MATERIAL SAFETY DATA SHEET

SRM Supplier: National Institute of Standards and Technology
Standard Reference Materials Program
Bldg. 202 Rm. 211
Gaithersburg, Maryland 20899

SRM Number: 3138
MSDS Number: 3138
SRM Name: Palladium Standard Solution
Date of Issue: April 1989
Date of Revision: 22 December 1999

MSDS Coordinator: Joylene W.L. Thomas
Phone: (301) 975-6776
ChemTrec: 1-800-424-9300

FAX: (301) 926-4751
e-mail: SRMMSDS@nist.gov

SECTION I. MATERIAL IDENTIFICATION

Material Name: Palladium Standard Solution

Description: SRM 3138 is a single element solution prepared gravimetrically to contain a nominal 10 mg/g of palladium with a hydrochloric acid volume fraction of 10 %.

Other Designations: **Palladium** in **Hydrochloric Acid** (aqueous hydrochloric acid; hydrogen chloride; muriatic acid); **Palladium Chloride*** (palladous chloride; palladium dichloride; palladium (II) chloride; dichloropalladium) in **Standard Solution**

Name	Chemical Formula	CAS Registry Number
Hydrochloric Acid	HCl	7647-01-0
Palladium Chloride	$PdCl_2$	7647-10-1
Palladium	Pd	7440-05-3

DOT Classification: Hydrochloric Acid, Solution, UN1789

Manufacturer/Supplier: It is available from a number of suppliers.

* The addition of palladium to hydrochloric acid, along with other intermediate chemical reactions, forms palladium chloride that will precipitate upon evaporation or drying of the sample.

SECTION II. HAZARDOUS INGREDIENTS

Hazardous Components	Nominal Concentration (%)	Exposure Limits and Toxicity Data
Hydrochloric Acid	10	ACGIH TLV-TWA: 5 mg/kg or 7.6 mg/m^3
		OSHA Standard Air (CL): 5 mg/kg or 7.6 mg/m^3
		Human, Inhalation: LC_{LO}: 1300 mg/kg/30 min
		Human, Inhalation: LC_{LO}: 3000 mg/kg/5 min
		Mouse, Intraperitoneal: LD_{50}: 40 412 Φg/kg
Palladium Chloride	1.7	No TLV-TWA established
		Rat, Intratracheal: LD_{50}: 6 mg/kg
		Rat, Oral: LD_{50}: 2704 mg/kg
Palladium	1	No TLV-TWA established

SECTION III. PHYSICAL/CHEMICAL CHARACTERISTICS

Hydrochloric Acid	Palladium Chloride	Palladium
Appearance and Odor: a colorless liquid; pungent, irritating odor.	**Appearance and Odor:** red to brown, deliquescent crystals	**Appearance and Odor:** a silver-white, ductile metal
Relative Molecular Mass: 36.46	**Relative Molecular Mass:** 177.3	**Relative Atomic Mass:** 106.4
Density: 1.05 (10 % hydrochloric acid)	**Density:** 4.0	**Density:** 12.0
Solubility in Water: soluble	**Solubility in Water:** soluble	**Solubility in Water:** insoluble
Solvent Solubility: soluble in alcohol and benzene	**Solvent Solubility:** soluble in hydrochloric acid, alcohol, and acetone	**Solvent Solubility:** soluble in aqua regia, sulfuric acid, and fused alkali

NOTE: The physical and chemical data provided are for the pure components. Physical and chemical data for this palladium/hydrochloric acid solution do not exist. The actual behavior of the solution may differ from the individual components.

SECTION IV. FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A **Method Used:** N/A **Autoignition Temperature:** N/A

Flammability Limits in Air (Volume %): **UPPER:** N/A
LOWER: N/A

Unusual Fire and Explosion Hazards: Hydrochloric acid is a negligible fire hazard when exposed to heat and/or flames. Hydrochloric acid may react with the evolution of heat on contact with water; the acid may release toxic, corrosive, flammable, or explosive gases.

Extinguishing Media: Use regular dry chemical, carbon dioxide, water, or regular foam.

Special Fire Procedures: Firefighters should wear a self-contained breathing apparatus (SCBA) with a full face piece in the pressure demand or positive mode and other protective clothing.

SECTION V. REACTIVITY DATA

Stability: __X__ **Stable** _____ **Unstable**

Conditions to Avoid: Avoid heat, moisture, and combustible materials.

Incompatibility (Materials to Avoid): Hydrochloric acid is incompatible with cyanides, metals, amines, bases, metal cyanides, oxidizing materials, acids, halo carbons, combustible materials, halogens, and metal salts. Palladium is incompatible with metals, combustible materials, acids, peroxides, oxidizing materials, and metal salts.

