Section 1: Product and Company Identification

Product Name: Osmium Tetroxide Crystals
Synonym: Osmic Acid, Osmium (VIII) Oxide, Osmic acid anhydride

Company Name
Ted Pella, Inc., P.O. Box 492477, Redding, CA 96049-2477
Inside USA and Canada 1-800-237-3526 (Mon-Thu. 6:00AM to 4:30PM PST; Fri 6:00AM to 4:00PM PST)
Outside USA and Canada 1-530-243-2200 (Mon-Thu. 6:00AM to 4:30PM PST; Fri 6:00AM to 4:00PM PST)

CHEMTREC USA and Canada Emergency Contact Number 1-800-424-9300 24 hours a day
CHEMTREC Outside USA and Canada Emergency Contact Number +1-703-741-5970 24 hours a day

Section 2: Hazard Identification

Classification of the substance or mixture.

Signal Word: DANGER

GHS Categories:
GHS05 - Corrosive
GHS06 - Acute Toxicity
Oral: Category 1
Dermal: Category 2
Inhalation: Category 3
GHS07 - Irritant
Skin Corrosion: Category 1A
Eye Damage: Category 1
GHS08 - Health Hazard
Reproductive Toxicity: Category 2
Specific target organ toxicity: Category 3

Label elements
GHS Pictograms:

Hazard Statements
H300 + H310 Fatal if swallowed or in contact with skin.
H331 Toxic if inhaled.
H314 Causes severe skin burns and eye damage.
H361 Suspected of damaging fertility or the unborn child.
H335 May cause respiratory irritation.

Precautionary Statements
P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.
P260 Do not breathe dust/fume/gas/mist/vapors/spray.
P262 Do not get in eyes, on skin, or on clothing.
P264 Wash thoroughly after handling.
Do not eat, drink or smoke when using this product.

Use only outdoors or in a well-ventilated area.

Wear protective gloves/protective clothing/eye protection/face protection.

If swallowed: Immediately call a poison center/doctor.

Specific treatment (see on this label)

If swallowed: Rinse mouth. Do NOT induce vomiting.

If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.

IF INHALED: Remove person to fresh air and keep comfortable for breathing.

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do so. Continue rinsing.

IF exposed or concerned: Get medical advice/attention.

Call a poison center/doctor if you feel unwell.

Take off immediately all contaminated clothing and wash it before reuse.

Store in a well-ventilated place. Keep container tightly closed.

Dispose of contents/container in accordance with local/regional/national international regulations.

Classification complies with OSHA Hazard Communication Standard (29 CFR 1910.1200) and is consistent with the provisions of the United Nations Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

Section 3: Composition / Information on Ingredients

<table>
<thead>
<tr>
<th>Hazardous Component(s)</th>
<th>CAS No.</th>
<th>EC No.</th>
<th>Index No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osmium (VIII) Oxide</td>
<td>20816-12-0</td>
<td>244-058-7</td>
<td>076-001-00-5</td>
</tr>
</tbody>
</table>

Section 4: First Aid Measures

General advice: Immediately remove any clothing soiled by the product.

Remove breathing apparatus only after contaminated clothing have been completely removed. In case of irregular breathing or respiratory arrest provide artificial respiration.

Inhalation: Supply fresh air or oxygen; call for physician.

In case of unconsciousness, place patient stably in side position for transport.

Skin Contact: Immediately wash with water and soap and rinse thoroughly.

Eye(s) Contact: Rinse opened eye for several minutes under running water; consult a physician.

Ingestion: Drink copious amounts of water and provide fresh air. Immediate call for a physician.

Note to physician:
Most important symptoms and effects, both acute and delayed: No further relevant information available.

Indication of any immediate medical attention and special treatment needed: No further relevant information available.
Section 5: Fire Fighting Measures

Suitable extinguishing media: Use firefighting measures that suit the environment.

Specific hazards during firefighting: No further relevant information available.

Special protective equipment for fire fighters: Mouth respiratory protective device.

Section 6: Accidental Release Measures

Personal precautions, protective equipment and emergency procedures:

- Wear protective equipment.
- Keep unprotected persons away.

Environmental precautions:

- Do not allow to enter sewers/surface or ground water.

