

SAFETY DATA SHEET PACKET

Product Identifier

SRM Number: 931h

SRM Name: Liquid Absorbance Standard for Ultraviolet and Visible Spectrophotometry

SRM Description:

A unit of Standard Reference Material (SRM) 931h consists of three kits, each comprising three cobalt-nickel solutions at different concentrations (Level I, Level II and Level III) and a blank solution (12 ampoules total). Each sealed borosilicate glass ampoule contains approximately 10 mL of solution.

SRM 931h Parts:

Liquid Absorbance Standard for Ultraviolet and Visible Spectrophotometry Level I

Liquid Absorbance Standard for Ultraviolet and Visible Spectrophotometry Level II

Liquid Absorbance Standard for Ultraviolet and Visible Spectrophotometry Level III

Liquid Absorbance Standard for Ultraviolet and Visible Spectrophotometry Blank

Company Information

National Institute of Standards and Technology
Standard Reference Materials Program
100 Bureau Drive, Stop 2300
Gaithersburg, Maryland 20899-2300

Telephone: 301-975-2200

FAX: 301-948-3730

E-mail: SRMMSDS@nist.gov

Website: <http://www.nist.gov/srm>

Emergency Telephone ChemTrec:

1-800-424-9300 (North America)

+1-703-527-3887 (International)

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SAFETY DATA SHEET

1. SUBSTANCE AND SOURCE IDENTIFICATION

Product Identifier

SRM Number: 931h
SRM Name: Liquid Absorbance Standard for Ultraviolet and Visible Spectrophotometry
SRM Part: Liquid Absorbance Standard for Ultraviolet and Visible Spectrophotometry
 Level I and Level II
Other Means of Identification: Not applicable.

Recommended Use of This Material and Restrictions of Use

This Standard Reference Material (SRM) is intended primarily for critical evaluation of daily working standards used in spectrophotometry and for use as an accuracy check of the photometric scale of spectrophotometers that provide a narrow effective spectral bandpass not to exceed the following: 2.2 nm at 302 nm, 2.9 nm at 395 nm, 4.8 nm at 512 nm, and 12.3 nm at 678 nm [1]. A unit of SRM 931h consists of three kits, each comprising three cobalt-nickel liquid filter solutions at different concentrations (Level I, Level II, and Level III) and a blank solution (12 ampoules total). Each sealed borosilicate glass ampoule contains approximately 10 mL of solution. This Safety Data Sheet is for level I and level II.

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 +1-703-527-3887 (International)

2. HAZARDS IDENTIFICATION

Classification

Physical Hazard:	Oxidizer	Category 2
Health Hazard:	Skin Corrosion/Irritation	Category 1B
	Serious Eye Damage/Eye Irritation	Category 1
	Carcinogenicity	Category 2

Label Elements
Symbol



Signal Word
 DANGER

Hazard Statement(s)

H272	May intensify fire; oxidizer.
H314	Causes severe skin burns and eye damage.
H351	Suspected of causing cancer through inhalation.

Precautionary Statement(s)

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P210	Keep away from heat.
P220	Keep away from clothing and other combustible materials.
P260	Do not breathe mists, vapors, or spray.
P264	Wash hands thoroughly after handling.
P280	Wear protective gloves, protective clothing, and eye protection.
P301 + P330 + P331	If swallowed: Rinse mouth. Do NOT induce vomiting.
P303 + P361 + P353	If on skin (or hair): Remove immediately all contaminated clothing. Rinse skin with water.
P304 + P340	If inhaled: Remove person to fresh air and keep comfortable for breathing.
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 doctor.
P363	Wash contaminated clothing before reuse.
P405	Store locked up.
P501	Dispose of contents and container according to local regulations.

Hazards Not Otherwise Classified: Not applicable.

Ingredients(s) with Unknown Acute Toxicity: Not applicable.

3. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

Substance: Cobalt and nickel in perchloric/nitric acid solution

Other Designations:

- Nitric acid (aqua fortis; hydrogen nitrate; azotic acid; engraver's acid)
- Perchloric acid (dioxonium perchlorate)

Components are listed in compliance with OSHA's 29 CFR 1910.1200; for the actual values see the NIST Certificate of Analysis.

Hazardous Component(s)	CAS Number	EC Number (EINECS)	Nominal Mass Concentration (%)
Perchloric acid	7601-90-3	231-512-4	3 - 5
Nitric acid	7697-37-2	231-714-2	0.4 - 0.7
Cobalt	7440-48-4	231-158-0	0.4 - 0.7
Nickel	7440-02-0	231-111-4	0.4 - 0.7
Non-Hazardous Component(s)			
Water	7732-18-5	231-791-2	93 -97

4. FIRST AID MEASURES

Description of First Aid Measures:

Inhalation: If adverse effects occur, remove to uncontaminated area. If not breathing, give artificial respiration or oxygen by qualified personnel. Seek immediate medical attention.

Skin Contact: Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get immediate medical attention. Thoroughly clean and dry contaminated clothing before reuse. Destroy contaminated shoes.

Eye Contact: Immediately flush eyes, including under the eyelids with copious amounts of water for at least 15 minutes. Seek immediate medical attention.

Ingestion: Contact a poison control center immediately for instructions. Do not induce vomiting. Give water to rinse out mouth. Never give liquids to a person with reduced awareness or becoming unconscious. If vomiting occurs, keep head lower than hips to prevent aspiration. If not breathing, give artificial respiration by qualified personnel. Seek immediate medical attention.

Most Important Symptoms/Effects, Acute and Delayed: Acid burns to skin, eyes, and lungs.

Indication of any immediate medical attention and special treatment needed, if necessary: If any of the above symptoms are present, seek immediate medical attention.

5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Negligible fire hazard. Oxidizer; may ignite or explode on contact with combustible materials. See Section 9, "Physical and Chemical Properties" for flammability properties.

Extinguishing Media:

Suitable: Regular dry chemical, carbon dioxide, water, regular foam.

Unsuitable: None listed.

Specific Hazards Arising from the Chemical: Thermal decomposition will form oxides of nitrogen, chlorine, cobalt and nickel.

Special Protective Equipment and Precautions for Fire-Fighters: Avoid inhalation of material or combustion byproducts. Wear full protective clothing and NIOSH approved self-contained breathing apparatus (SCBA).

NFPA Ratings (0 = Minimal; 1 = Slight; 2 = Moderate; 3 = Serious; 4 = Severe)

Health = 3

Fire = 0

Reactivity = 3

Other = OX

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures: Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment; see Section 8, "Exposure Controls and Personal Protection".

Methods and Materials for Containment and Clean up: Do not touch spilled material. Avoid contact with combustible materials. Notify safety personnel of spills. Absorb with sand or other non-combustible material. Collect spilled material in appropriate container for disposal. Isolate hazard area and deny entry. Keep out of water supplies and sewer.

7. HANDLING AND STORAGE

Safe Handling Precautions: See Section 8, "Exposure Controls and Personal Protection". Handle glass ampoules with care.

