April 26, 2016

Binesh Tharakan
U.S. NRC Region IV
Division of Nuclear Materials Safety
1600E. Lamar Blvd
Arlington, TX 76011-4511

RE: Transportation Incident at the White Mesa Mill Involving an 11e.(2) Shipment

Dear Mr. Tharakan:

On March 29, 2016, Energy Fuels Resources Inc.'s (EFRI) White Mesa Uranium Mill contacted the Division of Waste Management and Radiation Control to report a leaking shipment of 11e.(2) material that had arrived at its facility. The Radiation Safety Officer of the Mill described the material as a white paste like substance. The 11e.(2) shipment originated from the Cameco-Smith Ranch facility (a Nuclear Regulatory Commission (NRC) licensed facility) in Wyoming and was sent to the Mill to be disposed in the Mill's tailings cells.

The Mill's radiation safety staff documented the leak with photographs, radiological surveys and a written description. Documentation of the leak indicates that 11e.(2) material leaked onto the transport container, the transport conveyance and U.S. Highway 191 near the Mill. During transport, a winter storm with rain and snow went through Wyoming, Colorado and Utah when this incident occurred (March 28 and 29, 2016). Therefore, there is a high probability that any road contamination would have been washed away and making it impossible to determine when the leaking of the transport began.

A further description of the incident from EFRI dated April 4, 2016, including radiological survey results, is enclosed.

The following regulations are applicable to this incident:

1. 49 CFR 173.427(c)(1) – Transportation requirements for low specific activity (LSA) Class 7 (radioactive) material and surface contaminated objects (SCO).
Contrary to 49 CFR 173.427(c)(1), 10 CFR 71.43(f) and 10 CFR 71.71, the Cameco-Smith Ranch Facility sent an 11e,(2) shipment to the White Mesa Mill in a roll-off container that did not contain the material under routine (normal) conditions of transport.

Contrary to 49 CFR 173.443, leakage from that container resulted in removable contamination on the outside of the container that exceeded DOT contamination limits for Alpha and an exterior dose rate greater than 0.5 mrem per hour.

This is the second incident of this type that has been reported to the Division with the first being reported on August 21, 2015. The Division requests that NRC take appropriate regulatory action with Cameco-Smith Ranch to prevent recurrence. Please find enclosed the EFRI report of the incident, photographs and shipping papers.

If you have any questions, please call Ryan Johnson at (801) 536-4255.

Sincerely,

[Signature]
Scott T. Anderson, Director
Division of Waste Management and Radiation Control

Enclosures: Documentation Letter, dated April 4, 2016 (DRC-2016-006042)
Cameco Smith Ranch Shipping Paperwork (DRC-2016-006041)
Photographs (DRC-2016-006044)
Email from Ryan Johnson, dated March 29, 2016 (DRC-2016-006045)

C: Worthy Glover, Jr., MMHRM, CPM, Health Office San Juan Public Health Department
Rick Meyer, Environmental Health Director, San Juan Public Health Department
David Ariotti, P.E., DEQ District Engineer
Ms. Linda Gersey, U.S. NRC Region IV, Division of Nuclear Materials Safety
Ryan S. Schierman, State of Wyoming, Wyoming Department of Environmental Quality, Natural Resources Program Manager
Jennifer Opila, Colorado Department of Public Health & the Environment, Hazardous Materials & Waste Management Division, Radiation Program, Program Manager
Notification of leaking 11e.(2) shipment arriving at the White Mesa Uranium Mill

1 message

Ryan Johnson <mjohnson@utah.gov>  
To: Linda.Gersery@nrc.gov, ryan.schieman@wyo.gov  
Cc: "Goble, Phillip" <pgoble@utah.gov>, Scott Anderson <standerson@utah.gov>

Linda,

This morning the RSO of the White Mesa Uranium contacted the Utah Division of Waste Management and Radiation Control (DWMRC). He informed the DWMRC that a 11e.(2) shipment arrived at their facility with evidence that some of the contents had leaked from the shipping container. This shipment originated from the Cameco-Smith Ranch in Wyoming, with the contents of the shipment to be disposed of in White Mesa’s tailing cells.

We are notifying you of this incident because Cameco-Smith Ranch is an NRC licensed facility (NRC RML SUA 1548). This is the second incident that the DWMRC is aware of with 11e(2) shipments originating from the Cameco-Smith Ranch facility in Wyoming. The last incident occurred on August 20, 2015. We will send you more information when the Mill send us their formal report on the incident.

--

Ryan Johnson, P.G.  
Environmental Scientist/Health Physicist  
Utah Division of Waste Management and Radiation Control

Disclaimer:

Statements made in this e-mail do not constitute the official position of the Director of the Division of Waste Management and Radiation Control. If you desire a statement of the Director's position, please submit a written request to this office, on paper, including documents relevant to your request.
April 4, 2016

Sent VIA E-MAIL AND EXPRESS DELIVERY

Mr. Scott Anderson
Director
Division of Waste Management and Radiation Control
Utah Department of Environmental Quality
195 North 1950 West
P.O. Box 144880
Salt Lake City, UT 84114-4820

Re: Transmittal of Documentation for Follow-up to Notifications Provided to the Division of Waste Management and Radiation Control ("DWMRC") for White Mesa Uranium Mill

Dear Mr. Anderson:

Attachment 1 to this letter provides Energy Fuels Resources USA Inc.'s ("EFRI's") follow-up documentation to previous notifications to DWMRC Personnel by David Turk on March 29, 2016 regarding Cameco IIe.(2) shipping issues.

Department of Transportation ("DOT") regulations in 49 CFR 171.15 require that persons in physical possession of a material during an incident provide notifications to DOT after the occurrence of any incident. Pursuant to this requirement, Greenfield Logistics made the appropriate notifications to U.S. DOT National Response Center on March 29, 2016.

If you should have any questions regarding this submittal please contact me at 303-389-4134.

Yours very truly,

Kathy Weinelt
Quality Assurance Manager

Energy Fuels Resources (USA) Inc.
225 Union Blvd. Suite 600
Lakewood, CO, US, 80228
303 974 2140
www.energyfuels.com

CC: David Frydenlund
Harold Roberts
David Turk
Logan Shumway
Scott Bakken
DOCUMENTATION FOR INCIDENT OF MARCH 29, 2016

Name of Reporter to DWMRC
Verbal Notification was provided to the Division of Waste Management and Radiation Control ("DWMRC") by David Turk White Mesa Mill Radiation Safety Officer ("RSO")
Initial written notification via e-mail was provided by David Turk White Mesa Mill RSO
This follow-up notification is provided by Kathy Weinel, EFRI Quality Assurance Manager ("QAM")

Notifications were provided to Mr. Phil Goble and Mr. Ryan Johnson of DWMRC on March 29, 2016.

Name and Address of Person Represented by Reporters
Energy Fuels Resources USA Inc.
225 Union Boulevard, Suite 600
Lakewood, Colorado 80228

For an incident located near:
White Mesa Mill
6425 South Highway 191
Blanding Utah, 84511

Phone Numbers Where Reporters Can Be Contacted
David Turk 435-678-4113
Kathy Weinel 303-389-4134

Date, Time, and Location of Incident
At approximately 0730 hours on Tuesday March 29, 2016, the staff at the White Mesa Mill (the "Mill") noted that an incoming Intermodal Container ("IMC") from Cameco - Smith Ranch was leaking a white paste like material. The IMC had traveled from the Cameco Smith-Ranch Facility in Glenrock, Wyoming overland to the Mill entrance in Blanding, Utah.

The incident involved a leaking 11e.(2) disposal shipment from Cameco – Smith Ranch in the Mill entry way. In addition, some material had spilled out of the container onto US Highway 191.

The Extent of the Injury
No injuries resulted from this incident.

Class or Division, Proper Shipping Name and Quantity of Hazardous Materials Involved
The leaked material is Class 7, UN2912, Radioactive Material, Low Specific Activity (LSA-1).

It is estimated that less than 5 gallons was present at the entrance to the Mill and on the truck and IMC.

