MSDS - Uranium Metal

24 HR Emergency Number:
VelocityEHS (USA) 1-800-255-3924

United Nuclear
Scientific Equipment & Supplies

SECTION I. MATERIAL IDENTIFICATION

Trade/Material Name:

Uranium-238, Uranium Metal, Depleted Uranium

Description:

Metal

Other Designations:

DU, U

A byproduct of the gaseous diffusion enrichment cycle, DU is artificially depleted in the lighter isotopes (^{233}U, ^{234}U and ^{235}U). This depletion process effectively eliminates nuclear criticality concerns. Used in research and in applications where its high density and/or high atomic number is advantageous.

NOTE: Depleted Uranium (DU) is regulated by the U. S. Nuclear Regulatory Commission (NRC), or Agreement State, which should be consulted for specific requirements on all aspects of the production and distribution of this radioactive material.

SECTION II. INGREDIENTS AND HAZARDS

Ingredient Name:

Uranium

CAS Number:	Percent:	Exposure Limits:
7440-61-1	ca 100	* OSHA PEL: 0.05 mg/m^3, 8-hr TWA

*ACGIH: 0.2 mg/m^3, TLV-TWA 0.6 mg/m^3, Ceiling Toxicity Data: Not Listed mCi/ml (occupational), 6E-14 mCi/ml air (effluent), insoluble. Weekly intake limit: 10 mg soluble uranium (10 CFR 20 Appendix B)

*Defined for both soluble and insoluble natural uranium compounds.

SECTION III. PHYSICAL DATA

Appearance & Odor:
A silver-white, lustrous, heavy, mildly radioactive metal. Appearance will change upon exposure to air or water, as oxidation occurs. Color darkens through brass, brown, to charcoal gray. Powders, fines, chips, or turnings oxidize rapidly yielding a dull or flat dark gray or brown color. Some alloys will oxidize more slowly, retaining the silver-white and then brassy color. No odor found.

Boiling point: 3700 - 4200°C **Specific Gravity (H_2O=l):** 18.95 **Vapor Density (Air=1):** NA

Vapor Pressure: NA

Water Solubility (%): Insoluble

Melting Point: 1132°C

Evaporation Rate: NA

% Volatile By Volume: NA

Melting point data provided for the pure metal only.

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point (Method): 255 - 320°C in air
Limits: LEL %: None reported

UEL %: None reported

NFPA Fire Hazard Symbol Codes: Flammability: 1 Health: 1 Reactivity: 0 Special: –**

** Values determined by manufacturer, not found in NFPA guidebook references.

Extinguishing Media:
Use dry chemical Class D or carbon dioxide to fight small uranium fires. Flood large fires with water per DOT P.5800.3
Unusual Fire or Explosion Hazards: Finely divided turnings, shavings, or chips of uranium are more reactive than bulk form. Freshly prepared powder or fines may react exothermically with air or water and may reach ignition temperature. Do not disperse powders or fines into a dust cloud, which may be explosive. Water reactions may generate hydrogen gas, which is flammable.

Special FireFighting Procedures:

Wear an approved self-contained breathing apparatus (SCBA) with a full-face piece operated in the pressure demand or positive-pressure mode.

SECTION V. REACTIVITY DATA

Chemical Incompatibilities:

Uranium metal can react dangerously with carbon tetrachloride, chlorine, fluorine, nitric acid, nitric oxide, selenium, sulfur, and water (in finely divided form).

Conditions to Avoid:

Prevent contact with incompatible chemicals. Do not create dusty work conditions. Do not expose to oxidizers.

Hazardous Decomposition Products:

Uranium metal fume and/or oxide can be produced during uranium fires. Radioactive progeny (daughters) thorium-234, protactinium-234, and -234m (metastable) are produced by natural radioactive decay; they are the source of the majority of the penetrating radiation. These isotopes can be concentrated in situations where the metal is melted, condensed, or dissolved, potentially elevating the observed external dose rate.

Stability/Polymerization:

Material is stable in closed containers at room temperature under normal storage and handling conditions. Hazardous polymerization cannot occur.