Storage: Store and handle in accordance with all current regulations and standards. Unopened ampoules should be stored under normal laboratory conditions in an upright position inside the original container supplied by NIST. Keep separated from incompatible substances (See Section 10, "Stability and Reactivity").

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits:

Component: Perchloric acid

No limits established.

Component: Nitric acid

NIOSH (REL): 5 mg/m³ (2 ppm; TWA)
10 mg/m³ (4 ppm; STEL)
65 mg/m³ (25 ppm; IDLH)

ACGIH (TLV): 5 mg/m³ (2 ppm; TWA)
10 mg/m³ (4 ppm; STEL)

OSHA (PEL): 5 mg/m³ (2 ppm; TWA)

Component: Cobalt

NIOSH (REL): 0.05 mg/m³ (TWA, dust and fume)
20 mg/m³ (IDLH, dust and fume)

ACGIH (TLV): 0.02 mg/m³ (TWA)

OSHA (PEL): 0.1 mg/m³ (TWA, dust and fume)

Component: Nickel

NIOSH (REL):	0.015 mg/m ³ (TWA)
	10 mg/m ³ (IDLH)
ACGIH (TLV):	1.5 mg/m ³ (TWA, inhalable fraction)
OSHA (PEL):	1 mg/m ³ (TWA)

Engineering Controls: Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

Personal Protection: In accordance with OSHA 29 CFR 1910.132, subpart I, wear appropriate Personal Protective Equipment (PPE) to minimize exposure to this material.

Respiratory Protection: If workplace conditions warrant a respirator, a respiratory protection program that meets OSHA 29CFR 1910.134 must be followed. Refer to NIOSH 42 CFR 84 for applicable certified respirators.

Eye/Face Protection: Wear splash resistant safety goggles with a face shield. An eyewash station should be readily available near areas of use.

Skin and Body Protection: Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. Chemical-resistant gloves should be worn at all times when handling chemicals.

9. PHYSICAL AND CHEMICAL PROPERTIES

NOTE: The physical and chemical data provided are for the main hazardous components. No physical or chemical data are available for this solution. The actual behavior of the solution may differ from the pure components listed.

Descriptive Properties:	Perchloric acid (3 % to 5 % of this SRM)	Nitric acid (≤0.7 % of this SRM)
Appearance (physical state, color, etc.):	colorless liquid	colorless to yellow liquid
Molecular Formula:	HClO ₄	HNO ₃
Molar Mass (g/mol):	100.46	63.01
Odor:	not available	irritating odor
Odor threshold:	not available	not available
pH:	acidic	1 (1 M)
Evaporation rate:	not available	not available
Melting point/freezing point (°C):	not available	-42 (-43 °F)
Relative Density (g/L) as specific gravity (water = 1):	1.6	1.5027 at (25 °C)
Vapor Pressure (mmHg):	not available	47.9 at (20 °C)
Vapor Density (air = 1):	not available	3.2
Viscosity (cP):	not available	not available
Solubility(ies):	water	miscible with water and ether
Partition coefficient (n-octanol/water):	not available	not available
Thermal Stability Properties:		
Autoignition Temperature (°C):	not applicable	not applicable
Thermal Decomposition (°C):	not applicable	not applicable
Initial boiling point and boiling range (°C):	115 (239 °F)	83 (181 °F)
Explosive Limits, LEL (Volume %):	not applicable	not applicable
Explosive Limits, UEL (Volume %):	not applicable	not applicable
Flash Point (°C):	not applicable	not applicable
Flammability (solid, gas):	not applicable	not applicable

10. STABILITY AND REACTIVITY

Reactivity: Stable at normal temperatures and pressure.

Stability: X Stable Unstable

Possible Hazardous Reactions: None listed.

Conditions to Avoid: Contact with combustible or incompatible materials. Do not allow this solution to dry out.

Incompatible Materials: Acids, combustible materials, metals, oxidizing materials, metal oxides, halo carbons, halogens, metal salts, bases.

Fire/Explosion Information: See Section 5, "Fire Fighting Measures".

Hazardous Decomposition: Thermal decomposition will produce oxides of nitrogen, chlorine, cobalt and nickel.

Hazardous Polymerization: Will Occur X Will Not Occur

11. TOXICOLOGICAL INFORMATION

Route of Exposure: X Inhalation X Skin X Ingestion

Symptoms Related to the Physical, Chemical and Toxicological Characteristics: Burning pain and severe skin corrosion, eye, lung, and blood damage, and cancer.

Potential Health Effects (Acute, Chronic and Delayed):

Inhalation: May cause respiratory tract irritation with coughing, choking, and possibly burns of the mucous membranes. Other initial symptoms may include dizziness, headache, nausea and weakness. In some cases pulmonary edema may develop, either immediately in severe cases, or more likely after a latent period of 5 h to 72 h. The symptoms may include tightness in the chest, dyspnea, frothy sputum, and cyanosis. Depending on the concentration and duration of exposure, repeated or prolonged exposure may cause erosion of the teeth, inflammatory and ulcerative changes in the mouth, and possibly jaw necrosis. Bronchial irritation with cough and frequent attacks of bronchial pneumonia may occur.

Skin Contact: Direct contact may cause severe pain, burns and possibly brownish or yellowish stains. Burns may be deep with sharp edges and heal slowly with scar tissue formation. Effects of acid burns may be delayed. Repeated or prolonged contact may result in dermatitis or effects similar to acute exposure.

Eye Contact: Direct contact may cause pain, lacrimation, photophobia and burns. In mild burns, the epithelium regenerates rapidly and the eye recovers completely. In severe cases, the extent of injury may not be fully apparent for several weeks. Ultimately, the whole cornea may become deeply vascularized and opaque resulting in blindness. In the worst cases, the eye may be totally destroyed.

Ingestion: May cause circumoral burns with discoloration and corrosion of the mucous membranes of the mouth, throat, and esophagus. There may be immediate pain and difficulty or inability to swallow or speak. Epiglottal edema may result in respiratory distress and possibly asphyxia. Marked thirst, nausea, vomiting and diarrhea may occur. Depending on the area and degree of corrosion, the vomitus may contain fresh or dark blood and large shreds of mucosa.

Numerical Measures of Toxicity:

Acute Toxicity: Not classified.

Perchloric acid, Rat, Oral LD50: 1100 mg/kg

Nitric acid, Rat, Inhalation LC50: 130 mg/m³ (4 h)

Nickel, Rat, Oral LD50: >9000 mg/kg

Cobalt, Rat, Oral LD50: 6170 mg/kg

Skin Corrosion/Irritation: This SRM contains >1 % acid and it is classified as Category 1B.

Serious Eye Damage/Irritation: This SRM contains >1 % acid and it is classified as Category 1.

Respiratory Sensitization: Classification not possible.

Classification is not possible since this is a corrosive mixture.

Skin Sensitization: Classification not possible.

Classification is not possible since this is a corrosive mixture.

Germ Cell Mutagenicity: No data available; not classified.

Carcinogenicity: Category 2.

