including precautionary statements
Signal Word 'DANGER'
Hazard statement(s)
H300 + H310 Fatal if swallowed or in contact with skin
H314 Causes severe skin burns and eye damage.
H330 Fatal if inhaled.
H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled.
Precautionary statement(s)
P260 Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264 Wash hands thoroughly after handling.
P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.
P284 Wear respiratory protection.
P302 + P350 IF ON SKIN: Gently wash with plenty of soap and water.
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310 Immediately call a POISON CENTER or doctor/ physician.

3. Hazards Identification

Primary Routes(s) Of Entry
Eyes: Likely
Inhalation: Likely
Skin: Likely
Ingestion: Likely

Eye Hazards
REDNESS, PAIN, BLURRED VISION, LOSS OF VISION, SEVERE DEEP BURNS.

Skin Hazards
POSSIBLE SKIN DISCOLORATION (green or black), REDNESS, SKIN BURNS, PAIN, BLISTERS. VERY TOXIC IN CONTACT WITH THE SKIN.
### 3. Hazards Identification - Continued

**Ingestion Hazards**
ABDOMINAL CRAMPS, BURNING SENSATION, SHOCK OR COLLAPSE. VERY TOXIC IF SWALLOWED.

**Inhalation Hazards**
BURNING SENSATION, COUGH, HEADACHE, WHEEZING, SHORTNESS OF BREATH, VISUAL DISTURBANCES, SYMPTOMS MAY BE DELAYED. VERY TOXIC IF INHALED.

**Subchronic (Target Organ Effects)**
EYES, SKIN, RESPIRATORY SYSTEM, CENTRAL NERVOUS SYSTEM.

**Conditions Aggravated By Exposure**
AVOID ALL CONTACT WITH THIS CHEMICAL.

**Conditions Aggravated By Overexposure**
POTENTIAL KIDNEY DAMAGE.

### 4. First Aid Measures

**Eye**
FIRST RINSE WITH PLENTY OF WATER FOR 15 MINUTES. CONTACT A PHYSICIAN IMMEDIATELY.

**Skin**
RINSE WITH PLENTY OF WATER FOR 15 MINUTES, REMOVE CONTAMINATED CLOTHING AND SHOES AND WASH BEFORE REUSE. CONTACT A PHYSICIAN IMMEDIATELY.

**Ingestion**
RINSE MOUTH PROVIDED VICTIM IS CONSCIOUS. NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON. GIVE NOTHING TO DRINK. REST. CONTACT A PHYSICIAN IMMEDIATELY.

**Inhalation**
REMOVE TO FRESH AIR IMMEDIATELY, REST. HALF-UPRIGHT POSITION. ARTIFICIAL RESPIRATION IF INDICATED, CONTACT A PHYSICIAN IMMEDIATELY.

### 5. Fire Fighting Measures

**Flash Point:** NA °C  
**Flash Point Method:** NA  
**Autoignition Point:** NA °C  
**Flammability Class:** NA  

**Fire And Explosion Hazards**
O4Os is a strong oxidizer and may react explosively with many organic compounds. Risk of fire and explosion when mixed with combustible substances. No contact with flammable substances. Not combustible but enhances combustion of other substances. Emits toxic fumes under fire conditions.
5. Fire Fighting Measures - Continued

Extinguishing Media
Suitable: Carbon dioxide, dry chemical powder, appropriate foam

Fire Fighting Instructions
Use NIOSH/MSHA approved self-contained breathing apparatus and full protective clothing.

6. Accidental Release Measures
EVACUATE AREA IMMEDIATELY! CONSULT AN EXPERT (Onsite HazMat Team or 911). SWEEP SPILLED SUBSTANCE INTO CONTAINERS; IF APPROPRIATE, MOISTEN FIRST TO PREVENT DUSTING THEN REMOVE TO SAFE PLACE. DO NOT ABSORB IN SAW-DUST OR OTHER COMBUSTIBLE MATERIAL, DO NOT LET THIS CHEMICAL ENTER THE ENVIRONMENT (EXTRA PERSONAL PROTECTIVE EQUIPMENT WITH FULL PROTECTIVE EQUIPMENT AND SELF-CONTAINED BREATHING APPARATUS IS A MUST).

