



December 16, 2013

D. Blair Spitzberg, Ph.D, Chief  
Repository and Spent Fuel Safety Branch  
Division of Nuclear Materials Safety

Via FEDEX

Re: **Reply to a Notice of Violation**  
**Source Material License SUA-442, Docket Number 40-6622**  
**NRC Inspection Report 040-06622/13-001**

Dear Sir:

The following response address a single Severity Level IV violation identified during the September 25, 2013 NRC inspection of Pathfinder Mines Corporation's Shirley Basin site located in Carbon County, Wyoming, and as noted in the NRC correspondence to Pathfinder Mines Corporation dated November 26, 2013.

**Violation**

During an NRC inspection conducted on September 25, 2013, one violation of NRC requirements was identified. In accordance with the NRC Enforcement Policy, the violation is listed below:

10 CFR 71.5(a) requires that a licensee who transports licensed material outside of the site of usage, as specified in the NRC license, or where transport is on public highways, or who delivers licensed material to a carrier for transport, comply with the applicable requirements of the regulations appropriate to the mode of transport of the Department of Transportation (DOT) in 49 CFR Parts 107, 171-180, and 390-397.

49 CFR 172.702 requires that each hazmat employer shall ensure that each hazmat employee is trained and tested, and that no hazmat employee performs any function subject to the requirements of 49 CFR Parts 171-177 unless trained, in accordance with Subpart H of 49 CFR Part 172. The terms Hazmat Employer and Hazmat Employee are defined in 49 CFR 171.8.

49 CFR 172.704(a) specifies the elements of hazmat employee training as: (1) general awareness/familiarization training; (2) function-specific training; and (3) safety training. 49 CFR 172.204(c) requires, in part, that a hazmat employee receive initial training, and recurrent training at least once every two years.

Contrary to the above, during the period between October 10, 2011 and July 31, 2013, the licensee did not provide training for its hazmat employee as required by Subpart H to 49 CFR Part 172, and the licensee otherwise meets the definition of hazmat employer in 49 CFR 171.8. Specifically, one hazmat employee's training expired on October 9, 2011, and no recurrent training was performed. This hazmat employee conducted radiation surveys required by 49 CFR 173.443 for shipments of licensed material transported offsite by public highway after the expiration of the hazmat training. This is a Severity Level IV violation (Supplement V).

PATHFINDER MINES CORPORATION

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935 PENDELL BLVD., P.O. BOX 730 MILLS, WYOMING 82644, U.S.A.  
TEL.: 307 234 5019 FAX: 307 473 7306 WWW.US.AREVA.COM

**Response and actions**

1. Reason for the violation: The reason for the violation was the inadvertent missing of the training deadline. This was due to two causes, 1) an unfortunate oversight and 2) the pending sale of PMC caused internal oversight confusion.
2. Corrective steps taken and results achieved:
  - a. Prior to receipt of the NOV formal training of the involved staff was conducted at a course offered by Nevada Technical Associated November 18-22 2013 as part of the RSO annual refresher. In addition November 25 2013 a training day was conducted at the PMC office in Mills Wyoming. A copy of the documentation of training and the outline of the materials used in the in-house training is enclosed in this response.
3. Corrective steps that will be taken to avoid further violations:
  - a. The bi-monthly safety meetings will be a primary source of continued emphasis on this topic to ensure continued proper documentation and protocols are followed.
4. Date when full compliance was achieved: November 25, 2013.

Sincerely,



R. Mark Owens  
General Manager

Copy Ted Carter – USNRC

**Training Documents from November 25<sup>th</sup>, 2013**

**PATHFINDER Mines Corporation****MEMORANDUM**

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**DATE:** December 10, 2013      **File:** P:\Shirley Basin\Regulatory & Environment Data\Safety Meeting Notes\Rad Safety And Functional Training.Docx

**TO:** File      **Copy:**

**FROM:** RSO

**RE:** Rad Safety and Transportation Functional Training

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**Summary**

On November 25<sup>th</sup> 2013 a safety training day was held in the PMC offices at Mills Wyoming. In attendance were R. Mark Owens - RSO and Kenneth Hurley – Consultant. The training topics included a review of the basics of radiation and hazard awareness, the basic regulations governing the transport of radioactive material specific to the handling of LSA-1, and site specific functional aspects of handling the material received at the Shirley Basin Disposal site.

