NBL Program Office
U. S. Department of Energy

SAFETY DATA SHEET
PITCHBLENDE ORE - SILICA MIXTURE
(Uranium Standard)

SECTION 1: CHEMICAL PRODUCTS & COMPANY IDENTIFICATION

NBL Program Office
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1 Science.gov Way,
Oak Ridge, TN 37830
1-240-780-6842

Emergency Phone Numbers: 1-240-780-6842

Chemical Name: Pitchblende ore containing uranium oxide (U_3O_8) mixed with silica (SiO_2). Silica is the major component.

Other Identifiers: CRM 101-A, CRM 102-A, CRM 103-A, CRM 104-A, CRM 105-A

Use and Restriction: This material is prepared for use as a standard or intra-laboratory comparison program at analytical laboratories, which routinely handle uranium and/or plutonium. NBL expects that recipients of their material are in compliance with 29 CFR 1910.1200 (h) which requires employers to provide employees with effective information and training in hazardous chemicals in their workplace.

Chemical Family: Mixture uranium ore/silicon dioxide, Radioactive

SECTION 2: HAZARDS IDENTIFICATION

OSHA Hazards
Toxic by inhalation, toxic by ingestion.

Target Organs
Kidney, Liver, Lungs, Brain.

GHS Label Elements

Pictogram 

Revision Date: June 24, 2020

Signal Words: Danger

Hazard Statements:	Toxic by inhalation and ingestion Causes damage to organs through prolonged or repeated exposure May damage kidneys May cause cancer
Precautionary Statements:	Do not breathe dust Use personal protective equipment as required Avoid contact with skin, eyes and clothing When using do not eat, drink or smoke In case of accident or if you feel unwell seek medical advice immediately Use only with adequate ventilation

GHS Classification
May cause cancer (category 1A)
Skin Irritation (Category 2)
Eye Irritation (Category 2)
Specific target organ toxicity - repeated exposure (Category 1)
Specific target organ toxicity – acute exposure (Category 2)

GHS Hazard Ratings
R23/25: Toxic by inhalation and ingestion
R33: Danger of cumulative effects
S20/21: When using do not eat, drink or smoke
S45: In case of accident or if you feel unwell seek medical advice immediately
S61: Avoid release to the environment.

CERCLA Ratings (SCALE 0-3): HEALTH=U FIRE=0 REACTIVITY=0 PERSISTENCE = 0
NFPA RATINGS (SCALE 0-4): HEALTH=U FIRE=0 REACTIVITY=0

Inhalation of crystalline quartz, silica, can cause silicosis. Simple silicosis may only cause changes on chest X-ray. If the disease progresses, cough, shortness of breath, and death may occur. Crystalline silica is listed with IARC as a Class 2A carcinogen and with NTP as a substance reasonably anticipated to be a carcinogen in its sixth annual report on carcinogens.

A CAS number, 112945-52-5, has been assigned to Amorphous Fumed Silica to distinguish it from crystalline silica. Unlike crystalline silica, amorphous silica is

considered biologically benign. However, as with any dust hazard, it may cause discomfort to the eyes, skin and respiratory tract.

Pitchblende is a naturally occurring radioactive material. It is the principal ore source for uranium, which occurs in it as uranium oxide, U_3O_8. Hazards are those associated with radiation and with dust particles.

CERCLA Ratings (SCALE 0-3): HEALTH=3 FIRE=0 REACTIVITY=0 PERSISTENCE = 3

NFPA RATINGS (SCALE 0-4): HEALTH=U FIRE=0 REACTIVITY=0
CARCINOGEN STATUS:

OSHA: N
NTP: Y
IARC: Y

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

Material	Component	CAS Number	Percent
CRM 101-A	Crystalline Quartz	14808-60-7	97.321
	Amorphous fumed silica	112945-52-5	0.973
	Uranium Oxide (in pitchblende)	1344-59-8	1.188
	Other pitchblende constituents		0.518
CRM 102-A	Crystalline Quartz	14808-60-7	98.838
	Amorphous fumed silica	112945-52-5	0.988
	Uranium Oxide (in pitchblende)	1344-59-8	0.121
	Other pitchblende constituents		0.053
CRM 103-A	Crystalline Quartz	14808-60-7	98.924
	Amorphous fumed silica	112945-52-5	0.989
	Uranium Oxide (in pitchblende)	1344-59-8	0.059
	Other pitchblende constituents		0.028
CRM 104-A	Crystalline Quartz	14808-60-7	98.993
	Amorphous fumed silica	112945-52-5	0.990
	Uranium Oxide (in pitchblende)	1344-59-8	0.012
	Other pitchblende constituents		0.005

CRM 105-A	Crystalline Quartz	14808-60-7	99.0082
	Amorphous fumed silica	112945-52-5	0.9901
	Uranium Oxide (in pitchblende)	1344-59-8	0.0012
	Other pitchblende constituents		0.0005

Other Contaminants: Trace amount of radium (Ra). Calculated values of radium content for each CRM are available on the Certificates of Analysis that accompany the reference materials. The radium to uranium ratio is 3.44×10^{-7}.