Handling & Storage (Pictograms)

7. Handling And Storage

Handling And Storage Precautions
Keep containers tightly closed. Wash thoroughly after handling.

Handling Precautions
If eyes are exposed to vapor over a short period of time, night vision will be affected for about one evening. One will notice colored halos around lights. Avoid contact with eyes, skin and clothing. Avoid breathing dust or solution spray. Avoid exposure to vapor. Avoid prolonged or repeated exposure. Keep container closed when not in use. Use only with adequate personal protection. Use with local exhaust ventilation. Use only in closed systems. Use NIOSH approved respiratory protection.

Storage Precautions
Keep tightly closed. Do not store directly on ground. Do not store near combustible materials. Keep away from heat, sparks, flame, and other sources of ignition. Store in a cool, dry place.

Work/Hygienic Practices
Wash thoroughly with soap and water after handling. Use good personal hygiene.

Other Precautions
0.1 mg/m3 supplied air respirator with a full facepiece, any self-contained breathing apparatus with a full facepiece. Any chemical cartridge respirator with a high efficiency particulate filter with a full facepiece and cartridges providing protection against osmic acid. Any air-purifying full facepiece respirator (gas mask) with a chin style or front or back mounted canister providing protection against osmium tetroxide and having a high efficiency particulate filter. 1 mg/m3 any supplied air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode

Emergency or planned entry in unknown concentration or immediately dangerous to life or health conditions. Any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode. Any self-contained breathing apparatus.

Escape: Any air-purifying full face piece respirator (gas mask) with a chin-style or front or back mounted canister providing protection against osmium tetroxide and having a high efficiency particulate filter. Any appropriate escape type self-contained breathing apparatus.

LDLH 1mg/m3
### 8. Exposure Controls/Personal Protection

#### Engineering Controls
- **Ventilation:** Local Exhaust: Required in handling area
- **Mechanical:** Desirable to insure concentration of material below TLV/TWA levels
- **Other:** Fume Hood

#### Safety shower and eyewash

#### Eye/Face Protection
- ANSI approved safety glasses/goggles or full face piece with respirator

#### Skin Protection
- Rubber/Neoprene (use compatible chemical-resistant gloves).

#### Respiratory Protection
- NIOSH approved chemical cartridge respirator for acid gas and dust/mist/fume or self-contained breathing apparatus with full face shield.

#### Other/General Protection
- Lab coat/apron, flame and chemical resistant protective clothing, eye wash, safety shower, and hygiene facilities for washing.

#### Ingredient(s) - Exposure Limits

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>TWA</th>
<th>ST</th>
<th>OSHA PEL</th>
<th>IDLH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osmium Tetroxide/Osmium Oxide</td>
<td>0.002 MG/M3 (0.002 PPM)</td>
<td>0.006 MG/M3 (0.0006 PPM)</td>
<td>0.002 MG/M3</td>
<td>1 MG/M3 AS (Os)</td>
</tr>
</tbody>
</table>

**CONVERSION:** 1 PPM = 10.40 MG/M3

#### 9. Physical And Chemical Properties

**Appearance**
- Colorless yellow solid

**Odor**
- A sharp chlorine like odor

**Chemical Type:** Mixture

**Physical State:** Solid

- **Melting Point:** 107.6 °F 39.5-41.0 °C
- **Boiling Point:** 266.0 °F 130 °C
- **Specific Gravity:** 4.9 g/cm3
- **Molecular Weight:** 254.2
- **Percent Volatiles:** NL
- **Percent VOCs:** NL

**Packing Density:** RELATIVE DENSITY - 4.9

**Vapor Pressure:** 7 mmHg

**Vapor Density:** 8.8

**pH Factor:** NL At a Concentration Of NL
9. Physical And Chemical Properties - Continued

| Solubility: | 6% @ 77 DEGREE F |
| Viscosity: | NL |
| Evaporation Rate: | NE |

NON-COMBUSTIBLE SOLID.