Listed as a Carcinogen/Potential Carcinogen X Yes No

Nickel and cobalt are listed as Group 2B (Possibly carcinogenic to humans) by IARC.

Nickel is listed as reasonably anticipated to be a human carcinogen by NTP.

Reproductive Toxicity: Not classified.

Nitric acid, Rat, Oral TDLo: 2345 mg/kg (pregnant 18 d)

Nitric acid, Rat, Oral TDLo: 21 150 mg/kg (pregnant 1 d to 21 d)

Nickel, Rat, Oral TDLo: 158 mg/kg (multigeneration)

Specific Target Organ Toxicity, Single Exposure: No data available; not classified.

Specific Target Organ Toxicity, Repeated Exposure: No data available; not classified.

Aspiration Hazard: No data available; not classified.

12. ECOLOGICAL INFORMATION

Ecotoxicity Data:

Perchloric acid: No data available.

Nitric acid: Starfish (*Asterias rubens*) LC50: 100 mg/L to 300 mg/L (48 h, renewal/aerated water)

Cobalt: Zebrafish (*Brachydanio rerio*) LC50: >100 mg/L (96 h, static)

Nickel: Zebrafish (*Brachydanio rerio*) LC50: >100 mg/L (96 h)

Persistence and Degradability: No data available.

Bioaccumulative Potential: No bioaccumulation.

Mobility in Soil: No data available.

Other Adverse effects: No data available.

13. DISPOSAL CONSIDERATIONS

Waste Disposal: Dispose of waste in accordance with all applicable federal, state, and local regulations. Nitric and perchloric acids subject to disposal regulations: U.S. EPA 40 CFR 262, Hazardous Waste Numbers: D001, D002, D003.

14. TRANSPORTATION INFORMATION

U.S. DOT and IATA: UN3098, Oxidizing liquid, corrosive n.o.s. (perchloric acid, nitric acid), Hazard Class 5.1, Sub Risk 8, Packing Group II, Excepted Quantities E2.

15. REGULATORY INFORMATION

U.S. Regulations:

CERCLA Sections 102a/103 (40 CFR 302.4): Nitric acid, 1000 lbs (454 kg) final RQ.

Nickel, 100 lb (45.4 kg) final RQ.

SARA Title III Section 302 (40 CFR 355.30): Nitric acid, 1000 lbs (454 kg) final TPQ

SARA Title III Section 304 (40 CFR 355.40): Nitric acid, 1000 lbs (454 kg) EPCRA RQ

SARA Title III Section 313 (40 CFR 372.65): 0.1 % de minimis concentration (Nickel, Cobalt);
1 % de minimis concentration (Nitric acid)

OSHA Process Safety (29 CFR 1910.119): Regulated for acids at higher concentrations:

Nitric acid: 500 lbs TQ (≥94.5 % by weight)

Perchloric acid: 5000 lbs TQ (concentration >60 % by weight)

SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE HEALTH: Yes.

CHRONIC HEALTH: Yes.

FIRE: Yes.

REACTIVE: Yes.

PRESSURE: No.

State Regulations:

California Proposition 65: WARNING! This product contains chemicals (cobalt and nickel) known to the state of California to cause cancer.

U.S. TSCA Inventory: Perchloric acid, nitric acid, nickel and cobalt are listed.

TSCA 12(b), Export Notification: Not listed.

Canadian Regulations:

WHMIS Information: Not provided for this material.

16. OTHER INFORMATION

Issue Date: 08 March 2016

Sources: ChemAdvisor, Inc., SDS *Nitric Acid*, 09 December 2015.

ChemAdvisor, Inc., SDS *Perchloric Acid, 60 - 72 %*, 09 December 2015.

ChemAdvisor, Inc., SDS *Cobalt*, 09 December 2015.

ChemAdvisor, Inc., SDS *Nickel*, 09 December 2015.

Hazardous Substances Data Bank (HSDB), National Library of Medicine's TOXNET system, *Nitric Acid* CAS No. 7697 37 2; available at <http://toxnet.nlm.nih.gov> (accessed Mar 2016).

CDC; NIOSH; *NIOSH Pocket Guide to Chemical Hazards*; Department of Health and Human Services (DHHS), Centers for Disease Control and Prevention (CDC), National Institute for Safety and Health; *Nitric Acid*, 13 February 2015; available at <http://www.cdc.gov/niosh/npg/npgd0447.html> (accessed Mar 2016).

EC; European Chemical Substance Information System (ESIS), *Nitric Acid*, CAS No. 7697-37-2; available at <http://esis.jrc.ec.europa.eu/index.php?PGM=cla> (accessed Mar 2016).

EC; European Chemical Substance Information System (ESIS), *Perchloric Acid*, CAS No. 7601-90-3; available at <http://esis.jrc.ec.europa.eu/index.php?PGM=cla> (accessed Mar 2016).

EC; European Chemical Substance Information System (ESIS), *Cobalt*, CAS No. 7440-48-4; available at <http://esis.jrc.ec.europa.eu/index.php?PGM=cla> (accessed Mar 2016).

EC; European Chemical Substance Information System (ESIS), *Nickel*, CAS No. 7440-02-0; available at <http://esis.jrc.ec.europa.eu/index.php?PGM=cla> (accessed Mar 2016).

Key of Acronyms:

ACGIH	American Conference of Governmental Industrial Hygienists	NTP	National Toxicology Program
CAS	Chemical Abstracts Service	OSHA	Occupational Safety and Health Administration
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	PEL	Permissible Exposure Limit
CFR	Code of Federal Regulations	RCRA	Resource Conservation and Recovery Act
DOT	Department of Transportation	REL	Recommended Exposure Limit
EINECS	European Inventory of Existing Commercial Chemical Substances	RQ	Reportable Quantity
EPCRA	Emergency Planning and Community Right-to-Know Act	RTECS	Registry of Toxic Effects of Chemical Substances
IARC	International Agency for Research on Cancer	SARA	Superfund Amendments and Reauthorization Act
IATA	International Air Transport Association	SCBA	Self-Contained Breathing Apparatus
IDLH	Immediately Dangerous to Life and Health	SRM	Standard Reference Material
LC50	Lethal Concentration	STEL	Short Term Exposure Limit
LD50	Median Lethal Dose or Lethal Dose, 50 %	STOT	Specific Target Organ Toxicity
LEL	Lower Explosive Limit	TLV	Threshold Limit Value
MSDS	Material Safety Data Sheet	TPQ	Threshold Planning Quantity
NFPA	National Fire Protection Association	TSCA	Toxic Substances Control Act
NIOSH	National Institute for Occupational Safety and Health	TWA	Time Weighted Average
NIST	National Institute of Standards and Technology	UEL	Upper Explosive Limit
n.o.s.	Not Otherwise Specified	WHMIS	Workplace Hazardous Materials Information System

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

Users of this SRM should ensure that the SDS in their possession is current. This can be accomplished by contacting the SRM Program: telephone (301) 975-2200; fax (301) 948-3730; e-mail srmmsds@nist.gov; or via the Internet at <http://www.nist.gov/srm>.

