



PAGE 1 of 7	<b>PLATINUM METALS REFINERY</b> 
REVISION N <sup>o</sup> : 1	WORK PROCEDURE TASK: <b>HAZARD DATA SHEET - RUTHENIUM</b>
	SECTION: VAULTS
	DOCUMENT N <sup>o</sup> : <b>HDS 017</b>

DISTRIBUTION CONTROL SHEET

COPY N <sup>o</sup>	LOCATION	TITLE
1	Quality Offices	Document Controller
2	Johan Theron	Group Exec Corp Relations (Electronic)
3	Alice Lourens	Group Corp Relations Manager (Hardcopy)
4	Suzanne Finney	BML Manager (Electronic)
5	Jamie Welman	PML Manager (Electronic)
6	Sifiso Sibiya	Group Exec- Refining and Marketing (Electronic)
8	Pieter Gravett	Base Metal Sales Manager (Electronic)
9	Delisile Mathebula	PGMs Sales Manager (Electronic)


**NOTE:** Although this is a Quality controlled document, copies are readily available to all interested parties. No record is kept of copies issued but whenever a major update is carried out copies are sent to all Impala’s PGM customers. The current version is also available on the Implats website [www.implats.co.za](http://www.implats.co.za)

PAGE 2 of 7	<p align="center"><b>PLATINUM METALS REFINERY</b></p> 
REVISION N <sup>o</sup> .: 1	WORK PROCEDURE TASK: <b>HAZARD DATA SHEET - RUTHENIUM</b>
	SECTION: VAULTS
	DOCUMENT N <sup>o</sup> .: <b>HDS 017</b>

## SAFETY DATA SHEET

**PRODUCT NAME: RUTHENIUM POWDER**

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION
<p><b>Identification of the preparation:</b></p> <p><b>Product name:</b> Ruthenium powder      <b>Product code:</b> RU METAL</p> <p><b>Chemical name:</b> Ruthenium              <b>Formula:</b> Ru</p> <p><b>Recommended uses:</b> Manufacture of Ruthenium chemicals for use in catalysts, as metal and/or in alloys for electrical contacts, sputtering targets.</p> <p><b>Company Identification:</b></p> <p>Impala Platinum Limited – Refineries                  Corner East Geduld Road &amp; Cowles Street                  P O Box 222, Springs 1560, South Africa                  Tel.: +27 (0)11 360 3111, Fax: +27 (0)11 360 3202  <a href="http://www.implats.co.za">www.implats.co.za</a>      jamie.welman@implats.co.za</p> <p><b>Emergency telephone no.:</b> Impala Platinum Refineries +27 (0)11 360 3777</p> <p><b>Poison Centre - Tygerberg Hospital, Belville, Cape +27 (0)21 931 6129</b></p>

2. HAZARD IDENTIFICATION	
<p><b>Low toxicity</b></p> <p><b>WARNING</b></p> <p><b>Harmful -if swallowed, - in contact with skin, - if inhaled</b></p> <p>The product may cause adverse health effects with high-level dust generation, inhalation or prolonged skin contact. May form ruthenium salts on contact with acids.</p>	

Page 3 of 7	Doc No: <b>HDS 017</b>	<b>IMPALA PLATINUM</b>
REVISION: 1		<b>HAZARD DATA SHEET - RUTHENIUM</b>

**Additional Labeling:**

Each container should be labeled as follows:

**Before use read Safety Data Sheet**

If dissolved, ensure adequate enclosure or ventilation; do not breathe mists and avoid solution contact with eyes, skin and clothing – may cause sensitization or allergic reaction

If melted do not breathe furnace fumes

**3. COMPOSITION / INFORMATION ON INGREDIENTS**

<b>Major components:</b>	<b>Typical wt %:</b>	CAS #:	7440-18-8
Ruthenium	99.90-99.99%	EINECS Number:	231-127-1

**4. FIRST AID MEASURES**

**Inhalation:** If over exposure occurs leave exposure area immediately. If other than minor symptoms are displayed seek immediate medical attention

**Ingestion:** If poisoning occurs, contact a Doctor or Poisons Information Centre on +27-21-931-6129. Do not induce vomiting. Give a glass of water to drink. Seek urgent medical attention.

**Skin:** Gently flush affected areas with soap and water. Seek medical attention if irritation develops.

**Eyes:** Flush gently with running water for at least 15 minutes. Seek medical attention if irritation develops.

**5. FIRE-FIGHTING MEASURES**

**Suitable extinguishing media:** does not burn

**Extinguishing media not be used:** not applicable

**Special exposure hazards:** may evolve toxic fumes in fire. Remain upwind and notify those downwind of hazard

**Special protective equipment for fire-fighters:** wear full protective equipment including Self Contained Breathing Apparatus (SCBA) if combating fire

**NOTE:** Unlike some finely divided Ruthenium powder supplied by other companies, the material supplied by Impala Platinum is non-flammable and therefore DOES NOT present a fire hazard.