10. Stability And Reactivity

| Stability: | Stable |
| Hazardous Polymerization: | Will not occur |

**Conditions To Avoid (Stability)**
- COMBUSTIBLE MATERIAL, HCl AND OXIDIZED AGENTS.

**Incompatible Materials**
- STRONG REDUCING AGENTS, ORGANIC MATERIALS, FINELY POWDERED METALS, COMBUSTIBLE MATERIAL, AND OXIDIZED AGENTS. CONTACT WITH HYDROCHLORIC ACID WILL CAUSE A FORMATION OF POISONESS CHLORINE GAS.

**Hazardous Decomposition Products**
- BEGINS TO SUBLIME BELOW BOILING POINT AND RELEASES A POISONESS AND IRRITATING VAPOR. CONTACT WITH OTHER MATERIALS MAY CAUSE FIRE.

**Conditions To Avoid (Polymerization)**
- WILL NOT POLYMERIZE.

11. Toxicological Information

**Reproductive Effects**

**Chronic**
- Species: Rat
- Dose: 20336 UMOL/L
- Route of Application: Intratesticular
- Exposure Time: (1D MALE)
- Result paternal effects: Spermatogenesis (including genetic material, sperm morphology, motility, and count).
- Paternal effects: Testes, epididymis, sperm duct

- Species: Mouse
- Dose: 20336 UMOL/L
- Route of Application: Subcutaneous
- Exposure Time: (30D MALE)
- Result paternal effects: Spermatogenesis (including genetic material, sperm morphology, motility, and count).
- Paternal effects: Testes, epididymis, sperm duct

**Mutagenicity (Genetic Effects)**

**Chronic**
- Species: Hamster
- Dose: 200 UMOL/L
- Cell type: Embryo
- Mutation test: Unscheduled DNA synthesis

**Conditions Aggravated By Exposure**
- REPEATED OR PROLONGED CONTACT WITH SKIN MAY CAUSE DERMATITIS. THE SUBSTANCE MAY CAUSE EFFECT ON THE KIDNEY.
11. Toxicological Information - Continued

**Conditions Aggravated By Overexposure**

REPEATED OR PROLONGED CONTACT WITH SKIN MAY CAUSE DERMATITIS. THE SUBSTANCE MAY CAUSE EFFECT ON THE KIDNEY.

<table>
<thead>
<tr>
<th>Mode of Exposure</th>
<th>Species</th>
<th>LD50 Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intraperitoneal</td>
<td>Rat</td>
<td>14100 UG/KG</td>
</tr>
<tr>
<td>Intraperitoneal</td>
<td>Mouse</td>
<td>13500 UG/KG</td>
</tr>
<tr>
<td>Oral</td>
<td>Mouse</td>
<td>162 mg/kg</td>
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</table>

12. Ecological Information

**Toxicity - Aquatic And Terrestrial Plants**

THIS SUBSTANCE MAY BE HAZARDOUS TO THE ENVIRONMENT; SPECIAL ATTENTION SHOULD BE GIVEN TO CRUSTACEA.

13. Disposal Considerations

Consult Federal EPA, State and local regulations for proper disposal/recycle/reclamation

NOTE: Chemical additions, processing, or otherwise altering this material may make the waste management information presented above incomplete, inaccurate, or otherwise inappropriate.

**RCRA Information**

OsO4 is a listed EPA Hazardous Waste - P087

14. Transport Information

**Proper Shipping Name**

OSMIUM TETROXIDE

**Hazard Class**

6.1

**Secondary Hazard Class**

NA

**DOT Identification Number**

2471
14. Transport Information - Continued

<table>
<thead>
<tr>
<th>DOT Shipping Label</th>
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<tr>
<td>Toxic substances</td>
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</table>

<table>
<thead>
<tr>
<th>Freight Class</th>
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<tbody>
<tr>
<td>NL</td>
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<table>
<thead>
<tr>
<th>Packaging Exceptions</th>
</tr>
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<tbody>
<tr>
<td>SEE DOT Regulations</td>
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</table>

<table>
<thead>
<tr>
<th>Packaging Requirements</th>
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<td>PG I</td>
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<thead>
<tr>
<th>Additional Shipping Paper Description</th>
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<tbody>
<tr>
<td>IATA REGULATIONS:</td>
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</table>

IATA REGULATIONS ARE THE SAME AS DOT REGULATIONS. ALWAYS CONSULT IATA HANDBOOK BEFORE SHIPPING.