In the presence of moisture or humidity, uranium metal may react to evolve flammable hydrogen gas.

SECTION VI. HEALTH HAZARD INFORMATION

Summary of Risk:

Uranium and its salts are both toxic and radioactive. Dermatitis, renal damage, acute necrotic arterial lesions, and possibly death may occur from extreme exposure. Inhalation of fine uranium particles presents increased radiation hazards; isolated uranium particles in the lungs may be a long-term cancer hazard. The more soluble uranium compounds are considered most toxic to the kidneys; the lung is the critical organ for insoluble respirable dusts or fines such as oxide powders. Uranium dusts are respiratory irritants, with coughing, shortness of breath as possible outcomes. Prolonged skin contact can cause damage to the basal cells. Radioactivity is the property of the spontaneous emissions of alpha or beta particles and gamma rays, by the disintegration of the nuclei of the atoms.

Medical Conditions Which May Be Aggravated by Contact:

None reported.

Target Organs:

Respiratory system; skin; eyes; kidneys; liver; blood; lymphatic system; and bone marrow.

Primary Entry Route(s):

In solid forms, ingestion, skin, or eye contact. Inhalation of dusts or fines.

Acute Effects:

Nausea, vomiting, shortness of breath, and coughing.

Chronic Effect(s):

Primarily the effects of radiation from insoluble compounds. Possibilities include pneumoconiosis, pulmonary fibrosis, lymphoma, osteosarcoma, and lung cancer.

Eye Contact:

Flush immediately, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 minutes.

Skin Contact:

Immediately wash with soap and water. Decontaminate body surfaces following radiation standards (procedures). Be careful not to abrade skin, in order to avoid systemic uptake.

Inhalation:

Remove exposed person to fresh air and support breathing as needed.

Ingestion:

Never give anything by mouth to someone who is unconscious or convulsing. Seek professional medical assistance.

GET MEDICAL HELP (IN-PLANT OR COMMUNITY) FOR ALL EXPOSURES. Seek prompt medical assistance for further treatment, observation, and support after first aid. Follow established procedures including radiation monitoring programs.

NOTE TO PHYSICIAN:

Following significant ingestion, gastric lavage, with 2% bicarbonate solution, is recommended. A 5% bicarbonate solution has been used by some poison control specialists in radiation treatment. Depending on the

solubility of the material, follow-up bioassay (urine) sampling can be used to assess the severity of a potential assimilation.

Carcinogenicity:

The NTP, IARC, and OSHA do not specifically list uranium and its compounds as carcinogens; because of its radioactivity it is considered a carcinogen if inhaled, ingested, or injected. The ACGIH lists uranium and its compounds as an A1 (Confirmed Human) carcinogen. NIOSH also lists uranium and its compounds as a confirmed carcinogen.

SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak Procedures:

Accidental leaks or spills of uranium and its compounds must be planned for well in advance of starting any work procedure. Special radiation procedures are required and professional assistance may be needed. Notify safety or health physics personnel, evacuate all non-essential personnel, and provide adequate ventilation. Clean-up personnel need protection against contact with and inhalation of dust or oxides.

Waste Management/Disposal:

Follow all applicable federal, state, and/or local regulations governing the disposal of radioactive waste and contaminated materials.

OSHA Designations:

Listed as Air Contaminant (29 CFR 1910.1000)

EPA Designations:

RCRA Hazardous Waste (40 CFR 261.33):

Exempted from RCRA regulation as Source Material.

SARA Extremely Hazardous Substance (40 CFR 355): Not listed.

SARA Section 313 Toxic Chemical (40 CFR 372.65): Not listed.

Reported in EPA TSCA Inventory: Yes

Transportation Data(49 CFR 172.101-2):

Proper Shipping Name: Radioactive Material, Low Specific Activity, n.o.s.

Identification Number: UN 2912

DOT Hazard Class: Radioactive Material, Class 7 UN Register: UN 2912

SECTION VIII. SPECIAL PROTECTION INFORMATION

Personal Protective Equipment:

Goggles:

Wear safety glasses with side shields. In dusty environments, wear chemical safety goggles and a face shield, per OSHA eye- and face-protection regulations.