Type of Incident and Nature of Hazardous Material Involvement and Whether a Continuing Danger to Life Exists at the Scene
The incident involved an IMC that was leaking a small amount of material. Some material had dripped from the truck and contacted the highway. The majority of the leaked material remained affixed to the IMC and transport truck. The leaking material was identified as Class 7, UN2912, Radioactive Material, Low Specific Activity (LSA-1).

At no time during the incident was there a danger to life.
The materials which were noted on the Highway 191 surfaces, as well as those on Mill property, were cleaned up following the incident by Mill Personnel.

Chronology of the Incident

- At approximately 0730 hours on Tuesday March 29, 2016, the staff at the Mill noted that an incoming IMC from Cameco - Smith Ranch was leaking a white paste like material. The IMC and truck were denied entry to the Mill facility pending investigation and approval from DWMRC.
- The RSO was notified. The RSO immediately examined the container and truck and took photographs.
- The RSO contacted Mr. Phil Goble with the State of Utah Division Of Waste Management and Radiation Control at approximately 0800 hours. The notification to Mr. Goble, included notice that a leaking 11e.(2) disposal shipment from Cameco - Smith Ranch arrived at the Mill and was sitting in the Mill entry way. Mr. Goble was also notified that there was white material that had spilled out of the container onto US Highway 191 near the entrance to the Mill property.
- After notification was given to the DWMRC, the RSO made contact with EFRI Corporate Staff. Ms. Kathy Weinel was notified via phone at approximately 0830 hours. Photographs were sent to EFRI Corporate Staff via text messaging.
- Ms. Weinel phoned the site RSO for Cameco Smith Ranch, a Mr. Travis Coleman. Mr. Coleman was not in the office and a voicemail was left.
- Ms. Weinel then contacted the Mine Manager, Mr. Craig Hiser to report the spill. This was the first notice to Mr. Hiser of an issue with the shipment as Greenfield Logistics, the shipping company, had not yet notified Smith Ranch Personnel of the incident.
- The RSO returned to the inbound shipment and took multiple photographs of the tractor, trailer and IMC and began a radiological survey of the material that was visible on US Highway 191 and EFRI entrance road.
- The white material on the asphalt highway and roadway ranged from 5,850 to 9,360 dpm/100cm² for alpha and 0.04 to 0.08 mrem/hr beta/gamma.
- There were four removable alpha swipes taken on the asphalt roadways. Those readings came back at 383 to 492.5 dpm/100cm².
- During the radiological survey, the RSO was contacted by the Greenfield Logistics dispatcher, Mr. Chris Hartley, to make sure that we were aware of the leaking container. He was told that BFRI was aware of the situation and that EFRI was in the process of gathering information and data for the report to DWMRC. Mr. Hartley was also notified that the container would not be released, because the container would need to be fully cleaned before allowing it to leave the facility. Due to the deteriorating weather conditions the cleaning process for that container was not possible at that time.
- The Mill Personnel went to the conveyance and performed a radiological survey on all components where there was visible material. The material came back with a total alpha measurement of between 35,100 to 58,500 dpm/100cm². The beta/gamma survey on the same material was 5.0 mrem/hr. A series of removable alpha swipes were collected. Those readings ranged from the lowest on the tires at 438.8 dpm/100cm² to the highest on the beam under the potential source at 2,551.3 dpm/100cm².
- The RSO spoke with the Greenfield driver, Mr. Doug Angell. He stated that he noticed the leaking container when he pulled onto our entrance way at 2330 hours on Monday March 28, 2016. He stated he then texted his dispatcher at that time about the leak. He also stated that on Monday March 28, 2016, while traveling near Meeker, Colorado, a deer ran in front of the truck and he had to hit the brakes hard. That was the only time during the trip that there was any sudden jarring of the load. He stated that he had filled up with fuel in Rawlins, Wyoming and, at that time, there was no leakage. It should be noted that all seals were still intact that Cameco installed prior to the container leaving their site.
• At approximately 0945 hours on Tuesday March 29, 2016, the RSO allowed the load onto the property pursuant to approval from DWMRC Personnel. The main reason for the allowing the truck and IMC onto the Mill property was that rain was starting to fall and washing some of the material off of the container and onto the ground. In order to prevent a larger cleanup, the decision was made to move the truck and IMC to the Mill Restricted Area.

• The area on US Highway 191 and the EFRI entrance way was washed and any contaminated soil (approximately 5 to 6 cubic yards) was excavated and taken into the Mill Restricted Area and then out to Cell 3 for disposal. The cleanup area extended approximately ¼ of a mile north on US Highway 191. The area was surveyed after the rain/snow storm stopped. Data from these scans is summarized below.

Summary of Scan Results

<table>
<thead>
<tr>
<th>Location</th>
<th>Background Units</th>
<th>Pre-Cleanup Results Units</th>
<th>Post-Cleanup Results Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>EFRI Entrance Road</td>
<td>212 dpm/100cm² and 10 µR/hr</td>
<td>5,850 dpm/100cm² and 0.04 mrem/hr</td>
<td>≤ Bkg and 23 µR/hr</td>
</tr>
<tr>
<td>US Highway 191 turnout</td>
<td>212 dpm/100cm² and 10 µR/hr</td>
<td>9,360 dpm/100cm² and 0.08 mrem/hr</td>
<td>≤ Bkg and 20 µR/hr</td>
</tr>
<tr>
<td>US Highway 191</td>
<td>212 dpm/100cm² and 10 µR/hr</td>
<td>5,850 dpm/100cm² and 0.04 mrem/hr</td>
<td>≤ Bkg and 10 µR/hr</td>
</tr>
<tr>
<td>Greenfield Truck</td>
<td>212 dpm/100cm² and 0.04 mrem/hr</td>
<td>35,100 dpm/100cm² and 5.0 mrem/hr</td>
<td>≤ Bkg and 0.04 mrem/hr</td>
</tr>
<tr>
<td>Greenfield IMC</td>
<td>212 dpm/100cm² and 0.04 mrem/hr</td>
<td>58,500 dpm/100cm² and 5.0 mrem/hr</td>
<td>Is still in the process of being cleaned</td>
</tr>
</tbody>
</table>

• The inbound IMC was dumped on Cell 3 and the then moved to the vicinity of the Old Decontamination pad in order for EFRI to perform a detailed decontamination of the unit once conditions improve. The truck was taken through the Old Decontamination wash station. The truck was released from the site at 1130 hours. All release surveys on the truck met applicable standards.

• At approximately 1830 hours on March 29, 2016, Greenfield Logistics reported the incident to DOT National Response Center. Kevin Williams at the National Response Center took the call and issued Case #1144028. Shane Johnson of Greenfield Logistics received a call from DOT to review the details of the report. Per e-mail communications from Greenfield Logistics, DOT considers the incident report closed.

• At approximately 0900 hours on March 30, 2016, Ms. Weinert spoke with Mr. Travis Coleman. Mr. Coleman was notified that this was the second incident of this type involving this material. EFRI recommended Smith-Ranch Personnel conduct an internal investigation into this incident to prevent recurrence.

• The US. Nuclear Regulatory Commission ("NRC") requested that Cameco retrace the route of the shipment to investigate the potential for additional released material. The Cameco team obtained a detailed account of the route. In the event that additional released material was identified, Cameco's Emergency Response contractor was standing by to respond.

• On April 1, 2016 a Cameco team comprised of the Smith Ranch RSO, Mr. Travis Coleman, a Smith Ranch Health Physics Technician ("HPT"), Mr. Chris Pendleton, and Mr. Ken Vaughn, the Cameco Director of Communications traveled to the Mill in Blanding Utah. They arrived at 1830 on Friday, April 1, 2016.

• The Cameco team surveyed Highway 191 from the Mill entrance to the 4-way intersection in Blanding in ¼ mile increments. No readings above background were noted.

• On April 2, 2016, the Cameco team retraced the shipping route and surveyed at points along the road. Additional data were collected in and around Meeker, Colorado due to the Greenfield
driver stating he had to stop quickly to avoid a deer in that area. Due to the potential for additional spillage, this area was surveyed at a higher frequency.

- Photographs are included on the CD attached to the hardcopy of this notice.