Methods and materials for containment and cleaning up:

- Use neutralizing agent.
- Dispose contaminated material as waste according to Section 13
- Ensure adequate ventilation.

Reference to other sections:

- Safe handling Information – Section 7
- Personal Protective Equipment – Section 8
- Disposal Information – Section 13

Protective Action Criteria for Chemicals

- PAC-1: 6.00E-04 ppm
- PAC-2: 0.0084 ppm
- PAC-3: 4.0 ppm

Section 7: Handling and Storage

Precautions for safe handling: Thorough dedusting.

Ensure good ventilation/exhaustion at the workplace.

Open and handle receptacle with care.

Information about protection against explosions and fire:

Keep respiratory protective device available.

Conditions for safe storage (including incompatibilities):

Requirements to be met by storerooms and receptacles: No special requirements.

Information about storage in one common storage facility: Not required.

Other information about storage conditions: Keep receptacle tightly sealed.

Specific end use(s): No further relevant information available.

Section 8: Exposure Controls / Personal Protection

<table>
<thead>
<tr>
<th>Components</th>
<th>CAS No.</th>
<th>Value type: (Form of exposure)</th>
<th>Control parameter</th>
<th>Permissible concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osmium (VIII) Oxide</td>
<td>20816-12-0</td>
<td>PEL: long-term value</td>
<td></td>
<td>0.002 mg/m³ (as Os)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>REL: short-term value</td>
<td></td>
<td>0.006 mg/m³, 0.0006 ppm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>REL: long-term value</td>
<td></td>
<td>0.002 mg/m³, 0.0002 ppm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TLV: short-term value</td>
<td></td>
<td>0.0006 ppm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TLV: short-term value</td>
<td></td>
<td>0.0002 ppm</td>
</tr>
</tbody>
</table>
Engineering Measures
Personal protection equipment: Keep away from foodstuffs, beverages and feed
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Store protective clothing separately.
Avoid contact with the eyes and skin.

Respiratory protection: In case of brief exposure or low pollution, use respiratory filtering device.
In case of intensive or prolonged exposure, use respiratory protection device that is independent of circulating air.

Hand protection:
• The glove material has to be impermeable and resistant to the product, substance and preparation.
• Due to missing tests, no recommendation to the glove material can be given for the product, the preparation or the mixture.
• Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation.

Material of gloves:
• The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.

Penetration time of glove material:
• The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

Eye protection:
• Tightly sealed goggles

Section 9 Physical and Chemical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Crystalline</td>
</tr>
<tr>
<td>Color</td>
<td>Colorless to pale yellow</td>
</tr>
<tr>
<td>Odor</td>
<td>Sharp chlorine like</td>
</tr>
<tr>
<td>Odor threshold</td>
<td>Not determined</td>
</tr>
<tr>
<td>pH</td>
<td>6-7</td>
</tr>
<tr>
<td>Melting point/range</td>
<td>103.1-105.8°F / 39.5-41°C</td>
</tr>
<tr>
<td>Boiling point/range</td>
<td>266°F / 130°C</td>
</tr>
<tr>
<td>Flash point</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Flammability (solid, gas)</td>
<td>Product is not flammable</td>
</tr>
<tr>
<td>Decomposition temperature</td>
<td>Not determined</td>
</tr>
<tr>
<td>Self-ignition</td>
<td>Not determined</td>
</tr>
<tr>
<td>Danger of explosion:</td>
<td>Product does not present an explosion hazard</td>
</tr>
<tr>
<td>Upper explosion/flamnability limit</td>
<td>Not determined</td>
</tr>
<tr>
<td>Lower explosion/flamnability limit</td>
<td>Not determined</td>
</tr>
<tr>
<td>Vapor pressure</td>
<td>10 hPa (7.5 mm Hg)</td>
</tr>
<tr>
<td>Density @ 20°C (68°F)</td>
<td>4.906 g/cm³ (40.94057 lbs/gal)</td>
</tr>
<tr>
<td>Relative density</td>
<td>Not determined</td>
</tr>
<tr>
<td>Vapor density</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Solubility in H₂O</td>
<td>Insoluble</td>
</tr>
<tr>
<td>Partition coefficient (n-octanol/water)</td>
<td>Not determined</td>
</tr>
<tr>
<td>Viscosity, dynamic</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Viscosity, kinematic</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Molecular weight</td>
<td>254.23 g/mol</td>
</tr>
</tbody>
</table>
Section 10: Stability and Reactivity

Chemical Stability
Thermal decomposition/conditions to be avoided:
- No decomposition if used according to specifications.