**Outline of Contents****Part 1 Rad Safety Review**

- Radiation Detection and Measurement
- Units of Measurement
- Radiation Exposure Survey Instruments / Contamination Survey Instruments
- Detector Types
  - Gas Filled
    - Geiger Mueller
  - Scintillation
- Detector Pre-use Operational Check
- Meter operation
- Radiation measurement Units

**Part 2 Transportation Regulation Overview**

- General Modes of Transport and Stats
- Focus on Safety and Package integrity in addition to the Rad Safety
- Types of Packaging (Industrial for our usage)
- Packaging risks and exceptions
- Labeling types
- Vehicle Limits
- Proper Vehicle Placarding
- Consignment vs, Shipment
- Class 7 Definition
- Classification: Nomenclature (LSA1)
- Hazard Labeling Overview

**Part 3 Functional Approach to By-Product Material Disposal**

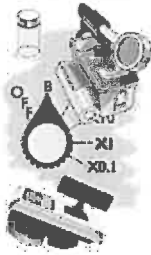
- Example of Cameco Load 10/13-66
  - Proper usage of Exhibit A
  - Bill of Lading with the proper documentation
  - Noted that there are difference in how Cameco vs. U1 approach the paperwork but both usages look acceptable.
  - Checks required to validate the contents, data on the forms, etc.
  - Release survey process using appropriate instruments and verifying that the returning load is under the transportation limits.
  - Difference between exclusive and non-exclusive usage
  - ALARA concerns
    - Washing vehicle is loose material present even if below Radiation limits
    - Verifying that the material is appropriate for disposal
    - Scan of vehicle(s) going offsite. Commitment is Quarterly but best practice is at each interval of disposal – weekly when on site.

Attachments:

Handout materials used for discussion.



## SECTION 4 – RADIATION DETECTION AND MEASUREMENT



Radiation detection instruments are necessary to determine the effectiveness of our radiation safety program.

Goal: We will provide information so that the radiation worker may:

1. Choose the correct radiation detection instrument.
2. Use the instrument properly.

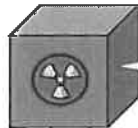


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## UNITS OF MEASUREMENT

Radiation source



Source strength:  
*Ci*  
*Bq*  
*kVp,*  
*mAs...*

Radiation beam



Exposure:  
*R*  
*X*

Absorbing Medium




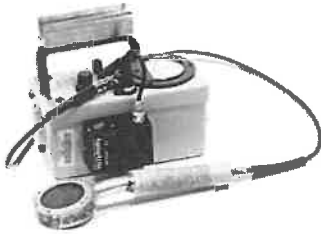

Absorbed dose:  
*rads, Gy*

Dose equivalent:  
*rem, Sv*

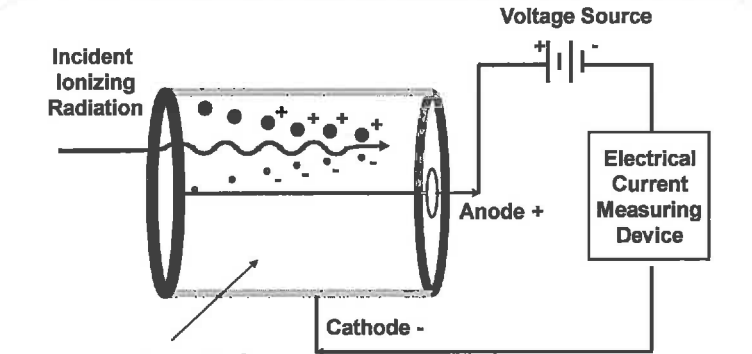


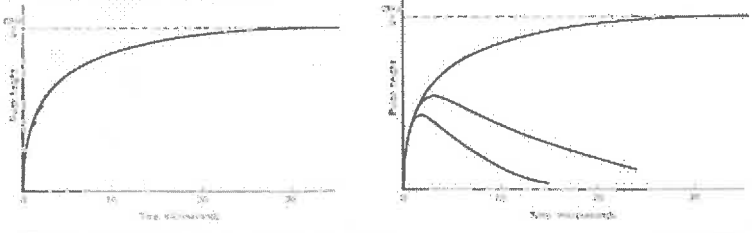
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RADIATION EXPOSURE SURVEY INSTRUMENTS	CONTAMINATION SURVEY INSTRUMENTS
<ul style="list-style-type: none"> <li>• Two categories of instruments available:</li> <li>• Typically read in mR/hr or R/hr</li> <li>• Best suited for use when entering a field of radiation</li> </ul>	<ul style="list-style-type: none"> <li>• Typically read in counts per minute (CPM)</li> <li>• Not designed for measuring radiation exposure</li> </ul>
	
<p><i>Some survey instruments are designed to do both</i></p>	
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### 4.7 GAS-FILLED DETECTORS





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4.6


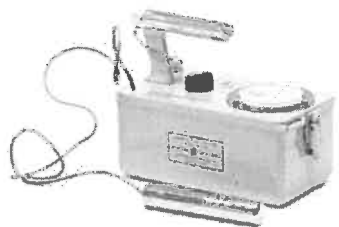
**4.7 THE PROPORTIONAL COUNTER**

- Adjust the voltage upward beyond the ion chamber plateau
- Ions from the initial ion pairs are accelerated
- electron acceleration is more important than positive ions
- Secondary electrons are produced by collisions by the primary ion-pair products
- Change the gas in the chamber
- These new design features create a gas amplification factor ( $>1$ ) - called an "avalanche"
- By increasing the tube voltage the avalanche spreads along the anode wire
- Pulse size is proportional to the chamber voltage
- Pulse size depends on the electric field gradient
- Anode (central) diameter is important