**6. ACCIDENTAL RELEASE MEASURES**

**Personal precautions:** If spilt (bulk) wear goggles and PVC or rubber gloves. Where a dust inhalation hazard exists (i.e. when used in large quantities) wear a Class P1 (particulate) respirator.

**Environmental precautions:** Prevent this material from entering into surface waters.

**Methods for cleaning-up:** SOLID – sweep up and place in sealed container. SOLUTION - Absorb with moist sand or similar and place in sealed containers for reprocessing or recovery.

Page 4 of 7	Doc No: <b>HDS 017</b>	<b>IMPALA PLATINUM</b>
REVISION: 1		<b>HAZARD DATA SHEET - RUTHENIUM</b>

**7. HANDLING AND STORAGE**

**Handling:** Avoid inhalation of dust or fumes. Avoid contact with skin or eyes. Use local ventilation which is adequate to limit exposure to levels not exceeding occupational exposure limits. Activities generating dust should be avoided.

**Storage:** Store in tightly sealed containers in a cool, dry and well-ventilated area removed from oxidizing agents, acids and foodstuffs. Ensure containers are adequately labeled, protected from physical damage and sealed when not in use. Check regularly for leaks or spills.

**8. EXPOSURE CONTROLS AND PERSONAL PROTECTION**

**Occupational Exposure Limit: (ACGIH, edition 2008)**

**TLV-TWA): 10mg/m<sup>3</sup> (inhalable particles); 3mg/m<sup>3</sup> (respirable particles) based on "particulates not otherwise classified"**

**Respiratory protection:** Use an appropriate and approved respirator for toxic dust or fume if airborne concentration is likely to exceed the occupational exposure limits.

**Hand protection:** Wear suitable gloves (PVC or rubber)

**Eye protection:** Wear dust-proof goggles.

**Skin protection:** Safety shoes, overalls or similar full-body work clothes should be worn and laundered daily. This protective clothing should not be worn at home.

**Personal Hygiene:** Practice good housekeeping and personal hygiene procedures. No eating, drinking or smoking in work area. Wash hands thoroughly before eating, drinking or smoking. Avoid ingestion, inhalation and skin and eye contact. Medical examinations, monitoring, record keeping and hygiene facilities are recommended.

**9. PHYSICAL AND CHEMICAL PROPERTIES**

**Appearance:** Pale gray metallic powder

**Odour:** Odourless

**pH:** not applicable

**Boiling point / boiling range:** 4150°C; 7502°F

**Melting point / melting range:** 2334°C; 4233°F

**Flash point:** not applicable

**Flammability (solid, gas):** non-flammable

**Autoflammability:** not applicable

**Explosive properties:** not applicable

**Oxidizing properties:** not applicable

**Vapour pressure:** unknown

**Relative density:** 2.1 - 2.8 (variable)

**Solubility : - hydrosolubility:** insoluble in water

**liposolubility (solvent-oil):** insoluble in solvent-oil

**Partition coefficient (n-octanol/water):** not applicable

Page 5 of 7	Doc No: <b>HDS 017</b>	<b>IMPALA PLATINUM</b>
REVISION: 1		<b>HAZARD DATA SHEET - RUTHENIUM</b>

**10. STABILITY AND REACTIVITY**

**The material is stable under normal circumstances**  
**Conditions to avoid:** Exposure to high temperatures (> 1000°C), generation of dust.  
**Incompatible materials:** Avoid contact with acids or strong oxidizing agents.  
**Hazardous decomposition products:** Ruthenium tetroxide formed with strong oxidizing agents

**11. TOXICOLOGICAL INFORMATION**

**ACUTE TOXICITY**

**Ingestion:** Ruthenium powder is **non-toxic**. May cause irritation of the gastro-intestinal tract.  
 Ruthenium **salts** may be more toxic

**SKIN IRRITATION / CORROSION**

**Non-irritant:** Low irritant. Prolonged and repeated exposure to dust/powder may result in irritation due to mechanical action. Possible sensitizer. Direct contact with ruthenium **salts** may result in irritation and skin sensitization.

**EYE DAMAGE / IRRITATION**

**Irritant:** Exposure may result in eye irritation, lachrymation, burning sensation and conjunctivitis and possible corneal burns with prolonged contact.

**RESPIRATORY OR SKIN SENSITIZATION**

**Non-irritant:** Ruthenium metal is unlikely to cause irritation except as a dust. Ruthenium **salts** are irritating to eyes, skin and mucous membranes and may cause sensitization.  
**Ruthenium tetroxide** can cause severe eye damage.

**REPRODUCTIVE CELL MUTAGENICITY**

The effects of Ruthenium **salts** have not been fully investigated.