SAFETY DATA SHEET

1. SUBSTANCE AND SOURCE IDENTIFICATION

Product Identifier

SRM Number: 931h
SRM Name: Liquid Absorbance Standard for Ultraviolet and Visible Spectrophotometry
SRM Part: Liquid Absorbance Standard for Ultraviolet and Visible Spectrophotometry Level III
Other Means of Identification: Not applicable.

Recommended Use of This Material and Restrictions of Use

This Standard Reference Material (SRM) is intended primarily for critical evaluation of daily working standards used in spectrophotometry and for use as an accuracy check of the photometric scale of spectrophotometers that provide a narrow effective spectral bandpass not to exceed the following: 2.2 nm at 302 nm, 2.9 nm at 395 nm, 4.8 nm at 512 nm, and 12.3 nm at 678 nm [1]. A unit of SRM 931h consists of three kits, each comprising three cobalt-nickel liquid filter solutions at different concentrations (Level I, Level II, and Level III) and a blank solution (12 ampoules total). Each sealed borosilicate glass ampoule contains approximately 10 mL of solution. This Safety Data Sheet is for level III.

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Classification

Physical Hazard:	Oxidizer	Category 2
Health Hazard:	Skin Corrosion/Irritation	Category 1B
	Serious Eye Damage/Eye Irritation	Category 1
	Carcinogenicity	Category 2
	STOT-Repeat Exposure	Category 1

Label Elements

Symbol



Signal Word

DANGER

Hazard Statement(s)

H272	May intensify fire; oxidizer.
H314	Causes severe skin burns and eye damage.
H351	Suspected of causing cancer through inhalation.
H372	Causes damage to organs through prolonged or repeated exposure <inhalation>.

Precautionary Statement(s)

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P210	Keep away from heat.
P220	Keep away from clothing and other combustible materials.
P260	Do not breathe mists, vapors, or spray.
P264	Wash hands thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P280	Wear protective gloves, protective clothing, and eye protection.
P301 + P330 + P331	If swallowed: Rinse mouth. Do NOT induce vomiting.
P303 + P361 + P353	If on skin (or hair): Remove immediately all contaminated clothing. Rinse skin with water.
P304 + P340	If inhaled: Remove person to fresh air and keep comfortable for breathing.
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 doctor.
P363	Wash contaminated clothing before reuse.
P405	Store locked up.
P501	Dispose of contents and container according to local regulations.

Hazards Not Otherwise Classified: Not applicable.

Ingredients(s) with Unknown Acute Toxicity: Not applicable.

3. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

Substance: Cobalt and nickel in perchloric/nitric acid solution

Other Designations:

Nitric acid (aqua fortis; hydrogen nitrate; azotic acid; engraver's acid)

Perchloric acid (dioxonium perchlorate)

Components are listed in compliance with OSHA's 29 CFR 1910.1200; for the actual values see the NIST Certificate of Analysis.

Hazardous Component(s)	CAS Number	EC Number (EINECS)	Nominal Mass Concentration (%)
Perchloric acid	7601-90-3	231-512-4	<7
Nitric acid	7697-37-2	231-714-2	1
Cobalt	7440-48-4	231-158-0	1
Nickel	7440-02-0	231-111-4	1
Non-Hazardous Component(s)			
Water	7732-18-5	231-791-2	>89

4. FIRST AID MEASURES

Description of First Aid Measures:

Inhalation: If adverse effects occur, remove to uncontaminated area. If not breathing, give artificial respiration or oxygen by qualified personnel. Seek immediate medical attention.

Skin Contact: Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get immediate medical attention. Thoroughly clean and dry contaminated clothing before reuse. Destroy contaminated shoes.

Eye Contact: Immediately flush eyes, including under the eyelids with copious amounts of water for at least 15 minutes. Seek immediate medical attention.

Ingestion: Contact a poison control center immediately for instructions. Do not induce vomiting. Give water to rinse out mouth. Never give liquids to a person with reduced awareness or becoming unconscious. If vomiting occurs, keep head lower than hips to prevent aspiration. If not breathing, give artificial respiration by qualified personnel. Seek immediate medical attention.

Most Important Symptoms/Effects, Acute and Delayed: Acid burns to skin, eyes, and lungs.

Indication of any immediate medical attention and special treatment needed, if necessary: If any of the above symptoms are present, seek immediate medical attention.

5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Negligible fire hazard. Oxidizer. May ignite or explode on contact with combustible materials. See Section 9, "Physical and Chemical Properties" for flammability properties.

Extinguishing Media:

Suitable: Regular dry chemical, carbon dioxide, water, regular foam.

Unsuitable: None listed.

Specific Hazards Arising from the Chemical: Thermal decomposition will form oxides of nitrogen, chlorine, cobalt and nickel.

Special Protective Equipment and Precautions for Fire-Fighters: Avoid inhalation of material or combustion byproducts. Wear full protective clothing and NIOSH approved self-contained breathing apparatus (SCBA).

NFPA Ratings (0 = Minimal; 1 = Slight; 2 = Moderate; 3 = Serious; 4 = Severe)

Health = 3

Fire = 0

Reactivity = 3

Other = OX

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures: Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment; see Section 8, "Exposure Controls and Personal Protection".

Methods and Materials for Containment and Clean up: Do not touch spilled material. Avoid contact with combustible materials. Notify safety personnel of spills. Absorb with sand or other non-combustible material. Collect spilled material in appropriate container for disposal. Isolate hazard area and deny entry. Keep out of water supplies and sewer.

7. HANDLING AND STORAGE

Safe Handling Precautions: See Section 8, "Exposure Controls and Personal Protection". Handle glass ampoules with care.

Storage: Store and handle in accordance with all current regulations and standards. Unopened ampoules should be stored under normal laboratory conditions in an upright position inside the original container supplied by NIST. Keep separated from incompatible substances (see Section 10, "Stability and Reactivity").

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits:

Component: Perchloric acid

No limits established.

Component: Nitric acid

NIOSH (REL): 5 mg/m³ (2 ppm; TWA)
10 mg/m³ (4 ppm; STEL)
65 mg/m³ (25 ppm; IDLH)

ACGIH (TLV): 5 mg/m³ (2 ppm; TWA)
10 mg/m³ (4 ppm; STEL)

OSHA (PEL): 5 mg/m³ (2 ppm; TWA)

Component: Cobalt

NIOSH (REL): 0.05 mg/m³ (TWA, dust and fume)
20 mg/m³ (IDLH, dust and fume)

ACGIH (TLV): 0.02 mg/m³ (TWA)

OSHA (PEL): 0.1 mg/m³ (TWA, dust and fume)

Component: Nickel

NIOSH (REL):	0.015 mg/m ³ (TWA)
	10 mg/m ³ (IDLH)
ACGIH (TLV):	1.5 mg/m ³ (TWA, inhalable fraction)
OSHA (PEL):	1 mg/m ³ (TWA)

Engineering Controls: Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

Personal Protection: In accordance with OSHA 29 CFR 1910.132, subpart I, wear appropriate Personal Protective Equipment (PPE) to minimize exposure to this material.

