

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND
SUPPORTING DOCUMENTATION FOR

*** RHODIUM, METAL FUME AND DUSTS AS RH ***

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for RHODIUM, METAL FUME AND DUSTS AS RH

The basic text of this document contains the draft technical standard approved by the Joint Review Committee of the NIOSH/OSHA Standards Completion Program and the supporting documentation for the substance RHODIUM, METAL FUME AND DUSTS AS RH.

The SCP draft technical standards are recommendations to the Department of Labor for its consideration in rulemaking and have no legal status until final rules have been promulgated by that agency. This draft standard is provided for your information only.

The References and Sources, Respirator Table Documentation and Use/Exposure and Control Documentation are the working documents used by the various SCP working groups during the development of the draft technical standard and serve as the technical foundation for the standard. The classification for each substance and the regulatory statements were derived following a decision logic established for the various sections of the standard.

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(a) Definitions. (1) "Permissible exposure" means exposure of employees to airborne concentrations of rhodium metal fume and dusts not in excess of 0.1 milligram per cubic meter (mg/M3), averaged over an eight-hour work shift (time weighted average), as stated in § 1910.1000, Table Z-1.

(2) "Action level" means one half of the permissible exposure for rhodium metal fume and dusts.

(b) Exposure determination and measurement. (1) Each employer who has a place of employment in which rhodium metal fume and dusts is released into the workplace air shall determine if any employee may be exposed to airborne concentrations of rhodium metal fume and dusts at or above the action level. The determination shall be made each time there is a change in production, process, or control measures which could result in an increase in airborne concentrations of rhodium metal fume and dusts.

(2) A written record of the determination shall be made and shall contain at least the following information:

(i) Any information, observations, or calculations which may indicate employee exposure to rhodium metal fume and dusts;

(ii) Any measurements of rhodium metal fume and dusts taken;

(iii) Any employee complaints of symptoms which may be attributable to exposure to rhodium metal fume and dusts; and

(iv) Date of determination, work being performed at the time, location within work site, name, and social security number of each employee considered.

(3) If the employer determines that any employee may be exposed to rhodium metal fume and dusts at or above the action level, the exposure of the employee in each work operation who is believed to have the greatest exposure shall be measured. The exposure measurement shall be representative of the maximum eight-hour time weighted average exposure of the employee.

(4) If the exposure measurement taken pursuant to paragraph (b) (3) of this section reveals employee exposure to rhodium metal fume and dusts at or above the action level, the employer shall:

(i) Identify all employees who may be exposed at or above the action level; and

(ii) Measure the exposure of the employees so identified.

(5) If an employee exposure measurement reveals that an employee is exposed to rhodium metal fume and dusts at or above the action level, but not above the permissible exposure, the exposure of that employee shall be measured at least every two months.

(6) If an employee exposure measurement reveals that an employee is exposed to rhodium metal fume and dusts above the permissible exposure, the employer shall:

(i) Measure the exposure monthly of the employee so exposed; and

(ii) Institute control measures as required by paragraph (d) of this section; and

(iii) Individually notify, in writing, within five days, every employee who is found to be exposed to rhodium metal fume and dusts above the permissible exposure. The employee shall also be notified of the corrective action being taken to reduce the exposure to at or below the permissible exposure.

(7) If two consecutive employee exposure measurements taken at least one week apart reveal that the employee is exposed to rhodium metal fume and

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dusts below the action level, the employer may terminate measurement for the employee.

(8) For purposes of this paragraph, employee exposure is that which would occur if the employee were not using a respirator.

(c) Methods of measurement. (1) An employee's exposure shall be obtained by any combination of long term or short term samples which represents the employee's actual exposure averaged over an eight-hour work shift (See Appendix B (iv) of this section).

(2) The method of measurement shall have an accuracy, to a confidence level of 95 percent, of not less than that given in Table 1.