Conclusion
After final decontamination of the IMC to appropriate release standards, the IMC will be released. No further cleanup activities at the Mill, on Highway 191, or the travel way are required. EFRI has requested that Cameco Smith-Ranch personnel complete an investigation of the cause of this incident and take appropriate actions to prevent recurrence in the future. Cameco Resources has suspended all waste shipments from Smith Ranch-Highland and Crow Butte until the issue(s) that resulted in the incident are fully addressed. Cameco's investigation will address both the type of material and method of shipment (regarding no free liquid).
<table>
<thead>
<tr>
<th>Route:</th>
<th>Basic Description</th>
<th>Total Quantity</th>
<th>Weight</th>
<th>RATE</th>
<th>Charges</th>
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<tbody>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>HM</th>
<th>Proper Shipping Name, Hazard Class, Identifier Number (UN or MA), Packing Group, Tariff, 172.101, 172.202, 172.203</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>LIN912, RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-1)-CLASS 7</td>
</tr>
<tr>
<td></td>
<td>RADIONUCLIDE: RESIDUAL NATURAL URANIUM &amp; ASSOCIATED DAUGHTER PRODUCTS</td>
</tr>
<tr>
<td></td>
<td>PHYSICAL FORM: SOLID</td>
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<tr>
<td></td>
<td>CHEMICAL FORM: NATURAL URANIUM OXIDE UO2-2H2O</td>
</tr>
<tr>
<td></td>
<td>TOTAL ACTIVITY: 1.68E+04 (.08C)</td>
</tr>
<tr>
<td></td>
<td>TRANSPORT INDEX: NIA AS PER 49CFR172.203(3)(8)</td>
</tr>
<tr>
<td></td>
<td>FLAGARDS: RADIOACTIVE 7</td>
</tr>
<tr>
<td></td>
<td>EXCLUSIVE USE SHIPMENT: THIS VEHICLE IS ASSIGNED FOR EXCLUSIVE USE OF CAMECO RESOURCES, INC. UNDER PROVISIONS OF 49CFR172.247 INCLUDING EXEMPTING FROM MARKING AND LABELING REQUIREMENTS</td>
</tr>
<tr>
<td></td>
<td>DO NOT LOAD OTHER FREIGHT IN THIS VEHICLE, TRANSFER EN ROUTE</td>
</tr>
</tbody>
</table>

**PLACARDS TENDERED:** Yes [X] No [ ]

**REMIT C.O.D. TO:**

**ADDRESS:**

**CARRIER:** Greenfield Logistics

**PER:**

**DATE:** 3/2/11

**SHIPPER:** CAMECO RESOURCES, INC.

**PER:**

**DATE:** 3/2/11
DATE: 3/15/16
CONTAINER #: GFLU-1560
LOCATION: Selenium Plant
TOTAL YARDS: 13 yd

Seal #: 0061151
       0061167

POWER RESOURCES
(dba, Cameco Resources)

Yards:
1" =
2" =
3" =
3.5" =
4" =

End View
7.5"
90°

Side View
15.5'

Barium
RELEASE AUTHORIZATION FOR BY-PRODUCT MATERIAL
(Complies with D. O. T. Hazardous Material Regulations, 49 CFR Parts 100-199)

SHIPPER: Cameco Resources
Smith Ranch Highland Operation
762 Ross Road
Douglas, WY 82633
License No. SUA-1548

RECEIVER: Energy Fuels
6425 S. Hwy 191
Blanding, Utah 84511
License No. UT1900479 Amendment #4

SHIPPING DATE: 3/28/16
SRSHIPMENT #: 3/16-?
TOTAL MAXIMUM ACTIVITY OF LOAD: 1.83E9 (0.05C)

CONTENTS:
☐ UN 2912, Radioactive Material, Low Specific Activity (LSA-1), Class 7 Shipment contains by-product material from an in-situ uranium mine.
☐ RQ, UN 2912, Radioactive Material, Low Specific Activity (LSA-1), Class 7 Shipment contains by-product material from an in-situ uranium mine.
☐ UN 2913, Radioactive Material, Surface Contaminated Objects (SCO-1), Class 7 Shipment contains by-product material from an in-situ uranium mine.
☐ RQ, UN 2913, Radioactive Material, Surface Contaminated Objects (SCO-1), Class 7 Shipment contains by-product material from an in-situ uranium mine.

By execution below, it is represented that the byproduct material being transported is properly classified, described, loaded and labeled, and that the byproduct material is completely contained and in proper condition for transportation, according to the applicable regulations for the state and federal transportation departments.

The shipper certifies the byproduct material is not listed hazardous waste as defined in the Resource Conservation and Recovery Act, as amended, 40 CFR 261 et. seq. or comparable state laws. The byproduct material has not been mixed or commingled with hazardous waste as defined in 40 CFR 261 et. seq. No processes are operated on the site which is RCRA-listed processes as defined in 40 CFR 261 et. seq. All of the Byproduct Material is byproduct material as defined under Section 11(e)(2) of the Atomic Energy Act of 1954 as amended, 42 U.S.C. §2014(e)(2) and 10 CFR §40.4(4)(1). The chemical analysis as listed in Paragraph 2(C) of the Byproduct Disposal Agreement dated June 1, 2010 has been completed for this shipment.

DATE: 3/28/16 BY: [Signature]

NUCLEAR: The Clean Air Energy.
DRIVER RESPONSIBILITY STATEMENT

I, Douglas B. Angell, driver for Greenfield Logistics, have read and understand the Driver Instructions including Emergency Procedures provided by Cameco Resources. It is understood that I will be responsible for proper care and handling of all materials in the trucks and/or trailers under my jurisdiction.

DATE: 3/28/11

SIGNATURE: Douglas B. Angell
WYOMING OPERATIONS  
BYPRODUCT MATERIAL SHIPMENT TRUCK  
SURVEY

<table>
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<tr>
<th>METER MODEL</th>
<th>METER SN</th>
<th>CALIBRATION DATE</th>
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<td></td>
<td>229.617</td>
<td>3/11/15</td>
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<td>23558C</td>
<td>2/19/16</td>
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<tr>
<td>3116-3</td>
<td>Selenium Plant</td>
<td>3/18/16</td>
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<tr>
<th>BACKGROUND</th>
<th>mR/hr</th>
<th>Surface</th>
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<tbody>
<tr>
<td>0.05</td>
<td>0.5</td>
<td>6.6' (2 Meters)</td>
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<tr>
<td>Background</td>
<td>0</td>
<td>dpm/100 cm²</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CARRIER NAME</th>
<th>TRACTOR NO.</th>
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<tbody>
<tr>
<td>3</td>
<td>1500</td>
<td>4.0</td>
<td>6.6' (2 Meters)</td>
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<tr>
<td>5.0</td>
<td></td>
<td></td>
<td>6.6' (2 Meters)</td>
</tr>
<tr>
<td>2.83</td>
<td></td>
<td></td>
<td>6.6' (2 Meters)</td>
</tr>
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</table>

Quality Control Checklist (49CFR 173.475)
As per SHEQ Management System Volume IV-Transportation
The container is in good condition? [ ]
The container has been closed properly? [ ]
The container has been filled properly? [ ]
Exterior contamination/ Radiation levels below the limits? [ ]

Limits
Gamma = 200 mR/hr at surface
Gamma = 10 mR/hr at 2 meters
Gamma = 2 mR/hr in cab
Alpha = 1000 dpm/100 cm² for swipe survey
Alpha = 2200 dpm/100 cm² for instrument survey

0.4 mR/hr 6.6' (2 Meters) 3.0 mR/hr 6.6' (2 Meters) 708 dpm/100 cm²
Transportation Accident Response Guide (Instructions to the Driver)

1.) Introduction

Transportation accidents during the shipment of radioactive concentrates from uranium recovery facilities (yellowcake, brine, resin, byproduct, or slurry) occur infrequently on public highways and at trucking terminals. This material is classified by DOT as Radioactive (Class 7) material. Leakage or spillage of the contents from its container can be a potential health hazard to persons if they ingest or inhale the materials.