Respiratory Protection: If workplace conditions warrant a respirator, a respiratory protection program that meets OSHA 29CFR 1910.134 must be followed. Refer to NIOSH 42 CFR 84 for applicable certified respirators.

Eye/Face Protection: Wear splash resistant safety goggles with a face shield. An eyewash station should be readily available near areas of use.

Skin and Body Protection: Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. Chemical-resistant gloves should be worn at all times when handling chemicals.

9. PHYSICAL AND CHEMICAL PROPERTIES

NOTE: The physical and chemical data provided are for the main hazardous components. No physical or chemical data are available for this solution. The actual behavior of the solution may differ from the pure components listed.

Descriptive Properties:	Perchloric acid (<7 % of this SRM)	Nitric acid (1 % of this SRM)
Appearance (physical state, color, etc.):	colorless liquid	colorless to yellow liquid
Molecular Formula:	HClO ₄	HNO ₃
Molar Mass (g/mol):	100.46	63.01
Odor:	not available	irritating odor
Odor threshold:	not available	not available
pH:	acidic	1 (1 M)
Evaporation rate:	not available	not available
Melting point/freezing point (°C):	not available	-42 (-43 °F)
Relative Density (g/L) as specific gravity (water = 1):	1.6	1.5027 at (25 °C)
Vapor Pressure (mmHg):	not available	47.9 at (20 °C)
Vapor Density (air = 1):	not available	3.2
Viscosity (cP):	not available	not available
Solubility(ies):	water	miscible with water and ether
Partition coefficient (n-octanol/water):	not available	not available
Thermal Stability Properties:		
Autoignition Temperature (°C):	not applicable	not applicable
Thermal Decomposition (°C):	not applicable	not applicable
Initial boiling point and boiling range (°C):	115 (239 °F)	83 (181 °F)
Explosive Limits, LEL (Volume %):	not applicable	not applicable
Explosive Limits, UEL (Volume %):	not applicable	not applicable
Flash Point (°C):	not applicable	not applicable
Flammability (solid, gas):	not applicable	not applicable

10. STABILITY AND REACTIVITY

Reactivity: Stable at normal temperatures and pressure.

Stability: X Stable Unstable

Possible Hazardous Reactions: None listed.

Conditions to Avoid: Contact with combustible or incompatible materials. Do not allow this solution to dry out.

Incompatible Materials: Acids, combustible materials, metals, oxidizing materials, metal oxides, halo carbons, halogens, metal salts, bases.

Fire/Explosion Information: See Section 5, "Fire Fighting Measures".

Hazardous Decomposition: Thermal decomposition will produce oxides of nitrogen, chlorine, cobalt and nickel.

Hazardous Polymerization: Will Occur X Will Not Occur

11. TOXICOLOGICAL INFORMATION

Route of Exposure: X Inhalation X Skin X Ingestion

Symptoms Related to the Physical, Chemical and Toxicological Characteristics: Burning pain and severe skin corrosion, eye, lung, and blood damage, and cancer.

Potential Health Effects (Acute, Chronic and Delayed):

Inhalation: May cause respiratory tract irritation with coughing, choking, and possibly burns of the mucous membranes. Other initial symptoms may include dizziness, headache, nausea and weakness. In some cases pulmonary edema may develop, either immediately in severe cases, or more likely after a latent period of 5 h to 72 h. The symptoms may include tightness in the chest, dyspnea, frothy sputum, and cyanosis. Depending on the concentration and duration of exposure, repeated or prolonged exposure may cause erosion of the teeth, inflammatory and ulcerative changes in the mouth, and possibly jaw necrosis. Bronchial irritation with cough and frequent attacks of bronchial pneumonia may occur.

Skin Contact: Direct contact may cause severe pain, burns and possibly brownish or yellowish stains. Burns may be deep with sharp edges and heal slowly with scar tissue formation. Effects of acid burns may be delayed. Repeated or prolonged contact may result in dermatitis or effects similar to acute exposure.

Eye Contact: Direct contact may cause pain, lacrimation, photophobia and burns. In mild burns, the epithelium regenerates rapidly and the eye recovers completely. In severe cases, the extent of injury may not be fully apparent for several weeks. Ultimately, the whole cornea may become deeply vascularized and opaque resulting in blindness. In the worst cases, the eye may be totally destroyed.

Ingestion: May cause circumoral burns with discoloration and corrosion of the mucous membranes of the mouth, throat, and esophagus. There may be immediate pain and difficulty or inability to swallow or speak. Epiglottal edema may result in respiratory distress and possibly asphyxia. Marked thirst, nausea, vomiting and diarrhea may occur. Depending on the area and degree of corrosion, the vomitus may contain fresh or dark blood and large shreds of mucosa.

Numerical Measures of Toxicity:

Acute Toxicity: Not classified.

Perchloric acid, Rat, Oral LD50: 1100 mg/kg

Nitric acid, Rat, Inhalation LC50: 130 mg/m³ (4 h)

Nickel, Rat, Oral LD50: >9000 mg/kg

Cobalt, Rat, Oral LD50: 6170 mg/kg

Skin Corrosion/Irritation: This SRM contains >1 % acid and it is classified as Category 1B.

Serious Eye Damage/Irritation: This SRM contains >1 % acid and it is classified as Category 1.

Respiratory Sensitization: Classification not possible.

Classification is not possible since this is a corrosive mixture.

Skin Sensitization: Classification not possible.

Classification is not possible since this is a corrosive mixture.

Germ Cell Mutagenicity: No data available; not classified.

Carcinogenicity: Category 2.

Listed as a Carcinogen/Potential Carcinogen X Yes No

Nickel and cobalt are listed as Group 2B (Possibly carcinogenic to humans) by IARC.

Nickel is listed as reasonably anticipated to be a human carcinogen by NTP.

Reproductive Toxicity: Not classified.

Nitric acid, Rat, Oral TDLo: 2345 mg/kg (pregnant 18 d)

Nitric acid, Rat, Oral TDLo: 21 150 mg/kg (pregnant 1 d to 21 d)

Nickel, Rat, Oral TDLo: 158 mg/kg (multigeneration)

Specific Target Organ Toxicity, Single Exposure: No data available; not classified.

Specific Target Organ Toxicity, Repeated Exposure: This SRM contains 1 % nickel and it is classified as Category 1. Inhalation: Causes damage to organs through prolonged or repeated exposure.

Aspiration Hazard: No data available; not classified.

12. ECOLOGICAL INFORMATION

Ecotoxicity Data:

Perchloric acid: No data available.

Nitric acid: Starfish (*Asterias rubens*) LC50: 100-300 mg/L (48 h, renewal/aerated water)

Cobalt: Zebrafish (*Brachydanio rerio*) LC50: >100 mg/L (96 h, static)

Nickel: Zebrafish (*Brachydanio rerio*) LC50: >100 mg/L (96 h)

Persistence and Degradability: No data available.

Bioaccumulative Potential: No bioaccumulation.