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**4.7 THE GEIGER-MUELLER (GM) TUBE**

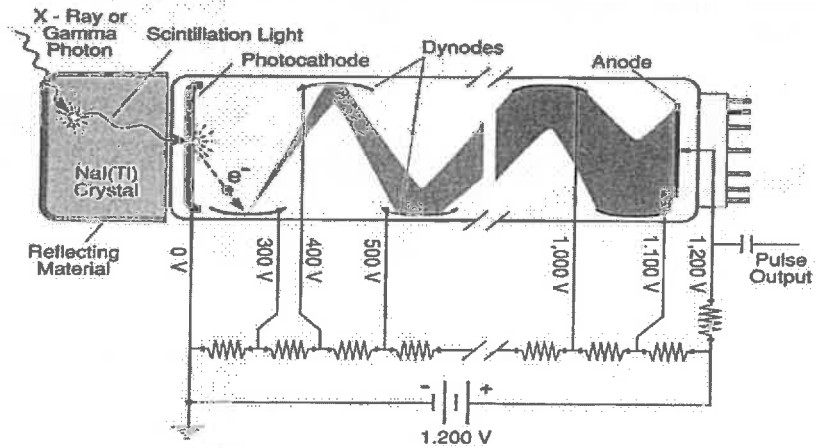
- Basic Readout module
- Two Geiger tubes: "Pancake" type and the "End-Window" type.
- Excellent for detecting small amounts of radioactivity
- Respond to but is not suited to measure radiation fields
- Possible paralysis of response at high count rates

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## SCINTILLATION DETECTOR

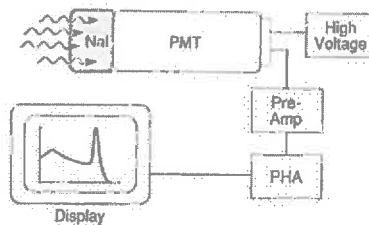


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## SCINTILLATION DETECTION SYSTEM

- Design of Basic Pulse Height Analysis System
- Amplitudes of voltage pulses are sorted by PHA
- PHA counts number of pulses for various voltages (energies)
- Display is a histogram of pulse heights



Phosphor	Rel Pulse Height	Decay Time nanosec
NaI (Tl)	210	250
Cs I	55	1,100
Plastic	28-48	3 - 5
'Liquid'	27-49	2 - 8

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4.18

## CHOOSING A METER

- Contamination or Radiation?
- X-ray, Gamma, Alpha or Neutron?
- Energy Dependence?
- Response Time: Fast or Slow?
- Sensitivity: Low doses or high doses?
- Fixed or Portable?
- Calibration?

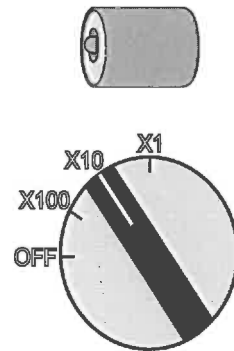


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## PRE-USE OPERATIONAL CHECK

- 1: Turn meter off. (Check Calibration). - Inspect Unit.
- 2: Open unit, install battery (observe polarity).
- 3: Turn to battery check
- 4: Turn to HV check
- 5: Test operation of each range by rotating selector switch to each position, observing meter deflection.
- 6: Turn range selector to the lowest setting wait 30 seconds. Open beta window. What is background?



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4-32

## APPLICATION OF CONTAMINATION SURVEY INSTRUMENTS

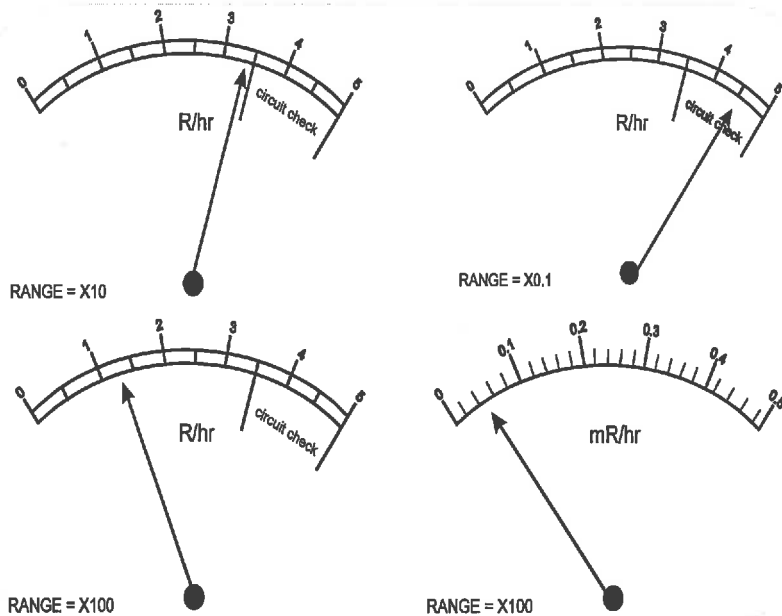
- Verify background radiation level
- Hold probe 1/2 inch from surface
- Move probe slowly, 1-2 inches per second
- Pause if count rate increases