Table 1

Concentration	Required Accuracy
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Above permissible exposure	$\pm 25\%$
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At or below permissible exposure	
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and above the action level	$\pm 35\%$
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At or below the action level	$\pm 50\%$
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(d) Compliance. (1) No employee shall be exposed to rhodium metal fume and dusts above the permissible exposure as defined in paragraph (a)(1) of this section.

(2) Employee exposures to airborne concentrations of rhodium metal fume and dusts shall be controlled to at or below the permissible exposure by engineering and work practice controls:

(i) Engineering and work practice controls shall be instituted to reduce exposures to at or below the permissible exposure, except to the extent that such controls are not technically feasible.

(ii) Wherever engineering and work practice controls are not sufficient to reduce exposures to at or below the permissible exposure, they shall nonetheless be used to reduce exposure to the lowest level feasible and shall be supplemented by respirators in accordance with paragraph (d)(4) of this section.

(3) Engineering controls. When mechanical ventilation is used to control exposure, measurements which demonstrate system effectiveness, for example, air velocity, static pressure, or air volume, shall be made at least every three months. Measurements of system effectiveness shall also be made within five days of any change in production, process, or control which might result in an increase in airborne concentrations of rhodium metal fume and dusts.

(4) Compliance with the permissible exposure shall not be achieved by the use of respirators except:

(i) During the time period necessary to install or implement engineering or work practice controls; or

(ii) In work situations in which engineering and work practice controls are technically not feasible; or

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(iii) To supplement engineering and work practice controls when such controls fail to reduce airborne concentrations of rhodium metal fume and dusts to at or below the permissible exposure; or

(iv) In emergencies.

(5) Where respirators are needed and permitted under this paragraph to reduce employee exposure, the employer shall select and provide the appropriate respirator from Table 2 and shall ensure that the employee uses the respirator provided.

TABLE 2 RESPIRATORY PROTECTION FOR RHODIUM METAL FUME AND DUSTS

CONDITION	PERMISSIBLE RESPIRATORY PROTECTION
Particulate Concentration	
0.5 mg/M3 or less	Any dust and mist respirator.
1 mg/M3 or less	Any fume respirator or high efficiency particulate respirator.
	Any dust and mist respirator except quarter mask respirators and single-use respirators.
	Any supplied-air respirator.
	Any self-contained breathing apparatus.
5 mg/M3 or less	A high efficiency particulate filter respirator with a full facepiece.
	Any supplied-air respirator with a full facepiece, helmet or hood.
	Any self-contained breathing apparatus with a full facepiece.
100 mg/M3 or less	A powered air-purifying respirator with a high efficiency particulate filter.
	A Type C supplied-air respirator operated in pressure-demand or other positive pressure or continuous-flow mode.
200 mg/M3 or less	A Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure mode or with a full facepiece, helmet or hood operated in continuous-flow mode.
Greater than 200 mg/M3 or entry and escape from	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.

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unknown concentrations	A combination respirator which includes a Type C supplied - air respirator with a full facepiece operated in pressure - demand or other positive pressure or continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.

Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.

(6) Respirators shall be approved by the Mining Enforcement and Safety Administration (formerly Bureau of Mines) or by the National Institute for Occupational Safety and Health under the provisions of 30 CFR Part 11.

(7) The employer shall institute a respiratory protection program in accordance with § 1910.134(b), (d), (e), and (f).

(e) Fire and safety. The employer shall familiarize himself with the information contained in the Substance Technical Guidelines (Appendix B of this section) for rhodium metal fume and dusts.

(f) Reserved.

(g) Spills and disposal. In the event that rhodium metal fume and dusts are inadvertently released the employer shall immediately provide available ventilation and then clean up the spill.

(h) Reserved.

(i) Training and information. (1) Each employer who has a workplace in which rhodium metal fume or dust is present shall keep a copy of this regulation with Appendixes A, B and C at the workplace. This material shall be made readily available to affected employees.

(2) Each employer who has employees exposed to rhodium metal fume or dust above the action level or employees who work where a potentially hazardous release of rhodium metal fume or dust may occur, shall annually:

(i) Inform affected employees of the information contained in the Substance Safety Data Sheet for rhodium metal fume and dusts (Appendix A of this section); and

(ii) Provide training to ensure that employees understand the precautions of safe use, emergency procedures, and the correct use of protective equipment relative to rhodium metal fume and dusts.