The purpose of this guideline is to provide direction for persons responding to a shipping accident involving radioactive materials, particularly when the contents have leaked from their containers. Leakage or spillage can range in severity depending on the specific accident conditions. Although this guideline addresses the worst-case situation, lesser response activities are envisioned for less severe accidents.

The guideline provides instructions to the driver and to other persons who are the first to arrive at the accident scene. These instructions request notifications be made to the shipper and the carrier. If warranted, the shipper will dispatch an initial response team to assist with accident investigation and response. The shipper will also alert a clean-up crew for possible duty and provide guidance for securing clean-up equipment and services. Clean-up methods, monitoring, sampling, release levels, and concluding activities are also described.

You are advised per these instructions to transport the items defined on the attached shipping documents under "EXCLUSIVE USE" provisions.

"EXCLUSIVE USE" (also referred to as "Sole Use" of "Full Load" as used in IAEA regulations) means any shipment:

- From a single consignor having the exclusive use of a transport vehicle or of an aircraft, or of a hold or compartment of an inland watercraft, or of a hold, compartment, or defined deck area of a seagoing vessel; and
- For which all initial, intermediate, and final loading and unloading is carried out by or under the direction of the consignor, consignee, or his designated agent.
Transportation Accident Response Guide (Instructions to the Driver)

Special remarks concerning exclusive use:

- DO NOT transfer the shipment from the originating carrier vehicle.
- DO NOT load other packages on the originating carrier vehicle.
- Deliver the shipment directly to consignor.
- Special routing may be required per attachment.

Transportation Accident Response Guide (Instructions to the Driver)

2.) Emergency Response Procedures Provided to Carrier

TO WHOM IT MAY CONCERN:

- Rescue and lifesaving may be conducted with minimal potential hazards from the cargo on this truck. If possible, avoid breathing dust from spilled cargo. **DO NOT DELAY RESCUE EFFORTS!**

- After needed rescue, lifesaving, first aid or fire fighting, please read the attached instructions in the event of cargo spillage.

- Please note that this truck is equipped with emergency equipment. It is accessible in the storage area on the neck of the trailer or is ___________________________ (write in location if not located in the trailer neck storage area).

TO THE DRIVER: Keep these emergency procedures with your shipping papers, along with Emergency Information For Carriers Form and Guide 162 Radioactive Materials ERG 2012.

This vehicle contains radioactive materials, which may be in the form of dry uranium oxide (yellowcake, U3O8), yellowcake, brine, resin, slurry, or byproduct (waste) material. The color of concentrated material is yellow. The slurry is a liquid material containing solid yellowcake. The material cannot burn or explode. **In the event of an accident involving spillage of material, the following actions are recommended in the order given if appropriate:**

I. **Lifesaving, Rescue, and Firefighting**

This may be done with minimal potential hazards from the material. If possible, avoid breathing and/or swallowing yellowcake dust, slurry, or byproduct material. The radioactive material on the skin or clothing is relatively harmless and simple washing methods will remove it.

If you believe you may have been contaminated with the material, please remove any contaminated clothing and place in plastic bag, use soap and water to wash contaminates
from hands or exposed area, and notify the Cameco Resources Emergency Response Team (CR ERT) upon their arrival at the accident site. To avoid ingestion of the material, do not eat, drink, or smoke while near the spill.

**Transportation Accident Response Guide (Instructions to the Driver)**

2. **Contact the Local Law Enforcement Agency**

Tell the police of the accident with spillage of "LOW SPECIFIC ACTIVITY" (LSA) radioactive material called "yellowcake", "slurry" or "byproduct material". Ask them to notify the state health department. Give them the location of the accident site and tell them of any injured persons.

Nebraska State Police: (308) 632-1211 or (402) 471-4545

Wyoming State Police: 1-800-442-9090

Colorado State Police: (303) 239-4500

(Emergency Dispatch – 24 hours) (303) 239-4501

Utah Highway Patrol: (801) 965-4518

3. **Cover the Spilled Material**

This vehicle carries a spill kit containing gloves, disposable coveralls, shoe covers, radioactive material signs, approved dust respirators with instructions, plastic sheeting, stakes, nails, a hammer, and a knife. Put on coveralls, respirator, gloves, and shoe covers, then cover the spilled material with the plastic. Secure the edges of the plastic to the ground using the stakes, or to the vehicle floor, etc., using the nails. The radioactive material signs should be positioned to provide notice to bystanders.

Unnecessary personnel should be instructed to stand upwind of the spill and 150 feet or more from it. Undamaged containers lying on the road may be moved to the side of the road. Caution: Full drums of yellowcake are very heavy, usually weighing in excess of 500 pounds for slurry and 800 pounds for dry product.

4. **Fill Out the Attached Questionnaire**

Please obtain all of the information requested on the attached form that you can. Please relay this information to the carrier and the shipper listed below. See the final pages of these instructions for additional emergency phone numbers.
Transportation Accident Response Guide (Instructions to the Driver)

5. Telephone the Carrier and the Shipper (Call Collect)

- The carrier is:

- The shipper is:

  Cameco Resources
  Douglas, Wyoming
  (307) 358-6541
  After hours
  (307) 358-6541 ext. 450

The Cameco Resources phone in the Central Plant (ext. 450) is manned 24-hours per day, 7-days per week. Please read the completed questionnaire to whoever answers your call. If necessary for their understanding, read the questionnaire a second time.

6. When Help Arrives

Cooperate with all civil authorities and carrier and shipper personnel who arrive at the scene. Follow their health-safety instructions on checking for possible contamination of your clothing or body.

Please be assured that your exposure to this material will be relatively harmless if you have followed these instructions. The radiological safety personnel who will arrive will be glad to answer any questions you have about this matter.

Thank you very much.
Transportation Accident Response Guide (Instructions to the Driver)

3.) Accident Evaluation Guide

1. Name of Trucking Company: _____________________________________________
2. Truck Number or Tag No: _______________________________________________
3. Name of Driver: ________________________________________________________
4. Name of Police Department Notified: _____________________________________
5. Phone Number of Police Notified: ________________________________________
6. Place of Accident: _____________________________________________________
7. Is the Driver Injured? _________________________________________________
8. Other Injured? _________________________________________________________
9. Bill of Lading Number: ________________________________________________
10. Destination of Shipment: ______________________________________________
11. Time of Accident: _____________________________________________________
12. Was There a Fire? _____________________________________________________
13. Is It Raining or Was Water Used to Put Out Fire or Wash Off Road? _________
14. Are Drums Outside of the Truck? _______________________________________
15. About How Many? _____________________________________________________
16. Are Contents of Drums or Tanks Spilled? __________________________________
17. Has the Spill Been Covered? ___________________________________________
20. Is the Spill Near a Building? __________________________________________
21. Is the Accident Area Lighted at Night? ___________________________________
22. Name of Nearest Large City? __________________________________________
23. Other Comments: _____________________________________________________
24. Your Name Please _____________________________________________________
   a. Can You Be Reached By Phone Near the Accident Site? ____________________
   b. Phone number: _______________________________________________________
   c. Home or Business Phone: _____________________________________________
   d. Your Address: ________________________________________________________

Date: ________________________
Transportation Accident Response Guide (Instructions to the Driver)

Shipper Notification - Cameco Resources Personnel - call in order listed until one is reached