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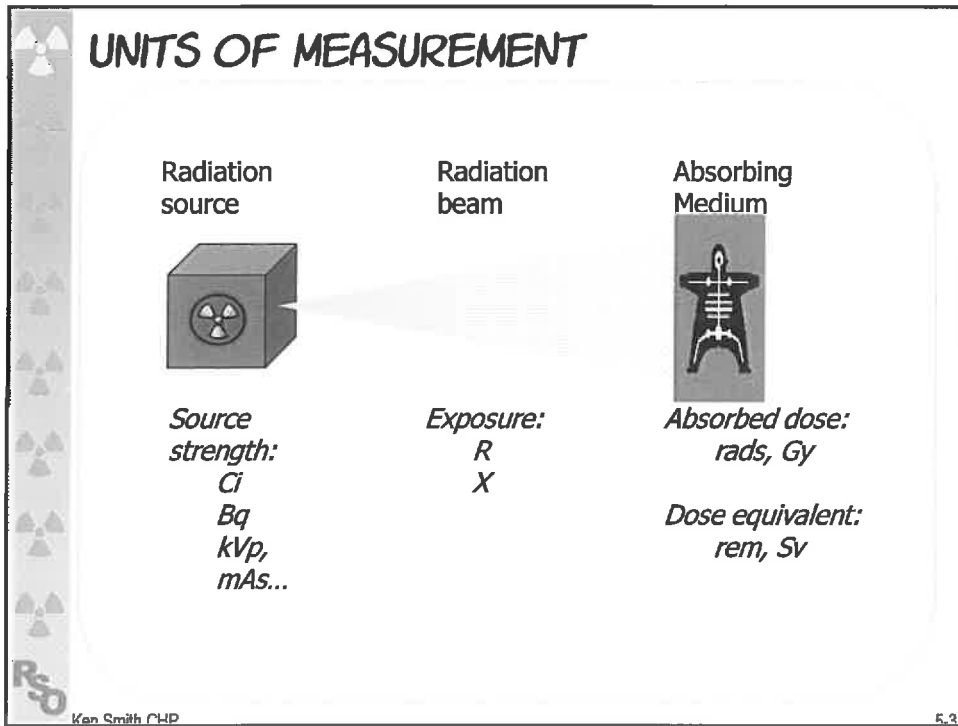
4.33

## READING THE METER FACE



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4.34



## ABSORBED DOSE (D)

Units of dose measure the amount of radiation energy absorbed or deposited per unit of mass.

- Rad
  - The old (CGS) unit of absorbed dose is the **rad**, which is an acronym for **Radiation Absorbed Dose**.
  - The unit rad can be applied to all types of radiation and is defined as the deposition by any radiation of **100 ergs of energy in one gram of any material**.

*1 R = 0.95 rad in soft tissue.*  
*1 R ~ 1 rad in tissue*
- Gray (Gy)
  - The SI Derived unit of absorbed dose is the **gray (Gy)**, equivalent to the deposition of one joule of energy per kilogram (1 J/kg).

**1 Gy = 100 rad**

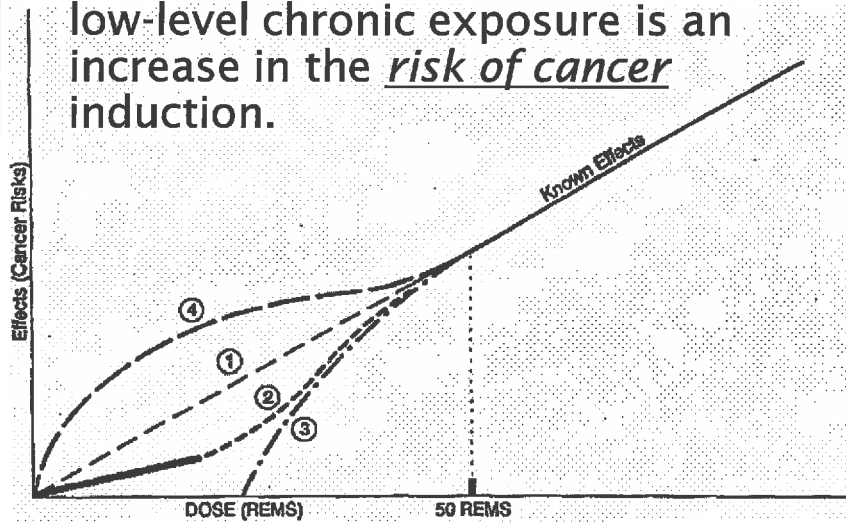
  - Although the rad and gray are measures of ionization produced, they do not give any information about the biological effects of the radiation that is absorbed.