SECTION 4: FIRST AID MEASURES

EYES: Flush with running water.

INHALATION: Remove to fresh air. Give oxygen with artificial respiration as needed. Seek medical attention for treatment, observation and support as needed.

SKIN: Wash with soap and water.

SECTION 5: FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARD: Negligible when exposed to flame or heat.

EXTINGUISHING MEDIA: Dry chemical, carbon dioxide, water spray or regular foam (most recent *Emergency Response Guidebook*, ERG) , developed jointly by Transport Canada (TC), the U. S. Department of Transportation (DOT) and the Secretariat of Transportation and Communications of Mexico (SCT).)

For Larger Fires, use water spray or fog (flooding amounts) (*Emergency Response Guidebook,*ERG.)

FIREFIGHTING: Move container from fire area if you can do it without risk. Apply cooling water to sides of containers exposed to flames until well after fire is out (*Emergency Response Guidebook*, ERG).

Do not move damaged containers; move undamaged containers out of fire zone. For massive fire in cargo area, use unmanned hose holder or monitor nozzles (*Emergency Response Guidebook*, ERG).

Contact the local, State, or Department of Energy radiological response team. Use suitable agent for surrounding fire. Cool containers with flooding amounts of water, apply from as far a distance as possible. Avoid breathing dusts or vapors, keep upwind. Keep unnecessary people out of area until declared safe by radiological response team.

FLASH POINT: Non-flammable solid.

HAZARDOUS COMBUSTION PRODUCTS: Thermal decomposition may release toxic/hazardous gases.

SECTION 6: ACCIDENTAL RELEASE MEASURES

OCCUPATIONAL SPILL: Do not touch damaged containers or spilled material. For large spills, dike far ahead of spill for later disposal. For dry spills, cover with plastic sheet or tarp to minimize spreading. Keep unnecessary people at least 150 feet upwind of spill. Isolate hazard area and deny entry. Limit entry to shortest time possible. Clean-up should be performed only by qualified radiation worker(s).

WATER SPILL: Contaminating any known source of drinking water with substances known to cause cancer and/or reproductive toxicity is prohibited by the California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65).

SECTION 7: HANDLING AND STORAGE

Observe all Federal, State, and local regulations when storing this substance.

Store in accordance with 10 CFR 20.

Store in a designated radioactive materials area.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure Limits:

QUARTZ:
30 mg/m3 /%Si02 +2 total dust, 10 mg/m3/%Si02+2 resp. dust, OSHA PEL
0.02 mg/m3 respir. fraction (cristobalite and alpha-quartz) ACGIH TLV
25 mg/m3 (cristobalite, tridymite), 50 mg/m3 (quartz, tripoli) NIOSH IDLH

Subject to California Proposition 65 cancer and/or reproductive toxicity warning and release requirements - (October 1, 1988)

URANIUM, Insoluble Compounds (As U):
0.05 mg/m^3 OSHA PEL-TWA
0.2 mg/m^3 ACGIH TWA; 0.6 mg/m^3 ACGIH STEL
0.2 mg/m^3 NIOSH Recommended TWA; 0.6 mg/m^3 NIOSH Recommended STEL

Occupational exposure to radioactive substances must adhere to standards established by the Occupational Safety and Health Administration, 29 CFR 1910.96, and/or the Nuclear Regulatory Commission, 10 CFR Part 20.

Engineering Controls:

VENTILATION: At a minimum, provide local exhaust or process enclosure ventilation. Depending upon the specific work place activity, a more stringent ventilation system may be necessary to comply with OSHA exposure limits and those set forth in 10 CFR 20.103.

RADIATION SHIELDING: One method of controlling external radiation exposure is to provide adequate shielding. The absorbing material used and the thickness required to attenuate the radiation to acceptable levels depends on the type of radiation, its energy, the flux and the dimensions of the source.

ALPHA PARTICLES: The typical alpha particles emitted by uranium oxide are easily shielded by a fraction of a millimeter of any ordinary material or a few inches of air. Thick paper, plastic, or cardboard will suffice.

BETA PARTICLES: Beta particles are more penetrating than alpha, and require additional shielding. These certified reference materials do not emit significant amounts of beta radiation.