(j) Reserved.

(k) Recordkeeping. (1) Exposure determination. (i) The employer shall keep an accurate record of all determinations required to be made pursuant to paragraph (b)(1) of this section.

(ii) This record shall include the written determination required in paragraph (b)(2) of this section.

(iii) This record shall be maintained until replaced by a more recent record.

(2) Exposure measurements. (i) The employer shall keep an accurate record of all measurements taken to determine employee exposure to rhodium metal fume and dusts.

(ii) This record shall include:

(A) The date of measurement;

(B) Operations involving exposure to rhodium metal fume and dusts which are being monitored;

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(C) Sampling and analytical methods used and evidence of their accuracy, including the method, results and date of calibration of sampling equipment;

(D) Number, duration, and results of samples taken; and

(E) Name, social security number and exposure of the employee monitored.

(iii) This record shall be maintained until replaced by a more recent record but in no event for less than one year.

(3) Mechanical ventilation. (i) When mechanical ventilation is used as an engineering control, the employer shall maintain an accurate record of the measurements demonstrating the effectiveness of such ventilation required by paragraph (d)(3)(i) of this section.

(ii) This record shall include:

(A) Date of measurement;

(B) Type of measurement taken;

(C) Result of measurement.

(iii) These records shall be maintained for at least one year.

(4) Employee training and information. (i) The employer shall keep an accurate record of all employee training and information required by paragraph (i) of this section.

(ii) This record shall include:

(A) Date of training;

(B) Name and social security number of employee trained;

(C) Content or scope of training provided.

(iii) This record shall be maintained until replaced by a more recent record.

(5) Access to records. (i) All records required to be maintained by this section shall be made available upon request to authorized representatives of the Assistant Secretary of Labor for Occupational Safety and Health and the Director of the National Institute for Occupational Safety and Health.

(ii) Employee exposure determination and exposure measurement records required to be maintained by this section shall be made available to employees and former employees and their designated representatives.

(iii) Employee medical records required to be maintained by this section shall be made available upon written request to a physician designated by the employee or former employee.

(1) Employee observation of measurement. (1) The employer shall give affected employees or their representatives an opportunity to observe any measurement of employee exposure to rhodium metal fume and dusts which is conducted pursuant to this section.

(2) When observation of monitoring of employee exposure to rhodium metal fume and dusts requires entry into an area where the use of personal protective devices, including respirators, is required, the observer shall be provided with and required to use such equipment and comply with all other applicable safety procedures.

(3) Without interfering with the measurement, observers shall be entitled to:

(i) Receive an explanation of the measurement procedure.

(ii) Visually observe all steps related to the measurement of the airborne concentration of rhodium metal fume and dusts that are being performed at the place of exposure; and

(iii) Record the results obtained.

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NOTE: The information contained in the following appendixes is advisory in nature and is not intended, by itself, to create any additional obligations not otherwise imposed or detract from any existing obligation.