**CARCINOGENICITY**

**Non-carcinogenic:** Ruthenium **salts** are listed as a non-carcinogenic in (all U.S.):

- i) in the National Toxicity Program (NTP) Report on Carcinogens
- ii) in the International Agency for Research on Cancer (IARC) monographs
- iii) by the Occupational Safety and Health Administration (OSHA)

Water-soluble Ruthenium compounds have caused tumours in laboratory animals.

**REPRODUCTIVE TOXICITY**

Rhodium chloride has caused mutations in bacteria and tumours in laboratory animals. However, the effects have not been fully investigated. Pregnant women should avoid contact with Ruthenium **salts**.

**SPECIFIC TARGET ORGAN TOXICITY – Single exposure**

Ruthenium **salts** may cause possible damage to the respiratory tract, GI tract, skin, eyes, teeth and immune system. However, the effects have not been fully investigated.

**SPECIFIC TARGET ORGAN TOXICITY – Repeated exposure**

Ruthenium **salts** may cause possible damage to the respiratory tract, GI tract, skin, eyes, teeth and immune system. However, the effects have not been fully investigated.

Page 6 of 7	Doc No: <b>HDS 017</b>	<b>IMPALA PLATINUM</b>
REVISION: 1		<b>HAZARD DATA SHEET - RUTHENIUM</b>

**ASPIRATION HAZARD**

**Inhalation:** Low irritant. Inhalation of dusts may result in upper respiratory tract irritation. Ruthenium metal poses a low hazard but Ruthenium **salts** are potential irritants and sensitizers.

**12. ECOLOGICAL INFORMATION**

**Due to the very low solubility of Ruthenium powder it does not directly pose any ecological threat. However, if converted to soluble Ruthenium salts it may have the following effects:**

**Accumulation:**

- **Persistence:** hazard of ruthenium persistency in the environment
- **Bioaccumulative potential:** hazard of ruthenium accumulation
- **Biomagnification:** potential hazard of ruthenium magnification
- **Biodegradability:** no information available

**Ecotoxicity:**

- **Aquatic organisms: Potentially toxic** to aquatic organisms. May cause long term adverse effects in the aquatic environment.
- **Soil organisms:** unknown; no information available
- **Plants and terrestrial animals:** unknown; no information available

**Other adverse effects:**

- **Ozone depletion potential:** does not contain ozone depleting substances
- **Photochemical ozone creation potential:** not applicable
- **Global warming potential:** not applicable
- **Effects on waste water treatment plants:** unknown; no information available

**The environmental effects of Ruthenium and its compounds have not been fully evaluated.**

**13. DISPOSAL CONSIDERATIONS**

Disposer must comply with state and local laws. This material can be metallurgically recycled by Impala Platinum, South Africa, which is a pre-authorized facility for the environmentally sound recovery of metals.

**14. TRANSPORT INFORMATION**

**NOT REGULATED FOR TRANSPORT PURPOSES**

- Packing :** in plastic bottles sealed in tins which in turn are sealed in boxes
- UN-Nr.:** not applicable
- IMDG-Code:** not applicable
- ICAO / IATA :** not applicable
- RID / ADR :** not applicable

Page 7 of 7	Doc No: <b>HDS 017</b>	<b>IMPALA PLATINUM</b>
REVISION: 1		<b>HAZARD DATA SHEET - RUTHENIUM</b>

<b>15. REGULATORY INFORMATION</b>
<p>United States: CERCLA Sections 102a/103 (40 CFR 302.4): Not regulated</p> <p>Canada: WHMIS Classification: D2B (toxic material)</p> <p>EU/EC Classification: X<sub>n</sub> (Harmful); not classified in Annex I of Directive 67/548/EEC (will change with implementation of GHS/REACH)</p>

<b>16. OTHER INFORMATION :</b>
<p><b>Hazard Information References :</b></p> <p>RTECS : Registry of toxic effects of Chemical Substances, NIOSH, edition January 1999</p> <p>Sax's Dangerous Properties of Industrial Materials (8th edition), R J Lewis Sr.</p> <p>Screening of Platinum Group Metals; Pt, Rh, Pd SWECO VIAK Screening Report 2007:2 (For Swedish Environmental Protection Agency)</p> <p>ECOTOX database; <a href="http://cfpub.epa.gov/ecotox">http://cfpub.epa.gov/ecotox</a></p> <p>The buyer assumes all risks with the use and handling of the material.</p> <p>The seller assumes no responsibility or liability in connection with the information supplied in this sheet or for any damage or injury caused by the material; reasonable safety procedures should be followed.</p> <p>The seller assumes no responsibility for injury or damage caused by use of the material even if reasonable safety procedures are followed. The information contained in this sheet is developed from what is believed to be accurate and reliable sources but the seller makes no warranties, either expressed or implied, and assumes no responsibility for the accuracy or completeness of the data contained herein.</p>