GAMMA RAYS: Gamma rays are highly penetrating and are most easily shielded by heavier elements (high Z number). These certified reference materials, in the quantities used for laboratory work, do not emit significant amounts of gamma radiation. If large (kg) quantities of this material are to be stored or used, consult a radiation protection specialist or health physicist to determine if shielding is required.

Personal Protective Equipment:

EYE PROTECTION: Employee must wear eye protection to prevent eye contact with this substance. Contact lenses should not be worn.

Emergency eye wash: If there is any possibility that an employee's eyes may be exposed to this substance, the employer must provide an eye wash station within the immediate area for emergency use.

CLOTHING: Employee must wear impervious clothing to prevent repeated or prolonged skin contact with this substance.

GLOVES: Employee must wear appropriate protective gloves to prevent contact with this substance. Used gloves that may have contacted this substance should be disposed of as radioactive waste.

RESPIRATOR: The following respirators and maximum use concentrations are recommendations by the U.S. Department of Health Services, NIOSH Pocket Guide to Chemical Hazards; or by the U.S. Department of Labor, 29 CFR 1910 Subpart Z.

The specific respirator selected must be based on contamination levels found in the work place. Airborne contamination levels must not exceed the working limits of the respirator. Respirators must be jointly approved by the National Institute for Occupational Safety and Health and the Mine Safety and Health Administration (NIOSH-MSHA).

SILICA (CRYSTALLINE): At any detectable concentration: Any self-contained breathing apparatus with full facepiece, operated in a pressure-demand or other positive pressure mode.

Any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.

Escape - Any air-purifying full facepiece respirator with a high-efficiency particulate filter. Any appropriate escape-type self-contained breathing apparatus.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

URANIUM, Insoluble compounds (As U):

AT ANY DETECTABLE CONCENTRATION:
Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Any supplied air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

Escape - any air-purifying, full-facepiece respirator with a high-efficiency particulate filer.

Any appropriate escape-type, self-contained breathing apparatus.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS: Any self-contained breathing apparatus that has a full facepiece respirator with a high-efficiency particulate filter.

Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance: White, amorphous crystals mixed with dark green or black radioactive powder or crystals.

SILICON DIOXIDE (SiO_2):
Molecular weight: 60.09
Molecular formula: $Si0_2$
Boiling point: 4046 □F (2230□C)
Melting point: 2930 □F (1610□C)
Vapor Pressure: 0 mm Hg @ 20 □C
Specific Gravity: 2.635-2.660
Water Solubility: insoluble
Solvent Solubility: Soluble in hydrofluoric acid; very slightly soluble in alkalis and hot concentrated phosphoric acid; insoluble in most acids and organic solvents.

URANIUM OXIDE (U_3O_8)
Molecular weight: 842
Molecular formula: (U_3O_8)
Boiling point: Decomposes
Melting point: 1300 □C (2372□F) decomposes

Specific Gravity: 8.30
Water Solubility: Insoluble
Solvent Solubility: Nitric acid, sulfuric acid

SECTION 10: STABILITY AND REACTIVITY

Reactivity: See below.

Chemical Stability: Stable under normal temperatures and pressures.

Conditions to Avoid: No potentially hazardous conditions could be found in literature, nor could any accidents be recalled in which uranium oxide reacted in a hazardous manner.

Incompatible Materials:

QUARTZ:
Alkalis (Strong): May be attacked.
Chlorine Trifluoride: Possible explosion.
Hydrochloric Acid: May be attacked with exothermic reaction.
Manganese Trifluoride: Violent reaction.
Metals: May produce violent explosion.
Oxidizers (Strong): Fire and explosion hazard.
Oxygen Trifluoride: Possible explosive reaction.
Ozone: Possible explosive reaction in presence of organic materials.
Vinyl Acetate: Vigorous reaction.
Xenon Hexafluoride: Possible detonation.

URANIUM OXIDE:
Bromine Trifluoride: Reaction is rapid below the boiling point of the trifluoride.

Hazardous Decomposition Products: Thermal decomposition may release hazardous and toxic gases.

Polymerization: Hazardous polymerization has not been reported to occur under normal temperature and pressure.

SECTION 11: TOXICOLOGY INFORMATION

Likely Routes of Exposure: Inhalation, ingestion, skin and eye contact.

Uranium oxide is irritating to the skin, eyes, and mucous membranes. Uranium compounds may be toxic to the kidneys (nephrotoxins). Chronic inhalation of insoluble uranium compounds may damage the lungs and effect the lymph nodes. Pneumoconiosis may occur. Deposition of uranium in the tissue of the bone occurs most readily with soluble uranium compounds.