Mine Management

1. Craig Hiser
   Mine Manager
   Work Phone
   (307)358-6541 ext. 415

2. Travis Coleman
   RSO
   (307)358-6541 ext. 431

3. Ken Garoutte
   Safety, Health, Environment and Quality Manager
   (307)358-6541 ext. 476

4. Smith Ranch Central Plant Operator
   (307)358-6541 ext. 450
   24 hours per day / 7 days per week

North Butte Operations

5. Erik Heide
   Mine Manager
   (307)358-6541 ext. 456

Casper Management

1. Brent Berg
   President
   (307)333-7735

2. Mike Thomas
   SHEQ Manager- DIV
   (307)333-7665
Transportation Accident Response Guide (Instructions to the Driver)

Emergency Response Telephone Number Guide

<table>
<thead>
<tr>
<th>State Agencies</th>
<th>Telephone No.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Colorado:</strong></td>
<td></td>
</tr>
<tr>
<td>State Police</td>
<td>(303) 239-4500</td>
</tr>
<tr>
<td>Health Department (24 hours)</td>
<td>(877) 518-5608</td>
</tr>
<tr>
<td><strong>Illinois:</strong></td>
<td></td>
</tr>
<tr>
<td>Highway Patrol General Headquarters</td>
<td>(217) 557-6630</td>
</tr>
<tr>
<td>Deputy Director</td>
<td>(217) 785-0614</td>
</tr>
<tr>
<td>Crash Report #</td>
<td></td>
</tr>
<tr>
<td><strong>Iowa:</strong></td>
<td></td>
</tr>
<tr>
<td>State Patrol Headquarters (Des Moines)</td>
<td>(315) 725-6090</td>
</tr>
<tr>
<td>Calls made after 4:30pm will automatically transfer to 911</td>
<td></td>
</tr>
<tr>
<td><strong>Kansas:</strong></td>
<td></td>
</tr>
<tr>
<td>Highway Patrol General Headquarters</td>
<td>(785) 296-6800</td>
</tr>
<tr>
<td>After hours</td>
<td></td>
</tr>
<tr>
<td>for highway help</td>
<td></td>
</tr>
<tr>
<td>Did you have a spike help</td>
<td></td>
</tr>
<tr>
<td><strong>Michigan:</strong></td>
<td></td>
</tr>
<tr>
<td>Highway Patrol</td>
<td>(517) 241-8000</td>
</tr>
<tr>
<td>(24 hours)</td>
<td></td>
</tr>
<tr>
<td><strong>Minnesota:</strong></td>
<td></td>
</tr>
<tr>
<td>Highway Patrol</td>
<td>(651) 201-7100</td>
</tr>
<tr>
<td>Dept. of Transportation Admin. Office</td>
<td></td>
</tr>
<tr>
<td><strong>Missouri:</strong></td>
<td></td>
</tr>
<tr>
<td>General Headquarters</td>
<td>(573) 751-3313</td>
</tr>
</tbody>
</table>
Transportation Accident Response Guide (Instructions to the Driver)

Emergency Response Telephone Number Guide

<table>
<thead>
<tr>
<th>State Agencies</th>
<th>Telephone No.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nebraska:</strong></td>
<td></td>
</tr>
<tr>
<td>Highway Patrol - Scottsbluff, NE.</td>
<td>(308) 632-1211</td>
</tr>
<tr>
<td>Lincoln, NE.</td>
<td>(402) 471-4545</td>
</tr>
<tr>
<td>Health and Human Services (8 a.m. - 5 p.m. Central)</td>
<td>(402) 471-2168</td>
</tr>
<tr>
<td>(After Business Hours - Call Hwy. Patrol - Lincoln)</td>
<td>(402) 471-4545</td>
</tr>
<tr>
<td>NDEQ (8 a.m. - 5 p.m. Central)</td>
<td>(402) 471-2186</td>
</tr>
<tr>
<td>(After Business Hours - Call Hwy. Patrol - Lincoln)</td>
<td>(402) 471-4545</td>
</tr>
<tr>
<td><strong>South Dakota:</strong></td>
<td></td>
</tr>
<tr>
<td>Division Headquarters</td>
<td>(605) 773-3105</td>
</tr>
<tr>
<td><strong>Utah:</strong></td>
<td></td>
</tr>
<tr>
<td>Highway Patrol - Price, UT. (Section 9)</td>
<td>(801) 965-4532</td>
</tr>
<tr>
<td>Division of Radiation Control (24 hour)</td>
<td>(801) 536-4123</td>
</tr>
<tr>
<td><strong>Wisconsin:</strong></td>
<td></td>
</tr>
<tr>
<td>State Patrol Division Headquarters</td>
<td>(608) 266-3212</td>
</tr>
<tr>
<td><strong>Wyoming:</strong></td>
<td></td>
</tr>
<tr>
<td>State Highway Police</td>
<td>1-800-442-9090</td>
</tr>
<tr>
<td>WDEQ (24 hour)</td>
<td>(307) 777-7781</td>
</tr>
<tr>
<td>Wyoming Department of Transportation</td>
<td>(307) 777-4484</td>
</tr>
</tbody>
</table>

Transportation Accident Response Guide (Instructions to the Driver)

<table>
<thead>
<tr>
<th>Federal &amp; Canadian Agencies</th>
<th>Telephone No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuclear Regulatory Commission</td>
<td></td>
</tr>
<tr>
<td>Operations Center - Bethesda, Md.</td>
<td>(301) 816-5100 or</td>
</tr>
<tr>
<td></td>
<td>(301) 951-0550 or</td>
</tr>
<tr>
<td></td>
<td>(301) 415-0550</td>
</tr>
<tr>
<td>Department of Transportation -</td>
<td></td>
</tr>
<tr>
<td>National Response Center</td>
<td>(800) 424-8802 or</td>
</tr>
<tr>
<td></td>
<td>(202) 267-2675</td>
</tr>
<tr>
<td>Ontario:</td>
<td></td>
</tr>
<tr>
<td>Provincial Police (24 hours)</td>
<td>(888) 310-1122</td>
</tr>
</tbody>
</table>
ON-SITE Transportation Accident Response Guide
For Pulling Unit Operators

1.) Introduction

Transportation accidents during the transport of radioactive concentrates from uranium recovery facilities (byproduct, or wellfield equipment that will be stored and reused) occur infrequently on public highways. This material is classified by DOT as radioactive material shipped as excepted package or Surface Contaminated Object SC0-1. Leakage or spillage of the contents from its container can be a potential health hazard to persons if they ingest or inhale the materials.

The purpose of this guideline is to provide direction for persons responding to a shipping accident involving radioactive materials, particularly when the contents have leaked from their containers. Leakage or spillage can range in severity depending on the specific accident conditions.

The guideline provides instructions to the driver and to other persons who are the first to arrive at the accident scene. These instructions request notifications be made to the shipper and the carrier. If warranted, the shipper will dispatch an initial response team to assist with accident investigation and response. The shipper will also alert a clean-up crew for possible duty and provide guidance for securing clean-up equipment and services.

TO WHOM IT MAY CONCERN:

- Rescue and lifesaving may be conducted with minimal potential hazards from the cargo on this truck. If possible, avoid breathing dust from spilled cargo. DO NOT DELAY RESCUE EFFORTS!

- After needed rescue, lifesaving, first aid or firefighting, please read the attached instructions in the event of cargo spillage.

Lifesaving, Rescue, and Firefighting

This may be done with minimal potential hazards from the material. If possible, avoid breathing and/or swallowing material that may be adhered to byproduct material or wellfield equipment. The radioactive material on the skin or clothing is relatively harmless and simple washing methods will remove it. If you believe you may have been contaminated with the material, please notify first responders upon their arrival at the accident site. To avoid ingestion of the material, do not eat, drink, or smoke while near the spill.
This vehicle contains radioactive materials, which may be in the form of natural uranium and associated daughter products. The color of the material may be red/orange or white/yellow. The material cannot burn or explode. *In the event of an accident involving spillage of material, the following actions are recommended in the order given if appropriate:*

**Contact Supervisor**

Contact your supervisor and give them the location of the accident site and tell them of any injured persons. The supervisor will communicate with the SHEQ Department and the RSO or their designees. Depending on the severity of the situation the Emergency Response Team may also be initiated.

**Initial response**

In the event of spilled radioactive materials, clean-up methods, monitoring, sampling and release levels will be performed under the direction of the RSO or designee. Additional requirements may also be applicable as per SHEQ Management System volume VIII.
THIS VEHICLE CONTAINS: (CHECK THE APPROPRIATE DESCRIPTION OF THE CARGO)

☐ URANIUM ORE CONCENTRATE (U₃O₈ or Yellowcake). The color may be black, greenish brown or yellow, with a dry granular to powdery texture.

☑ SOLID WASTE BYPRODUCT MATERIAL FROM THE PROCESSING OF URANIUM-
   Material may vary from white sludge to contaminated pipe, pumps and assorted trash.