Note: For simplicity purposes, 1 rad of photons is usually considered to be equivalent to 1 R. The actual physical relationship is such that an exposure of 1 R would produce an absorbed dose of 0.87 air rads. This means that 1 R = 87 ergs/g.

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## DOSE vs BIO. EFFECTS CURVES

- The principle hazard from radiation low-level chronic exposure is an increase in the risk of cancer induction.



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## FETAL IRRADIATION

NO SIGNIFICANT ADVERSE HEALTH EFFECTS BELOW 10 REM

Days After Fertilization	Period of Development	Effects
1-12	Pre-implantation	1. The most probable is death. 2. Little chance of malformation.
13-50	Organogenesis	1. Reduced lethal effects. 2. Congenital malformation. 3. Growth retardation.
51-280	Fetal	1. Effects on CNS. 2. Growth retardation with higher doses.
All		Increased childhood cancer risk.





## SECTION 10 - DOT RAM TRANSPORTATION REGULATIONS



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6.1



## REGULATIONS

### US DOT 49 CFR

- 171: General information & definitions
- 172: Hazardous Material Table, Communications, Emergency Response Information, Training
- 173: Shippers' General Requirements for Shipments & Packaging
- 174 -177: Carriage by rail, aircraft, vessel, highway
- 178: Specification for packages

### US NRC 10 CFR

- Part 20: Standards for protection against radiation
- Part 71: Packaging and transportation of radioactive materials.
  - requirements for packaging, preparation for shipment and transportation of licensed material
  - Applies to licensees authorized to receive, possess, use or transfer licensed material, if licensee delivers material to a carrier for transport, transports material outside the usage site of the license, or transports material on public highways