APPENDIX A

SUBSTANCE SAFETY DATA SHEET
FOR RHODIUM METAL FUME AND DUSTS

- I. SUBSTANCE IDENTIFICATION
 - A. Substance: Rhodium metal fume and dusts
 - B. Permissible Exposure: 0.1 milligram of rhodium metal fume and dusts per cubic meter of air (mg/M3) averaged over an eight-hour work shift.
 - C. Appearance: Gray fume or dust
- II. HEALTH HAZARD DATA
 - A. Comments: Rhodium metal fumes or dust have not been shown to be an industrial hazard nor have toxic effects been shown to occur in animals.
 - B. Ways in which the chemical affects your body: None known.
 - C. Effects of Overexposure:
 - 1. Short-term Exposure: None known.
 - 2. Long-term Exposure: None known.
- III. EMERGENCY FIRST AID PROCEDURES
 - A. Breathing: If you or any other person breathes in large amounts of rhodium metal fumes or dust move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.
 - B. Swallowing: When rhodium metal dust has been swallowed give the person large quantities of water. After the water has been swallowed, try to get the person to vomit by having him touch the back of his throat with his finger. Do not make an unconscious person vomit. Get medical attention.
- IV. RESPIRATORS AND PROTECTIVE CLOTHING
 - A. Respirators: Respirators are not the best way to control exposure to rhodium metal fume and dusts. You can only be required to wear them for routine use if your employer is in the process of installing controls or control measures prove inadequate. You may be required to wear respirators for non-routine activities or in emergencies. If respirators are worn, they must have a Mining Enforcement and Safety Administration (MESA) or National Institute for Occupational Safety and Health (NIOSH) approval label. (Older respirators may have a Bureau of Mines approval label.) For effective protection, respirators must fit your face and head snugly. Respirators should not be loosened or removed in work situations where their use is required. If you experience

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difficulty breathing while wearing a respirator, tell your employer.

B. Protective Clothing: Not applicable.

C. Eye Protection: Not applicable.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

A. Ask your supervisor where rhodium metal fume and dusts may be inadvertently released in your work area and for any additional plant safety and health rules.

VI. ACCESS TO INFORMATION

A. Each year your employer is required to inform you of the information contained in this Substance Safety Data Sheet for rhodium metal fume and dusts. In addition, your employer must instruct you in emergency procedures and the correct use of protective equipment.

B. Your employer is required to determine whether you are being exposed to rhodium metal fume and dusts. You or your representative have the right to observe employee exposure measurements and to record the results obtained. If your employer determines that you are being overexposed, he is required to inform you of the exposure and of the actions which are being taken to reduce your exposure.

C. Your employer is required to keep records of exposure determinations, exposure measurements, and medical surveillance. Your employer is required to make records of exposure determinations and your exposure measurements available to you or your representative upon your request. Your employer is required to release your medical records to your physician upon your written request.

APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES
FOR RHODIUM METAL FUME AND DUSTS

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification

1. Synonyms: None
2. Formula: Rh
3. Molecular weight: 102.9

B. Physical Data

1. Boiling point (760 mm Hg): Above 2500 C (4532 F)
2. Specific gravity (water = 1): 12.4
3. Vapor density (air = 1 at boiling point of rhodium metal fume and dusts): Not applicable
4. Melting point: 1966 C (3570 F)
5. Vapor pressure at 20 C (68 F): Essentially zero
6. Solubility in water, % by weight at 20 C (68 F): Insoluble
7. Evaporation rate (butyl acetate = 1): Not applicable

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8. Appearance: Gray fume or dust
- II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA
- A. Fire
1. Not combustible
- B. Reactivity
1. Conditions contributing to instability: None.
2. Incompatibilities: None.
3. Hazardous decomposition products: None.
4. Special precautions: None.
- III. SPILL AND DISPOSAL PROCEDURES
- A. If potentially hazardous amounts of rhodium metal dust and fumes are inadvertently released or spilled, the following steps should be taken:
1. Ventilate area of release or spill.
2. Collect spilled material in the most convenient and safe manner for reclamation, or for disposal in a sanitary landfill.
- C. Waste disposal methods: Rhodium metal dusts may be disposed of in a sanitary landfill.
- IV. MONITORING AND MEASUREMENT PROCEDURES
- A. EXPOSURE ABOVE THE ACTION LEVEL: Measurements taken for the purpose of determining employee exposure under this section are best taken such that the average 8-hour exposure may be determined from a single eight-hour sample or two (2) 4-hour samples. Several short time interval samples (up to 30 minutes) may also be used to determine the average exposure level. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee). Sampling and analyses may be performed by instruments such as detector tubes certified by NIOSH under 42 CFR part 84, portable direct-reading instruments, dosimeters, or by collection of the particulates using a high efficiency membrane filter with subsequent chemical analyses. The method of measurement must determine the concentration of rhodium metal fume and dusts to plus or minus 35%.
- B. EXPOSURE ABOVE THE PERMISSIBLE EXPOSURE: The monitoring and measurements under this section should be essentially the same as described under paragraph IV. A. Laboratories performing chemical analyses should be accredited in Industrial Hygiene Chemistry by the American Industrial Hygiene Association. The method of measurement must determine the concentration of rhodium metal fume and dusts to plus or minus 25%.
- C. METHODS: Methods meeting these accuracy requirements are available from the National Technical Information Service, U. S. Department of Commerce, Springfield, Virginia 22161 under the title "NIOSH Analytical Methods for Set M" (Order number XXXXXXXXXX).
- D. QUALIFIED PERSONS: Since many of the duties relating to employee protection are dependent on the results of monitoring and measuring procedures, employers should assure