☐ ION EXCHANGE RESIN CONTAINING ADSORBED URANIUM ON RESIN SURFACE

IN THE EVENT OF AN ACCIDENT INVOLVING SPILLAGE THE FOLLOWING ACTIONS
   ARE RECOMMENDED:

1. LIFESAVING
   
   A. USE FIRST AID TREATMENT- according to the nature of the injury.
   B. RADIOACTIVE MATERIAL- degree of hazard will vary from little to moderate.
   C. AVOID SWALLOWING OR BREATHING DUST. DO NOT EAT, DRINK OR SMOKE
      NEAR THE SPILL.
   D. LOW LEVEL RADIOACTIVE MATERIAL ON THE SKIN OR CLOTHING IS
      RELATIVELY HARMLESS
   E. REMOVE AND ISOLATE SUSPECTED CONTAMINATED CLOTHING AND SHOES
      AS SOON AS POSSIBLE AND WASH AFFECTED SKIN AREAS WITH SOAP AND
      WATER - DO NOT EAT, DRINK OR SMOKE UNTIL FREE OF CONTAMINATION.

2. FIRE FIGHTING
   
   A. DO NOT MOVE DAMAGED CONTAINERS; MOVE UNDAMAGED CONTAINERS
      OUT OF THE FIRE ZONE
   B. SMALL FIRES: DRY CHEMICAL, CO₂, WATER SPRAY OR REGULAR FOAM.
   C. LARGE FIRES: WATER SPRAY, FOG OR REGULAR FOAM.

3. SPILL OR LEAK
   
   A. DO NOT TOUCH DAMAGED CONTAINERS OR SPILLED MATERIAL.
   B. COVER DRY (POWDER) SPILL WITH PLASTIC SHEET OR TARP, TO MINIMIZE
      SPREADING
   C. ISOLATE AREA OF SPILL
   D. KEEP UNNECESSARY PEOPLE AT LEAST 150 FEET UPWIND OF SPILL;
      GREATER DISTANCES FOR PEOPLE DOWNWIND
NOTIFICATIONS

1. NOTIFY LOCAL LAW ENFORCEMENT AGENCY GIVING THEM SPECIFIC DETAILS REGARDING THE ACCIDENT AND REQUEST THEY NOTIFY THE STATE HEALTH DEPARTMENT AND TELL THEM CARGO IS:

- URANIUM ORE CONCENTRATE (U₃O₈ OR YELLOWCAKE). "LOW SPECIFIC ACTIVITY" (LSA) RADIOACTIVE MATERIAL
- SOLID WASTE BYPRODUCT MATERIAL FROM THE PROCESSING OF URANIUM "LOW SPECIFIC ACTIVITY" (LSA) RADIOACTIVE MATERIAL OR SURFACE CONTAMINATED OBJECT (SCO-1)
- ION EXCHANGE RESIN CONTAINING ABSORBED URANIUM ON RESIN SURFACE "LOW SPECIFIC ACTIVITY (LSA-1) RADIOACTIVE MATERIAL"

2. NOTIFY ONE OF THE FOLLOWING CAMECO RESOURCES PERSONNEL AT (307) 358-6541 DURING BUSINESS HOURS OR CALL IN THE ORDER LISTED UNTIL ONE IS REACHED.

TRAVIS COLEMAN RADIATION SAFETY OFFICER OFFICE (307)358-6541 ext.431
KEN GAROUTTE SHEQ MANAGER
CRAIG HIZER MINE MANAGER
POTENTIAL HAZARDS

HEALTH

- Radiation presents minimal risk to transport workers, emergency response personnel, and the public during transportation accidents. Packaging durability is related to potential hazards of material.
- Undamaged packages are safe; contents of damaged packages may cause external and/or internal radiation exposure.
- Low-radiation hazard when material is inside container. If material is released from package or bulk container, hazard will vary from low to moderate. Level of hazard will depend on the type and amount of radioactivity, the kind of material it is, and/or the surface it is on.
- Some material may be released from packages during accidents of moderate severity. This poses little risk to people.
- Released radioactive materials or contaminated objects usually will be visible if packaging fails.
- Some exclusive use shipments of bulk and packaged materials will have "RADIOACTIVE" labels. Labels, markings, and shipping papers provide identification.
- Some packages may have a "RADIOACTIVE" label and a second hazard label. The second hazard is usually greater than the radiation hazard; so follow this Guide as well as the response Guide for the second hazard class label.
- Some radioactive materials cannot be detected by commonly available instruments.
- Runoff from control of cargo fire may cause low-level pollution.

FIRE OR EXPLOSION

- Some of these materials may burn, but most do not ignite readily.
- Uranium and Thorium metal cuttings or granules may ignite spontaneously if exposed to air (see Guide 136).
- Nitrate is an oxidizer and may ignite other combustibles (see Guide 141).

PUBLIC SAFETY

- CALL Emergency Response Telephone number on shipping Paper first. If shipping Paper not available or no answer, refer to appropriate Telephone number listed on the inside back cover.
- Priorities for rescue, life-saving, first aid, and control of fire and other hazards are higher than the priority for measuring radiation levels.
- Radiation authorities must be notified of accident conditions, and is usually responsible for radiological decisions.
- Isolate spill or leak area immediately for at least 25 to 50 meters (80 to 150 feet) in all directions. Stay upwind.
- Keep unauthorized personnel away.
- Dilute or isolate unhandled persons or equipment suspected to be contaminated; delay decontamination and cleanup until instructions are received from Radiation Authority.

PROTECTIVE CLOTHING

- Positive pressure self-contained breathing apparatus (SCBA) and structural firefighters' protective clothing will provide adequate protection.

EVAJUATION

Large Spill
- Consider initial downwind evacuation for at least 100 meters (330 feet) if fire.
- When a large quantity of this material is involved in a major fire, consider an initial evacuation distance of 300 meters (1000 feet) in all directions.

SEAONS

- Presence of radioactive material will not change sea conditions.
- Move containers from fire area if you can do it without running Small Fires.
- Dry chemical, CO2, water spray or regular foam.
- Water spray fog (flooded amounts).
- Dike fire-control water for later disposal.

BUCKET LEAK

- Do not touch damaged packages or spilled material.
- Liquid Spills
  - Cover with sand, dirt, or other noncombustible absorbent.
  - Dike to collect large liquid spills.
  - Cover powder spills with plastic sheet or tarps to minimize spread.

FIRST AID

- Medical problems take priority over radiological contamination.
- Use first aid treatment according to the nature of injury.
- Do not delay care and transport of a seriously injured soldier.
- Apply artificial respiration if victim is not breathing.
- Administer oxygen if respiration is difficult.
- In case of contact with substance, wash from skin with running water for at least 20 minutes.
- Injured persons who contacted released material or contacted contaminated garments, equipment, or facilities.
- Ensure that medical personnel are aware of the medical precautions to protect themselves.
# Safety Data Sheet

## Uranium Peroxide Hydrate

**1. Product and company identification**

<table>
<thead>
<tr>
<th>Product name</th>
<th>Uranium Peroxide Hydrate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common name</td>
<td>UO₄, peroxyd yellowcake, yellowcake, peroxyd uranium ore concentrate, uranyl peroxyd</td>
</tr>
<tr>
<td>Material uses</td>
<td>Concentrate produced from the milling of the uranium ore for processing at a refinery</td>
</tr>
<tr>
<td>MSDS #</td>
<td>Cameco 141 E</td>
</tr>
<tr>
<td>Supplier/Manufacturer</td>
<td>Rabbit Lake Operation c/o Cameco Corporation 2121 11th Street West, Saskatoon, Saskatchewan Canada S7M1J3</td>
</tr>
<tr>
<td></td>
<td>Cameco Resources Crow Butte Operation 86 Crow Butte Road, Crawford, NE 69339 USA</td>
</tr>
<tr>
<td></td>
<td>Cameco Resources Smith Ranch Highland P.O. Box 1210 Glenrock, Wy 82637 USA</td>
</tr>
<tr>
<td></td>
<td>Tel: (306) 633 2141 Fax: (306) 633 2248</td>
</tr>
<tr>
<td></td>
<td>KMK Regulatory Services Inc. Tel: (306) 633 2141 Fax: (306) 633 2248</td>
</tr>
<tr>
<td>In case of emergency</td>
<td>1 905 885 8745</td>
</tr>
</tbody>
</table>

**2. Hazards identification**

### Emergency overview

**Physical state**: Solid (Powder)

**Color**: Yellow

**Odor**: No odor

### GHS Label Elements

- **Pictogram**: DANGER

**Signal word**: Toxic by inhalation and ingestion

**Hazard statements**: Danger of cumulative effects

**Precautionary measures**: Do not breathe dust. Do not ingest. Do not get on skin or clothing. Use only with adequate ventilation. Do not eat, drink or smoke when using this product. Avoid contact with eyes. Keep container closed. Wash thoroughly after handling.