Mobility in Soil: No data available.

Other Adverse effects: No data available.

13. DISPOSAL CONSIDERATIONS

Waste Disposal: Dispose of waste in accordance with all applicable federal, state, and local regulations. Nitric and perchloric acids subject to disposal regulations: U.S. EPA 40 CFR 262, Hazardous Waste Numbers: D001, D002, D003.

14. TRANSPORTATION INFORMATION

U.S. DOT and IATA: UN3098, Oxidizing liquid, corrosive n.o.s. (perchloric acid, nitric acid), Hazard Class 5.1, Sub Risk 8, Packing Group II, Excepted Quantities E2.

15. REGULATORY INFORMATION

U.S. Regulations:

CERCLA Sections 102a/103 (40 CFR 302.4): Nitric acid, 1000 lbs (454 kg) final RQ.

Nickel, 100 lb (45.4 kg) final RQ.

SARA Title III Section 302 (40 CFR 355.30): Nitric acid, 1000 lbs (454 kg) final TPQ

SARA Title III Section 304 (40 CFR 355.40): Nitric acid, 1000 lbs (454 kg) EPCRA RQ

SARA Title III Section 313 (40 CFR 372.65): 0.1 % de minimis concentration (Nickel, Cobalt);

1 % de minimis concentration (Nitric acid)

OSHA Process Safety (29 CFR 1910.119): Regulated for acids at higher concentrations:

Nitric acid: 500 lbs TQ (≥ 94.5 % by weight)

Perchloric acid: 5000 lbs TQ (concentration >60 % by weight)

SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE HEALTH:	Yes.
CHRONIC HEALTH:	Yes.
FIRE:	Yes.
REACTIVE:	Yes.
PRESSURE:	No.

State Regulations:

California Proposition 65: WARNING! This product contains chemicals (cobalt and nickel) known to the state of California to cause cancer.

U.S. TSCA Inventory: Perchloric acid, nitric acid, nickel and cobalt are listed.

TSCA 12(b), Export Notification: Not listed.

Canadian Regulations:

WHMIS Information: Not provided for this material.

16. OTHER INFORMATION

Issue Date: 08 March 2016

Sources: ChemAdvisor, Inc., SDS *Nitric Acid*, 09 December 2015.

ChemAdvisor, Inc., SDS *Perchloric Acid, 60- 72 %*, 09 December 2015.

ChemAdvisor, Inc., SDS *Cobalt*, 09 December 2015.

ChemAdvisor, Inc., SDS *Nickel*, 09 December 2015.

Hazardous Substances Data Bank (HSDB), National Library of Medicine's TOXNET system, *Nitric Acid* CAS No. 7697 37 2; available at <http://toxnet.nlm.nih.gov> (accessed Mar 2016).

CDC; NIOSH; *NIOSH Pocket Guide to Chemical Hazards*; Department of Health and Human Services (DHHS), Centers for Disease Control and Prevention (CDC), National Institute for Safety and Health; *Nitric Acid*, 18 November 2010; available at <http://www.cdc.gov/niosh/npg/npgd0447.html> (accessed Mar 2016).

EC; European Chemical Substance Information System (ESIS), *Nitric Acid, CAS No. 7697-37-2*; available at <http://esis.jrc.ec.europa.eu/index.php?PGM=cla> (accessed Mar 2016).

EC; European Chemical Substance Information System (ESIS), *Perchloric Acid, CAS No. 7601-90-3*; available at <http://esis.jrc.ec.europa.eu/index.php?PGM=cla> (accessed Mar 2016).

EC; European Chemical Substance Information System (ESIS), *Cobalt, CAS No. 7440-48-4*; available at <http://esis.jrc.ec.europa.eu/index.php?PGM=cla> (accessed Mar 2016).

EC; European Chemical Substance Information System (ESIS), *Nickel, CAS No. 7440-02-0*; available at <http://esis.jrc.ec.europa.eu/index.php?PGM=cla> (accessed Mar 2016).

Key of Acronyms:

ACGIH	American Conference of Governmental Industrial Hygienists	NTP	National Toxicology Program
CAS	Chemical Abstracts Service	OSHA	Occupational Safety and Health Administration
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	PEL	Permissible Exposure Limit
CFR	Code of Federal Regulations	RCRA	Resource Conservation and Recovery Act
DOT	Department of Transportation	REL	Recommended Exposure Limit
EINECS	European Inventory of Existing Commercial Chemical Substances	RQ	Reportable Quantity
EPCRA	Emergency Planning and Community Right-to-Know Act	RTECS	Registry of Toxic Effects of Chemical Substances
IARC	International Agency for Research on Cancer	SARA	Superfund Amendments and Reauthorization Act
IATA	International Air Transport Association	SCBA	Self-Contained Breathing Apparatus
IDLH	Immediately Dangerous to Life and Health	SRM	Standard Reference Material
LC50	Lethal Concentration	STEL	Short Term Exposure Limit
LD50	Median Lethal Dose or Lethal Dose, 50 %	STOT	Specific Target Organ Toxicity
LEL	Lower Explosive Limit	TLV	Threshold Limit Value
MSDS	Material Safety Data Sheet	TPQ	Threshold Planning Quantity
NFPA	National Fire Protection Association	TSCA	Toxic Substances Control Act
NIOSH	National Institute for Occupational Safety and Health	TWA	Time Weighted Average
NIST	National Institute of Standards and Technology	UEL	Upper Explosive Limit
n.o.s.	Not Otherwise Specified	WHMIS	Workplace Hazardous Materials Information System

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

Users of this SRM should ensure that the SDS in their possession is current. This can be accomplished by contacting the SRM Program: telephone (301) 975-2200; fax (301) 948-3730; e-mail srmmsds@nist.gov; or via the Internet at <http://www.nist.gov/srm>.

SAFETY DATA SHEET

1. SUBSTANCE AND SOURCE IDENTIFICATION

Product Identifier

SRM Number: 931h
SRM Name: Liquid Absorbance Standard for Ultraviolet and Visible Spectrophotometry
SRM Part: Liquid Absorbance Standard for Ultraviolet and Visible Spectrophotometry Blank
Other Means of Identification: Not applicable.

Recommended Use of This Material and Restrictions of Use

This Standard Reference Material (SRM) is intended primarily for critical evaluation of daily working standards used in spectrophotometry and for use as an accuracy check of the photometric scale of spectrophotometers that provide a narrow effective spectral bandpass not to exceed the following: 2.2 nm at 302 nm, 2.9 nm at 395 nm, 4.8 nm at 512 nm, and 12.3 nm at 678 nm [1]. A unit of SRM 931h consists of three kits, each comprising three cobalt-nickel liquid filter solutions at different concentrations (Level I, Level II, and Level III) and a blank solution (12 ampoules total). Each sealed borosilicate glass ampoule contains approximately 10 mL of solution. This Safety Data Sheet is for the blank.