Possibility of hazardous reactions:
- No dangerous reactions known.

Conditions to avoid:
- No further relevant information available.

Incompatible materials:
- No further relevant information available.

Hazardous decomposition products:
- No dangerous decomposition products known.

Reactivity:
- No further relevant information available.

Section 11: Toxicological Information

Acute toxicity:
- Oral LD50: 0.5 mg/kg (rat)
- Dermal LD50: 300 mg/kg (rat)
- Inhalation LC50 / 4h: 0.5 mg/L (rat)

Primary irritant effect:
On the skin: Strong caustic effect on skin and mucous membrane.
On the eye: Strong caustic effect.
Sensitization: No sensitizing effects known.

Additional Toxicology Information:
Swallowing will lead to a strong caustic effect on mouth and throat and to the danger of perforation of esophagus and stomach.

Carcinogenic categories:
- IARC: No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA’s list of regulated carcinogens.
- NTP: No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

Section 12: Ecological Information

Toxicity:
- Aquatic Toxicity: No further relevant information available.
- Persistence and degradability: No further relevant information available.

Behavior in environmental systems:
- Bioaccumulative potential: No further relevant information available.
- Mobility in soil: No further relevant information available.
Additional Ecological Information:
Water hazard class 1 (self assessment): slightly hazardous for water
Do not allow undiluted product or large quantities to reach ground water, water course or sewage system.
Must not reach bodies of water or drainage ditch undiluted or unneutralized.

Results of PBT and vPvB assessment:
PBT Not applicable
vPvB Not applicable

Other adverse effects: No further relevant information available.

Section 13 Disposal Considerations
Waste Treatment Methods:
Recommendations: Must not be disposed of together with household garbage.
Do not allow product to reach sewage system.

Uncleaned Product Containers:
Recommendations: Dispose in a safe manner in accordance with local, state and federal regulations.

Section 14: Transportation Information
U.S. Department of Transportation Ground (49 CFR)
Proper shipping name: Osmium tetroxide
Hazard class or division: 6.1-Toxic substances
Identification number: UN 2471
Packing group: I
Label: 6.1

International Air Transportation (ICAO/IATA)
Proper shipping name: Osmium tetroxide
Hazard class or division: 6.1-Toxic substances
Identification number: UN 2471
Packing group: I

Water Transportation (IMO/IMDG)
Proper shipping name: OSMIUM TETROXIDE, MARINE POLLUTANT
Hazard class or division: 6.1-Toxic substances
Identification number: UN 2471
Packing group: I
Marine Pollutant: Yes

Labels:
Special precautions for user: Warning: Toxic substances
Hazard identification number (Kemler code) 66
EMS Number: F-A,S-A
Stowage Category: B
Stowage Code: SW2 Clear of living quarters
Annex II of MARPO 73/78: Not applicable

**Transport/Additional Information:**

DOT Quantity Limitations: 5kg – Passenger aircraft/rail
50kg – Cargo aircraft only

Hazardous Substance: 454kg (1,000 lbs)
Remarks: Special marking with symbol (fish and tree)

*The transport classification(s) provided herein are for information purposes only, and solely based upon the properties of the unpackaged material as it is described within this Safety Data Sheet (SDS). Transportation classifications may vary by mode of transportation, package size, and variations in regional or country regulations.*

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**Section 15: Regulatory Information**

Safety, health and environmental regulations/legislation specific for the substance or mixture:
- No further relevant information available.