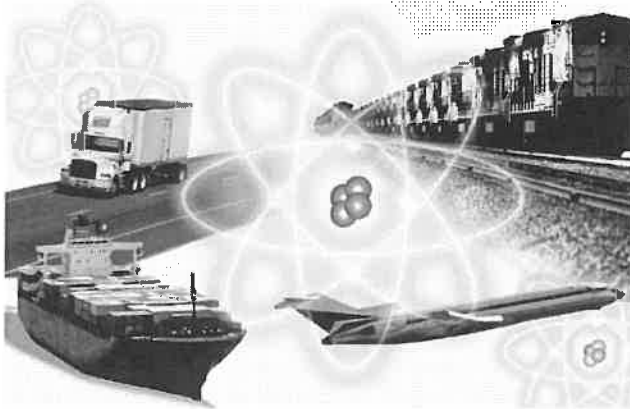


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10.3

## MODES OF TRANSPORT

- Air
- Rail
- Truck
- Water

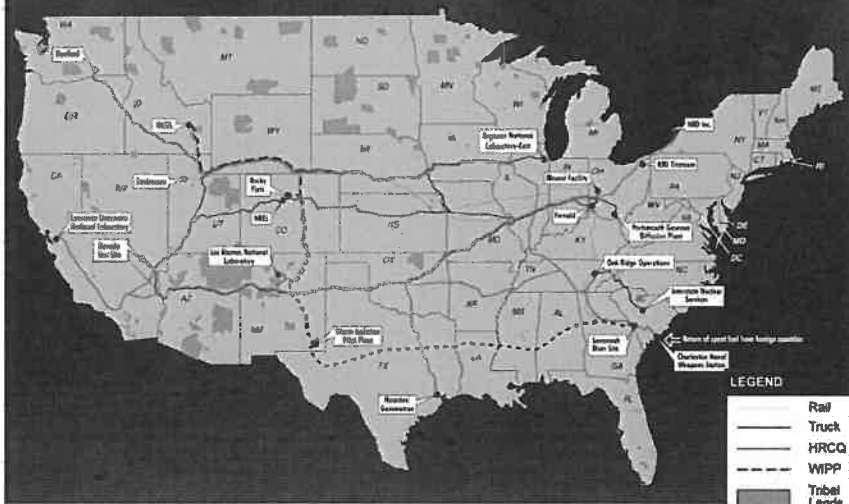


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10.5

## TRANSPORTATION ROUTES

Representative Transportation Routes: FY 2000 - 2001

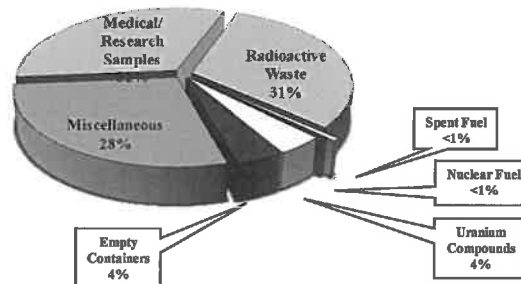


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10.6

## DOE'S SHIPPING ACTIVITY

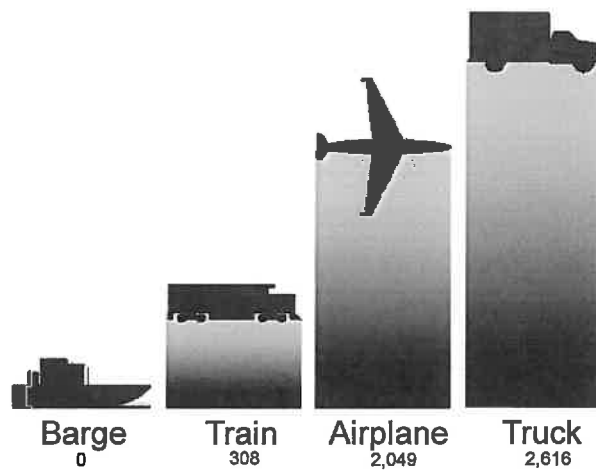
- 500 billion packages shipped annually in U.S.
- 100 million are hazardous
- 2.8 million are radioactive
- 5,000 DOE radioactive shipments per year



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10.7

## MODES OF TRANSPORT



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10.8





## TRANSPORTING RADIOACTIVE MATERIAL

- Radioactive material has many uses
- To be useful it must be shipped to where it is needed
- 2/3 of all shipped radioactive material is man-made
- Use of radioactive material also produces waste that must be transported
- Radioactive material is shipped in its most stable form
- Transport of radioactive material is highly regulated
- Two part philosophy of radioactive material transport says that:
  - Safety is primarily focused on the package
  - Package integrity is directly related to the hazard of the material it contains



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10.9



## EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND LIMITS FOR RADIONUCLIDES.

Isotope	Bq/g	Ci/g	Bq	Ci
<sup>99m</sup> Tc	100	2.7x10 <sup>-9</sup>	1x10 <sup>7</sup>	2.7x10 <sup>-4</sup>
<sup>131</sup> I	100	2.7x10 <sup>-9</sup>	1 x10 <sup>6</sup>	2.7x10 <sup>-5</sup>
<sup>18</sup> F	10	2.7x10 <sup>-10</sup>	1x10 <sup>6</sup>	2.7x10 <sup>-5</sup>
<sup>51</sup> Cr	1000	2.7x10 <sup>-8</sup>	1x10 <sup>7</sup>	2.7x10 <sup>-4</sup>
<sup>153</sup> Sm	100	2.7x10 <sup>-9</sup>	1x10 <sup>6</sup>	2.7x10 <sup>-5</sup>
<sup>201</sup> Tl	100	2.7x10 <sup>-9</sup>	1x10 <sup>6</sup>	2.7x10 <sup>-5</sup>



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10.10



## SAFE PACKAGING

- Rigorous standards help ensure safety
- Prior to transport, regulations require that radioactive material is:
  - Packaged
  - Sealed
  - Surveyed for external radiation and contamination
  - Marked and labeled



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10-14



## RADIOACTIVE MATERIAL PACKAGING

- Transported by all modes
- Four Package Types:
  - Excepted Packaging
  - Industrial Packaging
  - Type A Packaging
  - Type B Packaging
- Package type may indicate level of risk
- Excepted, Industrial, & Type A Packages contain non life-endangering quantities

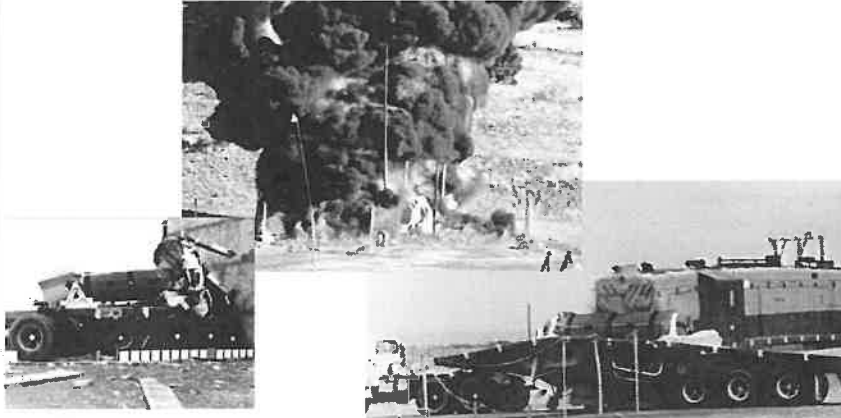


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10-15

## RISKS ASSOCIATED WITH SHIPPING PACKAGES

- Type B Packages built to withstand severe accidents
- No injuries or death resulting from the release of radioactive material in a transportation incident



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10.16

## EXCEPTED PACKAGING



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10.17

# INDUSTRIAL PACKAGING

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10-18

# TYPE A PACKAGING

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10-19



## RADIATION-WARNING LABELS

- Designed to inform personnel of package's radioactive contents
- Not all packages require warning labels
- When required, radiation-warning labels will:
  - Appear on opposite sides of package
  - Contain specific information on package contents and activity of radioactive material



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10-26



## RADIATION-WARNING LABELS

- Labels are applied based on DOT regulations
  - Four different labels may be used:



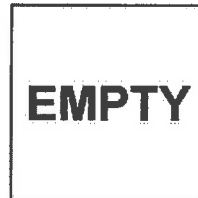
Radioactive White-I



Radioactive Yellow-II



Radioactive Yellow-III




EMPTY



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10-27

## RADIOACTIVE WHITE-I




The image shows a diamond-shaped hazard label for Radioactive White-I. At the top is a radiation symbol. Below it, the text reads "RADIOACTIVE I". Underneath that, there are two lines: "CONTENTS ....." and "ACTIVITY ....." with dotted lines. At the bottom of the diamond is the number "7".