Company Information

National Institute of Standards and Technology
 Standard Reference Materials Program
 100 Bureau Drive, Stop 2300
 Gaithersburg, Maryland 20899-2300

Telephone: 301-975-2200
 FAX: 301-948-3730
 E-mail: SRMMSDS@nist.gov
 Website: <http://www.nist.gov/srm>

Emergency Telephone ChemTrec:
 1-800-424-9300 (North America)
 +1-703-527-3887 (International)

2. HAZARDS IDENTIFICATION

Classification

Physical Hazard:	Oxidizer	Category 2
Health Hazard:	Skin Corrosion/Irritation	Category 1B
	Serious Eye Damage/Eye Irritation	Category 1

Label Elements
Symbol



Signal Word
 DANGER

Hazard Statement(s)

H272 May intensify fire; oxidizer.
 H314 Causes severe skin burns and eye damage.

Precautionary Statement(s)

P210	Keep away from heat.
P220	Keep away from clothing and other combustible materials.
P260	Do not breathe mists, vapors, or spray.
P264	Wash hands thoroughly after handling.
P280	Wear protective gloves, protective clothing, and eye protection.
P301 + P330 + P331	If swallowed: Rinse mouth. Do NOT induce vomiting.
P303 + P361 + P353	If on skin (or hair): Remove immediately all contaminated clothing. Rinse skin with water.
P304 + P340	If inhaled: Remove person to fresh air and keep comfortable for breathing.
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 doctor.
P363	Wash contaminated clothing before reuse.
P405	Store locked up.
P501	Dispose of contents and container according to local regulations.

Hazards Not Otherwise Classified: Not applicable.

Ingredients(s) with Unknown Acute Toxicity: Not applicable.

3. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

Substance: Perchloric acid

Other Designations:

Perchloric acid (dioxonium perchlorate)

Components are listed in compliance with OSHA's 29 CFR 1910.1200; for the actual values see the NIST Certificate of Analysis.

Hazardous Component(s)	CAS Number	EC Number (EINECS)	Nominal Mass Concentration (%)
Perchloric acid	7601-90-3	231-512-4	1
Non-Hazardous Component(s)			
Water	7732-18-5	231-791-2	>99

4. FIRST AID MEASURES

Description of First Aid Measures:

Inhalation: If adverse effects occur, remove to uncontaminated area. If not breathing, give artificial respiration or oxygen by qualified personnel. Seek immediate medical attention.

Skin Contact: Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get immediate medical attention. Thoroughly clean and dry contaminated clothing before reuse. Destroy contaminated shoes.

Eye Contact: Immediately flush eyes, including under the eyelids with copious amounts of water for at least 15 minutes. Seek immediate medical attention.

Ingestion: Contact a poison control center immediately for instructions. Do not induce vomiting. Give water to rinse out mouth. Never give liquids to a person with reduced awareness or becoming unconscious. If vomiting occurs, keep head lower than hips to prevent aspiration. If not breathing, give artificial respiration by qualified personnel. Seek immediate medical attention.

Most Important Symptoms/Effects, Acute and Delayed: Acid burns to skin, eyes, and lungs.

Indication of any immediate medical attention and special treatment needed, if necessary: If any of the above symptoms are present, seek immediate medical attention.

5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Negligible fire hazard. Oxidizer. May ignite or explode on contact with combustible materials. See Section 9, "Physical and Chemical Properties" for flammability properties.

Extinguishing Media:

Suitable: Regular dry chemical, carbon dioxide, water, regular foam.

Unsuitable: None listed.

Specific Hazards Arising from the Chemical: None listed.

Special Protective Equipment and Precautions for Fire-Fighters: Avoid inhalation of material or combustion byproducts. Wear full protective clothing and NIOSH approved self-contained breathing apparatus (SCBA).

NFPA Ratings (0 = Minimal; 1 = Slight; 2 = Moderate; 3 = Serious; 4 = Severe)

Health = 3

Fire = 0

Reactivity = 3

Other = OX

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures: Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment; see Section 8, "Exposure Controls and Personal Protection".

Methods and Materials for Containment and Clean up: Do not touch spilled material. Avoid contact with combustible materials. Notify safety personnel of spills. Absorb with sand or other non-combustible material. Collect spilled material in appropriate container for disposal. Isolate hazard area and deny entry. Keep out of water supplies and sewer.

7. HANDLING AND STORAGE

Safe Handling Precautions: See Section 8, "Exposure Controls and Personal Protection". Handle glass ampoules with care.

Storage: Store and handle in accordance with all current regulations and standards. Unopened ampoules should be stored under normal laboratory conditions in an upright position inside the original container supplied by NIST. Keep separated from incompatible substances (See Section 10, "Stability and Reactivity").

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits:

Component: Perchloric acid

No limits established.

Engineering Controls: Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

Personal Protection: In accordance with OSHA 29 CFR 1910.132, subpart I, wear appropriate Personal Protective Equipment (PPE) to minimize exposure to this material.

Respiratory Protection: If workplace conditions warrant a respirator, a respiratory protection program that meets OSHA 29CFR 1910.134 must be followed. Refer to NIOSH 42 CFR 84 for applicable certified respirators.

Eye/Face Protection: Wear splash resistant safety goggles with a face shield. An eyewash station should be readily available near areas of use.

Skin and Body Protection: Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. Chemical-resistant gloves should be worn at all times when handling chemicals.

9. PHYSICAL AND CHEMICAL PROPERTIES

NOTE: The physical and chemical data provided are for the main hazardous components. No physical or chemical data are available for this solution. The actual behavior of the solution may differ from the pure components listed.

Descriptive Properties:	Perchloric acid (1 % of this SRM)
Appearance (physical state, color, etc.):	colorless liquid
Molecular Formula:	HClO ₄
Molar Mass (g/mol):	100.46
Odor:	not available
Odor threshold:	not available
pH:	acidic
Evaporation rate:	not available
Melting point/freezing point (°C):	not available
Relative Density (g/L) as specific gravity (water = 1):	1.6
Vapor Pressure (mmHg):	not available
Vapor Density (air = 1):	not available
Viscosity (cP):	not available
Solubility(ies):	water
Partition coefficient (n-octanol/water):	not available
Thermal Stability Properties:	
Autoignition Temperature (°C):	not applicable
Thermal Decomposition (°C):	not applicable
Initial boiling point and boiling range (°C):	115 (239 °F)
Explosive Limits, LEL (Volume %):	not applicable
Explosive Limits, UEL (Volume %):	not applicable
Flash Point (°C):	not applicable
Flammability (solid, gas):	not applicable

10. STABILITY AND REACTIVITY

Reactivity: Stable at normal temperatures and pressure.

Stability: X Stable Unstable

Possible Hazardous Reactions: Contact with combustible or incompatible materials. Do not allow this solution to dry out (shock sensitive compound when dry).

Conditions to Avoid: Contact with combustible or incompatible materials.

Incompatible Materials: Acids, combustible materials, metals, oxidizing materials, metal oxides, halo carbons, halogens, metal salts, and bases.

Fire/Explosion Information: See Section 5, "Fire Fighting Measures".