**OSHA/HCS status**: This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200)

**Routes of entry**: Dermal contact, via cuts abrasion or open wounds. Eye contact. Inhalation. Ingestion.
Potential acute health effects

Inhalation: Harmful if inhaled. Kidney damage can occur due to chemical toxicity. Dissolution halftime of $\text{UO}_2\cdot\text{xH}_2\text{O}$ is fast for the synthetic lung fluid solubility test. Dust inhalation can result in an internal dose from alpha, beta and gamma radiation.

Ingestion: Harmful if swallowed. Kidney damage can occur due to chemical toxicity.

Skin: Skin dermatitis may result from skin contact.

Eyes: Irritating to eyes.

Potential chronic health effects

Chronic effects: May cause target organ damage, based on animal data. Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation.

Carcinogenicity: Not listed as a carcinogenic material by IARC or OSHA. Soluble and insoluble compounds of uranium are listed as potential occupational carcinogens by NIOSH, and confirmed human carcinogens by ACGIH, based on evidence from epidemiological studies.

Mutagenicity: No known significant effects or critical hazards.

Teratogenicity: No known significant effects or critical hazards.

Developmental effects: No known significant effects or critical hazards.

Fertility effects: No known significant effects or critical hazards.

Target organs: May cause damage to following organs: kidneys.

Over-exposure signs/symptoms

Inhalation: Adverse symptoms may include the following: respiratory tract irritation, coughing.

Ingestion: Chemical toxicity is largely shown in kidney damage that may not be reversible.

Skin: Prolonged contact can result in dermatitis.

Eyes: Adverse symptoms may include the following: pain or irritation, watering, redness.

Medical conditions aggravated by over-exposure: Pre-existing disorders involving any target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product.

See toxicological information (Section 11).

3. Composition/Information on Ingredients

United States

<table>
<thead>
<tr>
<th>Name</th>
<th>CAS number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uranium Peroxide Hydrate</td>
<td>19525-15-6</td>
<td>&gt;95</td>
</tr>
</tbody>
</table>

Canada

<table>
<thead>
<tr>
<th>Name</th>
<th>CAS number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uranium Peroxide Hydrate</td>
<td>19525-15-6</td>
<td>&gt;95</td>
</tr>
</tbody>
</table>

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health of the environment and hence require reporting in this section.

4. First aid measures

Eye contact: Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 20 minutes, occasionally lifting the upper and lower eyelids. Get medical attention.
### Skin contact
In case of contact, immediately flush skin with plenty of water for at least 20 minutes.

### Inhalation
Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Get medical attention immediately.

### Ingestion
Wash out mouth with water. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical doctor or poison control center immediately. Wash out mouth with water. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical doctor or poison control center immediately.

### Protection of first-aiders
No action shall be taken involving any personal risk or without suitable training. If it is suspected that dust is present, it may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Rescuer should wear and appropriate mask or self-contained breathing apparatus. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

### Notes to physician
No specific treatment. Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

## 6. Fire-fighting measures

### Flammability of the product
Not flammable

### Extinguishing media
- Suitable: CO₂, dry chemical, foam, alcohol-type foam, water fog
- Not suitable: None known.

### Special exposure hazards
Possible presence of radioactive uranium dust. No action shall be taken involving any personal risk or without suitable training.

### Hazardous thermal decomposition products
Uranium peroxide hydrate decomposes to produce uranium trioxide (UO₃) powder and oxygen (O₂) gas at high temperatures. Steam will be generated from water of hydration.

### Special protective equipment for firefighters
Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-shield operated in positive pressure mode.

### Special remarks on fire hazards
Uranium peroxide hydrate decomposes to produce uranium trioxide (UO₃) powder and oxygen (O₂) gas at high temperatures. The O₂ gas will increase the explosive limit range and rate of burning for flammable and combustible materials in the vicinity.

## 6. Accidental release measures

### Personal precautions
No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Do not breathe dust. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment (see Section 8).

### Environmental precautions
Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers by covering with a suitable cover. Drums of the material are to be shipped to the nearest Cameco Corporation facility or other licensed repository that can handle the material. Forward any contaminated clothing or equipment in separate marked drums. Inform the relevant authorities if the product has caused environmental pollution in sewers, waterways soil or air.

### Methods for cleaning up
- **Small Spill**: Move containers from spill area. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Dispose of via a licensed waste disposal contractor. Note: See Section 1 for emergency contact information and Section 13 for waste disposal.
Large Spill: Move containers from spill area. Cover suitably to prevent dispersal by wind and precipitation. Prevent entry into sewers, water courses, basements or confined areas. Approach release from upwind. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Dispose of via a licensed waste disposal contractor. Note: See Section 1 for emergency contact information and Section 13 for waste disposal.

7. Handling and storage

Handling: Put on appropriate personal protective equipment (see Section 8). Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. Do not get in eyes or on skin or clothing. Do not breathe dust. Do not ingest. Use only with adequate ventilation. Wear appropriate respirator. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container. In extremely rare occurrences, sealed drums of uranium peroxide can become pressurized with oxygen gas from decomposition. If signs of pressurization are observed (bulging lids and/or bottoms), do not handle the drums until they are evaluated by qualified uranium fuel cycle personnel who will determine safe handling procedures.

Storage: Uranium peroxide concentrates is shipped from the uranium mill to the refinery in a 200 l sealed steel drum. Store in accordance with radiation protection regulations in sealed containers. Store in original container away from extreme heat, incompatible materials (see Section 10) and food and drink. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination. In extremely rare occurrences, sealed drums of uranium peroxide can become pressurized with oxygen gas from decomposition. If signs of pressurization are observed (bulging lids and/or bottoms), do not handle the drums until they are evaluated by qualified uranium fuel cycle personnel who will determine safe handling procedures.

8. Exposure controls/personal protection

United States

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Exposure limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uranium peroxide hydrate</td>
<td>ACGIH TLV (United States, 3/2012) TWA: 0.2 mg/m³, (as U) 8 hours STEL: 0.6 mg/m³, (as U) 15 minutes</td>
</tr>
<tr>
<td></td>
<td>OSHA PEL (United States, 6/2010) TWA: 0.25 mg/m³, (as U) 8 hours</td>
</tr>
<tr>
<td></td>
<td>NIOSH REL (United States, 6/2009) TWA: 0.2 mg/m³, (as U) 10 hours STEL: 0.6 mg/m³, (as U) 15 minutes</td>
</tr>
</tbody>
</table>

Canada

<table>
<thead>
<tr>
<th>Occupational exposure limits</th>
<th>TWA (8 hours)</th>
<th>STEL (15 mins)</th>
<th>Ceiling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ingredient</td>
<td>ppm mg/m³</td>
<td>Other ppm mg/m³</td>
<td>Other ppm mg/m³</td>
</tr>
<tr>
<td>Uranium peroxide hydrate, as U</td>
<td>US ACGIH 3/2012 0.2</td>
<td>Other 0.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AB 4/2009 0.2</td>
<td>Other 0.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BC 4/2012 0.2</td>
<td>Other 0.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ON 7/2010 0.2</td>
<td>Other 0.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>QC 9/2011 0.2</td>
<td>Other 0.6</td>
<td></td>
</tr>
</tbody>
</table>

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Consult local authorities for acceptable exposure limits.