- Maximum of 0.5 mrem/hour on contact

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## RADIOACTIVE YELLOW-II



The image shows a diamond-shaped hazard label for Radioactive Yellow-II. At the top is a radiation symbol. Below it, the text reads "RADIOACTIVE II". Underneath that, there are two lines: "CONTENTS ....." and "ACTIVITY ....." with dotted lines. Below these lines is a small rectangular box labeled "TRANSPORT INDEX". At the bottom of the diamond is the number "7".

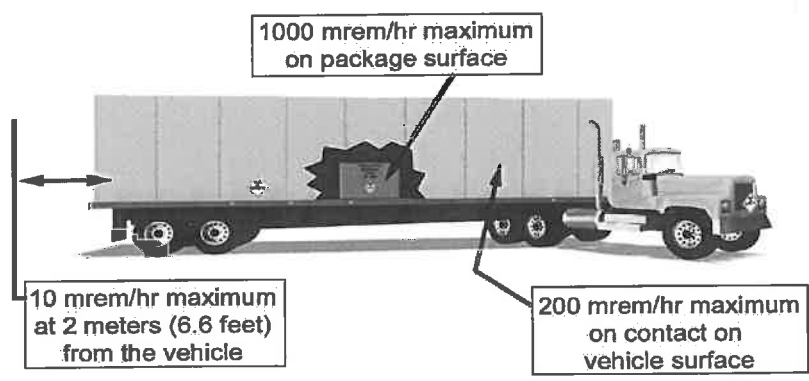
- 0.5 to 50 mrem/hour on contact
- Maximum TI of 1

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# RADIATION LIMITS - VEHICLES

## Exclusive use vehicle



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# 6.30 HRCQ PLACARDING

- There are two type of placards used for radioactive material shipments



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10.35

## DISPOSAL OF SHIPPING CONTAINERS

- Containers should be disposed of as non-radioactive waste.
- Remove or deface any radioactive material labels before disposal.



## 6.16 CLASS 7 HAZARD LABELS — RADIATION LIMITS



TI = 0 (~ TI ≤ 0.05)

Surface radiation:  
≤ 0.5 mrem/h (≤ 5 μSv/h)



TI ≤ 1.0

Surface radiation:  
≤ 50 mrem/h (≤ 0.5 mSv/h)



TI ≤ 10.0

Surface radiation:  
≤ 200 mrem/h (≤ 2 mSv/h)





### 3.1 Classification: Goals

Upon completion of this module, you will be able to do the following:

- Explain the difference between consignment and shipment.
- Define a Class 7 radioactive material.
- State four types of radioactive material that are excluded from the Class 7 radioactive material definition.
- Utilize DGR Table 10.3.A to determine exempt values.
- Determine if a material for transport meets the definition of a Class 7 radioactive material.
- Identify and describe six classifications of radioactive material.

### 3.2 Classification: Definition of Consignment Verses Shipment

Goal: Explain the difference between consignment and shipment.

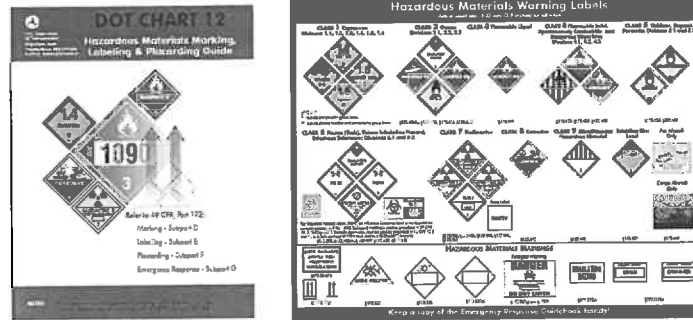
The HMR defines *consignment* as one or more packages of dangerous goods accepted by an operator from one shipper at one time and at one address, receipted for in one lot and moving to one consignee at one destination address.

The HMR defines *shipment* as the specific movement of a consignment from origin to destination.

Thus, *shipment* refers to the actual movement of the package, while *consignment* encompasses the material and its transportation.

Goal: Explain the difference between consignment and shipment.

**Hazardous materials** (also known as dangerous goods) are those goods which will meet the definition of at least one of the nine transportation hazard classes. Hazard classes portray the type of risk or hazard posed by the material.