**SARA - Superfund Amendments and Reauthorization Act:**
- Section 355 (extremely hazardous substances) Substance is not listed
- Section 313 (specific toxic chemical listings) Substance is listed

**TSCA - Toxic Substances Control Act:**
- Hazardous Air Pollutants: Substance is not listed
- California Proposition 65: Substance is not listed

**Carcinogenic categories:**
- EPA (Environmental Protection Agency): Substance is not listed
- TLV (Threshold Limit Value): Substance is not listed

**NIOSH (National Institute for Occupation Safety and Health):**
- Substance is not listed

**Chemical Safety Assessment:** An assessment has not been performed

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**Section 16: Other Information**

This Safety Data Sheet (SDS) is intended to comply with the OSHA Hazard Communication Standard (29 CFR 1910.1200) and is consistent with the provisions of the United Nations Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

**Full text of other abbreviations**

- **ACGIH:** USA. ACGIH Threshold Limit Values (TLV)
- **ACGIH BEI:** ACGIH - Biological Exposure Indices (BEI)
- **NIOSH REL:** USA. NIOSH Recommended Exposure Limits
- **OSHA Z-1:** USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
- **OSHA Z-2:** USA. Occupational Exposure Limits (OSHA) - Table Z-2
- **US WEEL:** USA. Workplace Environmental Exposure Levels (WEEL)
- **ACGIH / TWA:** 8-hour, time-weighted average
- **ACGIH / STEL:** Short-term exposure limit
- **NIOSH REL/TWA:** Time-weighted average concentration for up to a 10-hour workday during a 40-hour workweek
- **NIOSH REL/ST:** STEL - 15-minute TWA exposure that should not be exceeded at any time during a workday
- **OSHA Z-1 / TWA:** 8-hour time weighted average
- **OSHA Z-2/TWA:** 8-hour time weighted average
- **OSHA Z-2/CEIL:** Acceptable ceiling concentration
OSHA Z-2/Peak: Acceptable maximum peak above the acceptable ceiling concentration for an 8-hr shift
US WEEL/TWA: 8-hr TWA

AICS - Australian Inventory of Chemical Substances;
AIIC - Australian Inventory of Industrial Chemicals;
ASTM - American Society for the Testing of Materials;
bw - Body weight;
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act;
CMR - Carcinogen, Mutagen or Reproductive Toxicant;
DIN - Standard of the German Institute for Standardization;
DOT - Department of Transportation;
DSL - Domestic Substances List (Canada);
ECx - Concentration associated with x% response;
EHS - Extremely Hazardous Substance;
ELx - Loading rate associated with x% response;
EmS - Emergency Schedule; ENCS - Existing and New Chemical Substances (Japan);
ErCx - Concentration associated with x% growth rate response;
ERG - Emergency Response Guide;
GHS - Globally Harmonized System;
GLP - Good Laboratory Practice;
HMIS - Hazardous Materials Identification System;
IARC - International Agency for Research on Cancer;
IATA - International Air Transport Association;
IBC - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk;
IC50 - Half maximal inhibitory concentration;
ICAO - International Civil Aviation Organization;
IECSC - Inventory of Existing Chemical Substances in China;
IMDG - International Maritime Dangerous Goods;
IMO - International Maritime Organization; ISHL - Industrial Safety and Health Law (Japan);
ISO - International Organization for Standardization;
KECI - Korea Existing Chemicals Inventory;
LC50 - Lethal Concentration to 50 % of a test population;
LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose);
MARPOL - International Convention for the Prevention of Pollution from Ships;
MSHA - Mine Safety and Health Administration;
n.o.s. - Not Otherwise Specified;
NFPA - National Fire Protection Association;
NO(A)EC - No Observed (Adverse) Effect Concentration;
NO(A)EL - No Observed (Adverse) Effect Level;
NOELR - No Observable Effect Loading Rate;
NTP - National Toxicology Program;
NZIoC - New Zealand Inventory of Chemicals;
OECD - Organization for Economic Co-operation and Development;
OPPTS - Office of Chemical Safety and Pollution Prevention;
PBT - Persistent, Bioaccumulative and Toxic substance;
PICCS - Philippines Inventory of Chemicals and Chemical Substances;
(Q)SAR - (Quantitative) Structure Activity Relationship;
RCRA - Resource Conservation and Recovery Act;
RQ - Reportable Quantity;
SADT - Self-Accelerating Decomposition Temperature;
SARA - Superfund Amendments and Reauthorization Act;
SDS - Safety Data Sheet;
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