Respirator:

For emergency operations, entry into unknown atmospheres, or atmospheres immediately dangerous to life or health (IDLH), wear a SCBA with a full-face piece operated in the pressure demand (positive pressure) mode. If

significant oxide or powder formation has become airborne or the concentrations exceed OSHA, and/or NRC limits, wear a properly fitted NIOSH-approved air-purifying respirator equipped with HEPA cartridges. Because each type of respirator has an assigned protection factor, respirator selection should be done by an industrial hygienist, health physicist, or other qualified individual.

Other:

Wear impervious gloves, boots, aprons, etc., as appropriate, to prevent prolonged or repeated skin contact.

Workplace Considerations Ventilation:

Provide local ventilation as required to maintain exposure below the USNRC DAC (Derived Air Concentration) and OSHA PELs specified in Section 2.

Safety Stations:

Where powders, fines, dusts, or fumes of the metal are likely to be present, make emergency eye wash stations, safety/quick-drench showers, and washing facilities available in the work area. At a minimum, emergency eyewashes and showers should meet the design and performance requirements of the current ANSI Z358.1 Emergency Eyewash and Shower Standard.

SECTION IX. SPECIAL PRECAUTIONS

Storage Segregation:

Store uranium in closed containers; prevent access by unauthorized personnel. Depending on quantity stored, containers and area may require special placarding or postings based on RQ and dose rate.

Contamination:

Practice good personal hygiene. Always wash thoroughly after using this material. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do not eat, drink, or smoke in work areas. Do not allow exposure of personnel with open wounds or cuts. Use radiation monitoring equipment, if available, responsive to alpha and beta emissions.

Handling/Storage:

Do not allow moisture contamination of storage facilities or containers. Moisture contact may complete the oxidation of any residual metal and evolve potentially explosive concentrations of hydrogengas. Follow established federal and state regulations for the use and storage of radioactive materials.

Revised:

May 1, 2015

Overview of Uranium-238 Properties

Uranium-238, also known as Depleted Uranium or just DU, is the remaining Uranium metal after it has been depleted of the fissionable Uranium isotopes (U-233, U-234, and U-235) found in the natural metal. This depletion process eliminates any concerns about nuclear criticality.

While Uranium can be melted, fabricated, and machined using conventional practices, its mild radioactivity, chemical toxicity and pyrophoricity require that special precautions be taken in processing.

Pure Uranium metal is only mildly radioactive and is listed as a low specific-activity material in shipping regulations. The primary radiological hazards associated with this material are beta and alpha emissions. As with any radioactive material, the dose rate of its radiation emission decreases dramatically with distance from the source. As a result, working near Uranium and normal handling of this material does not result in excessive exposures. Nonetheless, significant exposures could result from prolonged very close contact, so unnecessary contact should be avoided.

Alpha radiation is also emitted by Uranium, but this non-penetrating radiation is not an external radiation hazard. However, it is an internal hazard. Finely divided Uranium particles from sanding, filing, or machining can become airborne and inhaled. Once inside the respiratory tract, the alpha radiation can damage sensitive lung tissue. Hence, it is important to ensure that airborne concentrations of Uranium remain below the OSHA standard of 0.25 mg/m^3 of air.

Being a heavy metal itself, Uranium metal is about as chemically toxic as other heavy metals such as Lead. Problems can best be avoided by careful control of any finely divided material or dust and by good personal hygiene.

Finely divided Uranium is pyrophoric (spontaneously ignites on contact with air); therefore, machining chips and grinding residue must be handled carefully and disposed of properly to avoid the danger of fire. These hazards can be minimized by using liberal amounts of machining fluid, keeping machining waste submerged in water or oil, removing chips from tools and work areas frequently, and avoiding mixed metal chips. Fire extinguishers should be readily available when working with Uranium. Be sure to use only dry power fire extinguishers or sand on Uranium fires.

Never use water on Uranium fires.