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that the evaluation of employee exposures is performed by a competent industrial hygienist or other technically qualified person.

V. MISCELLANEOUS PRECAUTIONS

A. Employers should advise employees of all areas and operations where exposure to rhodium metal fume and dusts could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to rhodium metal fume and dusts is likely to occur are: during the manufacture of rhodium-platinum alloys; during the manufacture of rhodium-gold alloys for dental castings; during its use in applying reflective coatings to instruments and reflectors; and during the refining and recovery of rhodium.

APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation.

II. TOXICOLOGY

No toxic effects of rhodium metal fume and dusts have been reported from animal experiments or from observations on human beings.

III. SIGNS AND SYMPTOMS

None known.

IV. SPECIAL TESTS

None in common usage.

V. TREATMENT

Remove from exposure. Flush eyes and skin with water. If swallowed and the person is conscious, induce vomiting. Give artificial resuscitation if indicated. Recovery is usually rapid and complete.

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. GENERAL

It is important that the physician become familiar with plant operating conditions in which exposure to rhodium occurs.

B. PREPLACEMENT

None required.

C. PERIODIC EXAMINATIONS

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None required.

VII. REFERENCES

1. American Conference of Governmental Industrial Hygienists: "Rhodium - as Rh," Documentation of the Threshold Limit Values for Substances in Workroom Air (3d ed., 2d printing), Cincinnati, 1974, p. 222.
2. Patty, Frank A.: Industrial Hygiene and Toxicology, Vol. II - Toxicology (2d ed. revised), Interscience Publishing Company, New York, 1963, pp. 1125-1131.
3. Browning, Ethel: Toxicity of Industrial Metals (2d ed.), Butterworths, London, 1969, pp. 278-279.

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REFERENCES AND SOURCES
RHODIUM METAL FUME AND DUSTS
1910.93

- (f) Personal Protective Equipment, and, (h) Sanitation
References: "Encyclopedia of Occupational Safety and Health," International Labour Office; Browning, "Metabolism and Toxicity of Industrial Metals"

COMMENTS: There are no data in the literature to indicate that this substance causes effects by eye or skin contact or ingestion. The Personal Protection and Sanitation sections are, therefore, reserved. ILO, like numerous other sources, notes "there are no significant experimental data and no reports of industrial experience indicating trouble from rhodium . . . in man." It is specifically noted in Browning that a woman who became sensitized to platinum had a negative patch test to rhodium.

SUBSTANCE TECHNICAL GUIDELINES

The references cited for this document include:

Kirk - Othmer, "Encyclopedia of Chemical Technology," 2nd edition, Vol. 15, p. 856 (K-O)

"Gmelin's Handbuch der Anorganischen Chemie," Vol. 64, p. 1 (Gmelin)
Patty F.A. (Editor), "Industrial Hygiene and Toxicology"

Sources of data items used:

- I. A. 1. Synonyms: None
2. Formula: Gmelin
3. Molecular weight: Gmelin
B. 1. Boiling point: Patty
2. Specific gravity: K-O
3. Vapor density: Not available
4. Melting point: Gmelin
5. Vapor pressure: ADL
6. Solubility in water: Gmelin
7. Evaporation rate: Not applicable
8. Appearance and odor: Gmelin
II. A. 1. Fire data: Not applicable
B. 1. Conditions contributing to instability: None
2. Incompatibilities: None
3. Hazardous decomposition products: None
4. Special precautions: None
III. A. Steps if released or spilled: ADL
C. Waste disposal method: Not applicable
V. Miscellaneous precautions: ADL