Deposition may occur, to a lesser degree, with insoluble compounds. Adverse effects of uranium bone deposition include blood disorders such as anemia and leukopenia. In humans, cancer of the lung, lymphatic and hemopoietic systems, and bone have been reported. Uranium compounds usually do not constitute an external radiation exposure hazard since uranium emits mainly alpha-radiation at a low energy level. Uranium may constitute an internal radiation hazard if it is absorbed into the body, delivering alpha emission onto tissues in which it is stored.

Crystalline silica can cause silicosis and is listed as a carcinogen. See Section 2 above.

SKIN CONTACT: Silica may cause irritation of intact skin via mechanical action. Skin abrasions may cause scarring. Uranium oxide may be irritating to the skin; however, there is no evidence that insoluble uranium compounds can be absorbed through unbroken skin. Penetration through damaged skin may result in internal damage or deposition of radioactive materials. Prolonged skin contact with insoluble uranium compounds should be avoided because of potential radiation damage to basal cells. Dermatitis has occurred as a result of handling some insoluble uranium compounds.

EYE CONTACT: Particles of silica may cause irritation via mechanical action. An abnormally high silicon content in the cornea, and a gradual decrease in visual acuity due to corneal opacities in the pupillary area, have been reported in a group of foundry workers who developed pulmonary silicosis. Radiation affects the eye by inducing acute inflammation of the conjunctiva and the cornea. The most sensitive part of the eye is the lens. An effect of eye irradiation is cataract formation. Cataracts may begin to develop anywhere from 6 months to several years after a single, large exposure or after prolonged exposure. The rate of growth and the degree of opacity are dependent upon the dose of radiation. The silicon content of these Certified Reference Materials is expected to preclude any long term eye contact via irritation. It is important to note that long term eye contact with these certified reference materials would most likely result in serious damage to the cornea long before cataracts would be formed.

INGESTION: Crystalline silicas are biologically inert. Effects of ingestion are due to mechanical action. The fate of ingested alpha emitters depends on their solubility. Uranium oxide is not biologically soluble and the primary dose received would be to the lining of the gut. Repeated ingestion of alpha emitters may lead to increased cancer risk.

SECTION 12: ECOLOGICAL INFORMATION

Environmental Impact Rating (0-4): No data available

Acute Aquatic Toxicity: No data available

Degradability: No data available

Log Bioconcentration Factor (BCF): No data available

Log Octanol/water partition coefficient: No data available

SECTION 13: DISPOSAL INFORMATION

Observe all Federal, State and local Regulations when disposing of this substance.

SECTION 14: TRANSPORTATION INFORMATION

The U.S. Department of Transportation (D.O.T.) Code of Federal Regulations (49 CFR Parts 100-185), the International Air Transportation Association (IATA), International Civil Aviation Organization (ICAO) and International Maritime Organization (IMDG) are all factored into the classification and transport of material.

Proper Shipping Name:
Hazard Class:
UN/ID Number:
Special Information:
Packing Group:

} To be determined on a case by case basis.

Classification of substances with multiple hazards must be determined in accordance with the criteria presented in the above mentioned regulations. Due to the various quantities/combinations of materials being shipped at one time, the information above must be determined based on the characteristics of the specific shipment.

SECTION 15: REGULATORY INFORMATION

TSCA STATUS:	Y
CERCLA SECTION 103 (40 CFR 302.4):	N
SARA SECTION 302 (40 CFR 355.30):	N
SARA SECTION 304 (40 CFR 355.40):	N
SARA SECTION 313 (40 CFR 372.65):	Y
OSHA PROCESS SAFETY (29 CFR 1910.119):	N
CALIFORNIA PROPOSITION 65:	Y

SARA HAZARD CATEGORIES, SARA SECTIONS 311/312 (40 CFR 370.21)

ACUTE HAZARD:	Y
CHRONIC HAZARD:	Y
FIRE HAZARD:	N
REACTIVITY HAZARD:	N
SUDDEN RELEASE HAZARD:	N

SECTION 16: OTHER INFORMATION

This material is prepared for use as a standard or in interlaboratory comparison programs at analytical laboratories which routinely handle uranium and/or plutonium. The New Brunswick Laboratory (NBL) assumes that recipients of this material have developed internal safety procedures which guard against accidental exposure to radioactive and toxic materials, contamination of the laboratory environment, or criticality. NBL further expects that personnel who handle radioactive materials have been thoroughly trained in the safety procedures developed by and for their Laboratory.

The information and recommendations set forth herein are presented in good faith and believed to be correct as of the revision date. However, recipients of this material should use this information only as a supplement to other information gathered by them, and should make independent judgement of the suitability and accuracy of this information. This statement is not intended to provide comprehensive instruction in developing an appropriate safety program and does not include all regulatory guidelines.

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