<table>
<thead>
<tr>
<th>DOT (Pictograms)</th>
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<tr>
<th>TDG - Canada (Pictograms)</th>
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15. Regulatory Information

<table>
<thead>
<tr>
<th>U.S. Regulatory Information</th>
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</table>

THIS CHEMICAL IS TSCA LISTED, AND IS ALSO cGMP UNDER FDA FOR IVD TESTING.

<table>
<thead>
<tr>
<th>SARA Hazard Classes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Health Hazard</td>
</tr>
<tr>
<td>Chronic Health Hazard</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>SARA Section 304 Reportable Quantity:</th>
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<tbody>
<tr>
<td>1000</td>
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</table>

SARA Title III - Section 313 Form "R"/TRI Reportable Chemical

<table>
<thead>
<tr>
<th>SARA Section 313 Notification</th>
</tr>
</thead>
</table>

This compound is subject to the reporting requirements of SARA Section 313.

<table>
<thead>
<tr>
<th>State Regulations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Massachusetts Right To Know Components</td>
</tr>
<tr>
<td>Osmic Acid CAS-No. 20816-12-0</td>
</tr>
</tbody>
</table>

| Pennsylvania Right To Know Components |
| Osmic Acid CAS-No. 20816-12-0 |

| New Jersey Right To Know Components |
| Osmic Acid CAS-No. 20816-12-0 |

| California Prop. 65 Components |
| This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm. |
15. Regulatory Information - Continued

**Canadian Regulatory Information**

This product has been classified in accordance with the hazard criteria of CPR, and the MSDS contains all the information required by the CPR.

DSL: Yes  
NDSL: No

**European Union (EU) Regulatory Information**

**INDICATION OF DANGER:** T +

**SYMBOL OF DANGER:** VERY TOXIC

**RISK #:** 26/27/28-34

**RISK PHRASE:** Very toxic by inhalation, in contact with skin and if swallowed. Causes burns.

**SAFETY #:** 7/9-26-45

**SAFETY PHRASE:** Keep container tightly closed and in well-ventilated place. In case of contact with eyes, rinse immediately with water and seek medical advice. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

**Right-To-Know (Pictograms)**

![Pictograms](image)

**WHMIS - Canada (Pictograms)**

![Pictograms](image)

**NFPA**

<table>
<thead>
<tr>
<th></th>
<th><strong>HMIS</strong></th>
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<tbody>
<tr>
<td>0</td>
<td>HEALTH 4</td>
</tr>
<tr>
<td>3</td>
<td>FLAMMABILITY 0</td>
</tr>
<tr>
<td>4</td>
<td>REACTIVITY 3</td>
</tr>
<tr>
<td></td>
<td>PERSONAL PROTECTION J</td>
</tr>
</tbody>
</table>

16. Other Information

**Precautionary Label**

Oxidizer, Target Organ Effect, Highly toxic by inhalation, Highly toxic by ingestion, Highly toxic by skin absorption, Respiratory sensitisier, Corrosive

**Revision/Preparer Information**

MSDS Preparer: Michael Doss - Dir Regulatory Affairs  
MSDS Preparer Phone Number: 410-398-7200  
This MSDS Supersedes A Previous MSDS Dated: 01/02/2003
Disclaimer

In compliance with the OSHA Hazard Communication Standard, 2.9 C.F.R 1910.1200, we are providing you with a Materials Safety Data Sheet (MSDS) for the hazardous material you are purchasing.

It is your responsibility to educate your employees on the safe use of the hazardous material. With this in mind, a copy should be forwarded to the supervisor of the user or to the user themselves, and copy should be retained in your files for future reference.

Colonial Metals, Inc. makes no presentation as to the accuracy of the information in the MSDS. The information is believed to be correct; however, you (the customer), should perform your own investigation and independent verification. If you resell the product, you are responsible to forward the information in the MSDS to your customer.

Colonial Metals, Inc.