See Section IV: *Unusual Fire and Explosion Hazards*

Hazardous Decomposition or Byproducts: Thermal decomposition of hydrochloric acid may release acid halides. Thermal decomposition of palladium chloride may release chlorine.

Hazardous Polymerization: _____ **Will Occur** __X__ **Will Not Occur**

SECTION VI. HEALTH HAZARD DATA

Route of Entry: __X__ **Inhalation** __X__ **Skin** __X__ **Ingestion**

Health Hazards (Acute and Chronic): Hydrochloric Acid: Hydrochloric acid may be fatal if inhaled, swallowed, or absorbed through the skin. This material causes burns and is extremely destructive to the tissue of the mucous membranes and upper respiratory tract, eyes, and skin. Inhalation may be fatal as a result of spasm, inflammation, and edema of the larynx and bronchi, chemical pneumonitis, and pulmonary edema. Symptoms of exposure may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting. Hydrochloric acid also causes severe burns.

Palladium and Palladium Chloride: Palladium chloride may be fatal if inhaled, swallowed, or absorbed through the skin. This material is irritating to the skin, eyes, mucous membranes, and upper respiratory tract. Eye contact may cause irritation with redness and pain. Repeated or prolonged exposure may cause conjunctivitis. Palladium may cause sensitization dermatitis in previously exposed persons; however, no trace of skin irritation was observed after human patch tests were performed with a buffered solution of palladium chloride. Palladium is poorly absorbed by the body when ingested. Mice given 5 mg/kg palladium as palladium chloride in drinking water for their lifetime showed reduced growth rate. A slight carcinogenic effect was noted.

Medical Conditions Generally Aggravated by Exposure: Pre-existing skin conditions may be aggravated by the acid.

Listed as a Carcinogen/Potential Carcinogen:

	Yes	No
In the National Toxicology Program (NTP) Report on Carcinogens		X
In the International Agency for Research on Cancer (IARC) Monographs		X
By the Occupational Safety and Health Administration (OSHA)		X

EMERGENCY AND FIRST AID PROCEDURES:

Skin Contact: Remove contaminated shoes and clothing. Rinse affected area with large amounts of water followed by washing the area with soap and water. Watch for chemical irritations and treat them accordingly. Obtain medical assistance if necessary.

Eye Contact: Immediately flush eyes, including under the eyelids, with copious amounts of water for at least 15 min. Obtain medical assistance.

Inhalation: If inhaled, move the victim to fresh air. If breathing is difficult, give oxygen; if the victim is not breathing, give artificial respiration. Obtain medical assistance if necessary.

Ingestion: If ingestion occurs, wash out mouth with water. **DO NOT** induce vomiting. Obtain medical assistance immediately.

TARGET ORGAN(S) OF ATTACK: **Hydrochloric Acid:** lungs, upper respiratory tract, skin, and teeth
Palladium Chloride: not available

SECTION VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken in Case Material Is Released or Spilled: Notify safety personnel of spills. Surfaces contaminated with spills should be covered with soda ash or sodium bicarbonate to neutralize the acid. Place the neutralized material into containers suitable for eventual disposal, reclamation, or destruction.

Waste Disposal: Follow all federal, state, and local laws governing disposal.

Handling and Storage: Provide general and local explosion proof ventilation systems to maintain airborne concentrations below the TLV. Provide approved respiratory apparatus for nonroutine or emergency use. Use an approved filter and vapor respirator when the vapor or mist concentrations are high. Wear gloves and chemical safety glasses where contact with the liquid or high vapor concentrations may occur. An eye wash station and washing facilities should be readily available near handling and use areas.

> **NOTE:** Contact lenses pose a special problem; soft lenses may absorb irritants and all lenses concentrate them. **DO NOT** wear contact lenses in the laboratory.

This material should be stored at room temperature.

SECTION VIII. SOURCE DATA/OTHER COMMENTS

Sources: MDL Information Systems, Inc., MSDS *Hydrochloric Acid*, June 2, 1999.
MDL Information Systems, Inc., MSDS *Palladium*, March 16, 1999.
MDL Information Systems, Inc., MSDS *Palladium Chloride*, December 9, 1997.
Handbook of Chemistry and Physics, 70th ed., 1989 – 1990.

Disclaimer: Physical and chemical data contained in this MSDS are provided only for use in assessing the hazardous nature of the material. The MSDS was prepared carefully, using current references; however, NIST does not certify the data on the MSDS. The certified value for this material is given on the NIST Certificate of Analysis.