Hazardous Decomposition: Thermal decomposition will produce hydrogen chloride and chlorine dioxide.

Hazardous Polymerization: Will Occur X Will Not Occur

11. TOXICOLOGICAL INFORMATION

Route of Exposure: Inhalation Skin Ingestion

Symptoms Related to the Physical, Chemical and Toxicological Characteristics: Burning pain and severe skin corrosion; eye and lung damage.

Potential Health Effects (Acute, Chronic and Delayed):

Inhalation: May cause respiratory tract irritation with coughing, choking, and possibly burns of the mucous membranes. Other initial symptoms may include dizziness, headache, nausea and weakness. In some cases pulmonary edema may develop, either immediately in severe cases, or more likely after a latent period of 5 h to 72 h. The symptoms may include tightness in the chest, dyspnea, frothy sputum, and cyanosis. Depending on the concentration and duration of exposure, repeated or prolonged exposure may cause erosion of the teeth, inflammatory and ulcerative changes in the mouth, and possibly jaw necrosis. Bronchial irritation with cough and frequent attacks of bronchial pneumonia may occur.

Skin Contact: Direct contact may cause severe pain, burns and possibly brownish or yellowish stains. Burns may be deep with sharp edges and heal slowly with scar tissue formation. Effects of acid burns may be delayed. Repeated or prolonged contact may result in dermatitis or effects similar to acute exposure.

Eye Contact: Direct contact may cause pain, lacrimation, photophobia and burns. In mild burns, the epithelium regenerates rapidly and the eye recovers completely. In severe cases, the extent of injury may not be fully apparent for several weeks. Ultimately, the whole cornea may become deeply vascularized and opaque resulting in blindness. In the worst cases, the eye may be totally destroyed.

Ingestion: May cause circumoral burns with discoloration and corrosion of the mucous membranes of the mouth, throat, and esophagus. There may be immediate pain and difficulty or inability to swallow or speak. Epiglottal edema may result in respiratory distress and possibly asphyxia. Marked thirst, nausea, vomiting and diarrhea may occur. Depending on the area and degree of corrosion, the vomitus may contain fresh or dark blood and large shreds of mucosa.

Numerical Measures of Toxicity:

Acute Toxicity: Not classified.

Perchloric acid, Rat, Oral LD50: 1100 mg/kg

Skin Corrosion/Irritation: This SRM contains ≥ 1 % acid and it is classified as Category 1B.

Serious Eye Damage/Irritation: This SRM contains ≥ 1 % acid and it is classified as Category 1.

Respiratory Sensitization: No data available; not classified.

Skin Sensitization: No data available; not classified.

Germ Cell Mutagenicity: No data available; not classified.

Carcinogenicity: Not classified.

Listed as a Carcinogen/Potential Carcinogen Yes No

Perchloric acid is not listed by IARC, NTP or OSHA as a carcinogen/potential carcinogen.

Reproductive Toxicity: No data available; not classified.

Specific Target Organ Toxicity, Single Exposure: No data available; not classified.

Specific Target Organ Toxicity, Repeated Exposure: No data available; not classified.

Aspiration Hazard: No data available; not classified.

12. ECOLOGICAL INFORMATION

Ecotoxicity Data:

Perchloric acid: No data available.

Persistence and Degradability: No data available.

Bioaccumulative Potential: No bioaccumulation.

Mobility in Soil: No data available.

Other Adverse effects: No data available.

13. DISPOSAL CONSIDERATIONS

Waste Disposal: Dispose of waste in accordance with all applicable federal, state, and local regulations. Perchloric acid is subject to disposal regulations: U.S. EPA 40 CFR 262, Hazardous Waste Numbers: D001, D003.

14. TRANSPORTATION INFORMATION

U.S. DOT and IATA: UN3098, Oxidizing liquid, corrosive n.o.s. (perchloric acid, nitric acid), Hazard Class 5.1, Sub Risk 8, Packing Group II, Excepted Quantities E2.

15. REGULATORY INFORMATION

U.S. Regulations:

CERCLA Sections 102a/103 (40 CFR 302.4): Not listed.

SARA Title III Section 302 (40 CFR 355.30): Not listed.

SARA Title III Section 304 (40 CFR 355.40): Not listed.

SARA Title III Section 313 (40 CFR 372.65): Not listed.

OSHA Process Safety (29 CFR 1910.119): Perchloric acid: 5000 lbs TQ (concentration >60 % by weight)

SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE HEALTH:	Yes.
CHRONIC HEALTH:	Yes.
FIRE:	Yes.
REACTIVE:	Yes.
PRESSURE:	No.

State Regulations:

California Proposition 65: Not listed.

U.S. TSCA Inventory: Perchloric acid is listed.

TSCA 12(b), Export Notification: Not listed.

Canadian Regulations:

WHMIS Information: Not provided for this material.

16. OTHER INFORMATION

Issue Date: 08 March 2016

Sources: ChemAdvisor, Inc., SDS *Perchloric Acid, 60 - 72 %*, 09 December 2015.

EC; European Chemical Substance Information System (ESIS), *Perchloric Acid, CAS No. 7601-90-3*; available at <http://esis.jrc.ec.europa.eu/index.php?PGM=cla> (accessed Mar 2016).

Key of Acronyms:

ACGIH	American Conference of Governmental Industrial Hygienists	NTP	National Toxicology Program
CAS	Chemical Abstracts Service	OSHA	Occupational Safety and Health Administration
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	PEL	Permissible Exposure Limit
CFR	Code of Federal Regulations	RCRA	Resource Conservation and Recovery Act
DOT	Department of Transportation	REL	Recommended Exposure Limit
EINECS	European Inventory of Existing Commercial Chemical Substances	RQ	Reportable Quantity
EPCRA	Emergency Planning and Community Right-to-Know Act	RTECS	Registry of Toxic Effects of Chemical Substances
IARC	International Agency for Research on Cancer	SARA	Superfund Amendments and Reauthorization Act
IATA	International Air Transport Association	SCBA	Self-Contained Breathing Apparatus
IDLH	Immediately Dangerous to Life and Health	SRM	Standard Reference Material
LC50	Lethal Concentration	STEL	Short Term Exposure Limit
LD50	Median Lethal Dose or Lethal Dose, 50 %	STOT	Specific Target Organ Toxicity
LEL	Lower Explosive Limit	TLV	Threshold Limit Value
MSDS	Material Safety Data Sheet	TPQ	Threshold Planning Quantity
NFPA	National Fire Protection Association	TSCA	Toxic Substances Control Act
NIOSH	National Institute for Occupational Safety and Health	TWA	Time Weighted Average
NIST	National Institute of Standards and Technology	UEL	Upper Explosive Limit
n.o.s.	Not Otherwise Specified	WHMIS	Workplace Hazardous Materials Information System

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

Users of this SRM should ensure that the SDS in their possession is current. This can be accomplished by contacting the SRM Program: telephone (301) 975-2200; fax (301) 948-3730; e-mail srmmsds@nist.gov; or via the Internet at <http://www.nist.gov/srm>.