USE/EXPOSURE AND CONTROL DOCUMENT

Sources used in the preparation of this document include:

Browning, E., "Toxicity of Industrial Metals," Butterworth and Company, 2nd edition, 1969 (Browning)

—"Documentation of Threshold Limit Values," American Conference of Governmental Industrial Hygienists, 1971 (ACGIH)

Hamilton, A. and Hardy, H. L., "Industrial Toxicology," Publishing Sciences Group, Inc., 3rd edition, 1974 (Hamilton and Hardy)

Hawley, G. G. - editor, "The Condensed Chemical Dictionary," Van Nostrand - Reinhold Company, 8th edition, 1971 (Hawley)

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Kirk, R. and Othmer, D., "Encyclopedia of Chemical Technology," Interscience Publishers, Division of John Wiley and Sons, Inc., 2nd edition, 1968 (K-O)

"Merck Index of Chemicals and Drugs," Merck and Company, Rahway, New Jersey, 8th edition, 1968 (Merck)

References for Specific Use/Exposure

1. Hamilton and Hardy, Hawley, K-O
2. Hawley
3. Hamilton and Hardy, Browning, Hawley, Merck
4. K-O

References for Specific Control Methods

ACGIH, Browning and Contractor Estimates were the references used in all the Specific Control Methods.

RESPIRATOR TABLE DOCUMENTATION

SUBSTANCE: Rhodium metal fume and dusts

D. O. L. STANDARD: 0.1 mg/M3

WARNING PROPERTIES:

Eye Irritation Level: Rhodium metal fume and dusts are not known to be an eye irritant.

IDLH: Since there is no evidence of an IDLH concentration for rhodium, metal fume and dusts, respirators have been assigned on the basis of the protection factor afforded by each device.

Other Toxicological Information: Browning reports that "no toxic effects of rhodium have been reported from animal experiments or from observations on human beings." The ILO also reports that "there are no significant experimental data and no reports of industrial experience indicating trouble from rhodium and its salts in man. The low threshold limit values quoted above have been based on the similarity of the metal to platinum."

NOTE: Acute toxicological information is needed if an accurate IDLH is to be set.

Patty F. A. (Editor): Industrial Hygiene and Toxicology, Volume 2, 2nd Rev. Ed., Interscience Publishers, New York, 1963 (Patty)

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USE/EXPOSURE AND CONTROL DOCUMENT
RHODIUM METAL FUME AND DUSTS

	Use/Exposure	Principal Route of Entry	Currently Used Control Methods
1.	Inhalation of fume during the manufacture of platinum alloys for use in thermocouples, windings for resistance furnaces, laboratory crucibles and catalysts for chemical processing	A	General dilution ventilation; local exhaust ventilation
2.	Inhalation of dust during the production and casting of rhodium powder. This is the final step in refining and recovering the metal.	A	General dilution ventilation; local exhaust ventilation; personal protective equipment (respiratory protective devices, goggles)
3.	Inhalation of fume during use in applying thin reflective coatings by sublimation to scientific instruments, radio and radar equipment, searchlight reflectors, cinema projections and headlight reflectors	A	General dilution ventilation; local exhaust ventilation
4.	Inhalation of fume during the manufacture of alloys for use in preparing dental castings	A	General dilution ventilation; local exhaust ventilation

- A -- Inhalation
- B -- Skin and eye contact resulting in localized irritation
- C -- Ingestion
- D -- Skin contact resulting in absorption and subsequent systemic poisoning

----- JES2 JOB STATISTICS -----

755 CARDS READ

0 SYSOUT PRINT RECORDS

0 SYSOUT PUNCH RECORDS

0.00 MINUTES EXECUTION TIME