Recommended monitoring procedures: If this product contains ingredients with exposure limits, personal, workplace, atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment. Reference should be made to appropriate monitoring standards. Reference to national guidance documents for methods for the determination of hazardous substances will also be required.

Engineering measures: Use only with adequate ventilation. Use process enclosures or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. This may require HEPA filtration of exhaust air.

Hygiene measures: Wash hands, forearms and face thoroughly after handling, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location. Contamination monitoring may be required for activities with direct exposure.

Personal protection

Respiratory: Use a properly fitted particulate filter respirator complying with an approved standard. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Hands: Chemical-resistant impervious gloves complying with an approved standard should be worn at all times when handling. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining the protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. Recommended: Rubber or neoprene for normal industrial use.

Eyes: Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dust. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection. Chemical splash goggles

Skin: Personal protective equipment for 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. Recommended: long sleeved coveralls

Environmental exposure controls: Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

9. Physical and chemical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical state</td>
<td>Solid (Powder)</td>
</tr>
<tr>
<td>Flash point</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Burning time</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Burning rate</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Auto-ignition temperature</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Flammable limits</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Color</td>
<td>Yellow</td>
</tr>
<tr>
<td>Odor</td>
<td>Odorless</td>
</tr>
<tr>
<td>Taste</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>
Chemical stability: The product is stable under normal conditions.

- Normal conditions in an operating environment: pressure 0.9 bar to 1.1 bar, oxygen 21% v/v, temperature from 0 to 30 °C

Conditions to avoid: Avoid extremely high temperatures.

Incompatible materials: Strong mineral acids such as nitric, sulphuric or hydrochloric acids.

Hazardous decomposition products: Under normal conditions of storage and use, hazardous decomposition products should not be produced. Uranium peroxide hydrate decomposes to produce uranium trioxide (UO₃) powder and oxygen (O₂) gas at temperatures at high temperatures.

Possibility of hazardous reactions: Under normal conditions of storage and use, hazardous reactions will not occur.

10. Stability and reactivity

11. Toxicological information

Acute toxicity

Uranium is a nephrotoxin (a kidney poison). Studies indicate that long term exposure may result in kidney impairment. While an LD₅₀ of 70 mg/kg has been estimated for soluble uranium salts[Kathren and Burklin (2008)], but insoluble uranium compounds were found to be practically non-toxic, indicating LD₅₀ for insoluble salts such as uranium peroxide hydrate should be much higher.
Chronic toxicity
There is no data available

Irritation/Corrosion
Skin : There is no data available
Eyes : There is no data available
Respiratory : There is no data available

Sensitizer
Skin : There is no data available
Respiratory : There is no data available

Carcinogenicity

<table>
<thead>
<tr>
<th>Classification</th>
<th>ACGIH</th>
<th>IARC</th>
<th>EPA</th>
<th>NIOSH</th>
<th>NTP</th>
<th>OSHA</th>
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</thead>
<tbody>
<tr>
<td>Uranium peroxide hydrate</td>
<td>A1</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Mutagenicity
There is some evidence of genetic effects from radiation in animal studies, however there has been no evidence reported in human studies.

Teratogenicity
There is no data available

Reproductive toxicity
There is limited available data on the reproductive toxicity in humans.

IDLH : 10 mg U/m³

12. Ecological information

Ecotoxicity :

Aquatic ecotoxicity
Green algae LOEC 70-170 µg/L; mussels EC₅₀ 380-600 µg/L (Warne et al. 2009)

Persistence/degradability
Sediments act as sinks for insoluble uranium compounds.

13. Disposal considerations

Waste disposal : Scrap uranium peroxide hydrate should be recycled through an appropriate licenced facility. Contaminated uranium peroxide hydrate must be disposed of as radioactive waste, rather than as hazardous chemical waste. It is recommended to consult local state and federal regulations and Cameco corporation to determine appropriate disposal routes for uranium peroxide hydrate waste.

Disposal should be in accordance with applicable national, regional and local laws and regulations.

Refer to Section 7: HANDLING AND STORAGE and SECTION 8: EXPOSURE CONTROL/PERSONAL PROTECTION for additional handling information and protection of employees.

14. Transport information

<table>
<thead>
<tr>
<th>Regulatory information</th>
<th>UN number</th>
<th>Proper shipping name</th>
<th>Classes</th>
<th>PG*</th>
<th>Label</th>
<th>Additional information</th>
</tr>
</thead>
</table>

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<table>
<thead>
<tr>
<th>Classification</th>
<th>UN2912</th>
<th>Description</th>
<th>PG*</th>
<th>Exemptions to the above classification may apply. AERG : 162</th>
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<tbody>
<tr>
<td>DOT</td>
<td>UN2912</td>
<td>RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-1) (non fissile or fissile excepted)</td>
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<td>-</td>
</tr>
<tr>
<td>TDG</td>
<td>UN2912</td>
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<td>-</td>
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<tr>
<td>IMDG Class</td>
<td>UN2912</td>
<td>RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-1) (non fissile or fissile excepted)</td>
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<td>-</td>
</tr>
<tr>
<td>IATA-DGR Class</td>
<td>UN2912</td>
<td>RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-1) (non fissile or fissile excepted)</td>
<td>7</td>
<td>-</td>
</tr>
</tbody>
</table>

**15. Regulatory information**

**United States**

- **HCS Classification**: Toxic material
  - Carcinogen
  - Target organ effects

- **U.S. Federal regulations**: TSCA 8(a) CDR Exempt/Partial exemption: Not determined
  - United States Inventory (TSCA8b): Not determined

- **Clean Air Act Section 112 (b)**: Not listed

- **Clean Air Act Section 602 Class I Substances**: Not listed

- **DEA List II Chemicals (Precursor Chemicals)**: Not listed

- **DEA List II Chemicals (Essential Chemicals)**: Not listed

**SARA 302/304**

Composition/information on ingredients

No products were found
### SARA 304 RQ
- Not applicable

### SARA 311/312
- Classification: Not applicable

### Composition/Information on ingredients
No products were found.

### State regulations
- **Massachusetts**: This material is not listed
- **New York**: This material is not listed
- **New Jersey**: This material is not listed
- **Pennsylvania**: This material is not listed
- **California Prop. 65**: No products were found

### Canada
- **WHMIS (Canada)**: Class D-18: Material causing immediate and serious toxic effects (Toxic); Class D-2A: Material causing other toxic effects (Very Toxic)

### Canadian lists
- **Canadian NPRI**: This material is not listed.
- **Canadian ARET**: This material is not listed.
- **CEPA Toxic substances**: This material is not listed.
- **Alberta Designated Substances**: This material is not listed.
- **Ontario Designated Substances**: This material is not listed.
- **Québec Designated Substances**: This material is not listed.
- **Canada Inventory**: This material is listed or exempted.

### International regulations
- **International lists**: Australia inventory (AICS): Not determined.
  - China inventory (IECSC): Not determined.
  - Japan inventory: Not determined.
  - Korea inventory: Not determined.
  - Malaysia inventory (EHS Register): Not determined.
  - Taiwan inventory (CSNN): Not determined.

### 16. Other information

#### Hazardous Material Information System (U.S.A)

<table>
<thead>
<tr>
<th>Health</th>
<th>Flammability</th>
<th>Physical Hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing severe hazards or risks.

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significant hazards or risks Although HMIS® ratings are not required on MSDSs under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868. The customer is responsible for determining the PPE code for this material.

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History

<table>
<thead>
<tr>
<th>Date of Issue</th>
<th>01 October 2015</th>
</tr>
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<tr>
<td>Date of previous</td>
<td>12 December 2013</td>
</tr>
<tr>
<td>issue</td>
<td></td>
</tr>
<tr>
<td>Version</td>
<td>3</td>
</tr>
<tr>
<td>Revised</td>
<td>2, 16</td>
</tr>
<tr>
<td>Section(s)</td>
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</tr>
</tbody>
</table>

Notice to reader

To the best of our knowledge the information contained herein is accurate. However, neither the above named supplier, no any of the subsidiaries assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.