**MORE INFO**  
DOT Chart 12

### 3.4 Classification: Definition of Radioactive Material

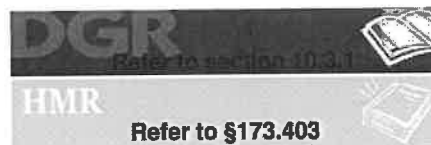
Goal: Define a Class 7 radioactive material.

49 CFR §173.403 of the HMR defines Class 7 *radioactive material* as any material containing radionuclides where both

- the *activity concentration* and
- the *total activity in the consignment*

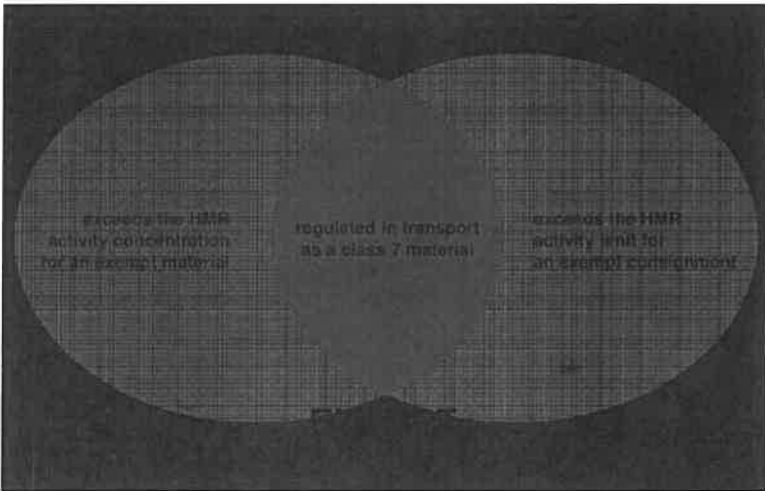
exceed the value specified in the DGR / HMR ( §173.436 or §173.433 ).

A material that only exceeds one of these limits is not a Class 7 radioactive material.



3.5 Classification: Visualizing the Class 7 Definition

Goal: Define a Class 7 radioactive material.



3.6 Classification: Excluded Radioactive Material

Goal: State four types of radioactive material that are excluded from the Class 7 radioactive material definition.

Radioactive materials that are excluded from the definition of Class 7 include:

- radioactive material administered to a person for medical purposes
- radioactive material in consumer products
- certain concentrations of naturally occurring radioactive material
- non-radioactive solid objects with minimal surface contamination



A graphic with two horizontal bars. The top bar is dark with "DGR" in large white letters and "Refer to section 10.0.1.4" in smaller white text. The bottom bar is light grey with "HMR" in large dark letters and "Refer to 173.401" in smaller dark text. There are small icons of a box and a container on the right side of each bar.

### 3.19 Classification: Nomenclature

Goal: Identify and describe six classifications of radioactive material.

Radioactive materials are grouped according to their form and characteristics:

- *Fissile*
- *Low Specific Activity (LSA)*
- *Surface Contaminated Object (SCO)*
- *Low Dispersible Material (LDM)*
- *Special Form*
- *Other Form*

A radioactive material may meet the definition of one or more of the above classifications.

HMR

Refer to 173.403



### 3.20 Classification: Fissile Material

Goal: Identify and describe six classifications of radioactive material.

A *fissile material* is capable of sustaining a chain reaction of nuclear fission.

Only the following four radionuclides are considered fissile:

- *Uranium-233*
- *Uranium-235*
- *Plutonium-239*
- *Plutonium-241*
- *Or a mixture containing any one of these isotopes*

Limited quantities of certain fissile materials may be shipped as *fissile excepted*.

HMR

Refer to 173.403 and 173.453



**3.21 Classification: LSA & SCO**

Goal: Identify and describe six classifications of radioactive material.

Radioactive material with a limited specific activity may be classified as *Low Specific Activity (LSA) material*.

- LSA-I
- LSA-II
- LSA-III

*Surface Contaminated Objects (SCO)* are solid objects which are not radioactive by themselves, but have radioactive contamination on their surface.

- SCO-I
- SCO-II

*Low Dispersible Material (LDM)* is a solid radioactive material that does not easily disperse.

**3.22 Classification: Low Specific Activity**

Goal: Complete a NRC Form 540 Shipping Paper.

*Low Specific Activity (LSA) material* means Class 7 (radioactive) material with limited specific activity which satisfies the descriptions and limits set forth below. Shielding material surrounding the LSA material may not be considered in determining the estimated average specific activity of the package contents.

LSA material must be in one of three groups:

- (1) LSA-I
- (2) LSA-II
- (3) LSA-III

3.23 Classification: Low Specific Activity

Goal: Complete a NRC Form 540 Shipping Paper.

(1) LSA-I:

- (i) Uranium and thorium ores, concentrates of uranium and thorium ores, and other ores containing naturally occurring radionuclides which are intended to be processed for the use of these radionuclides; or
- (ii) Solid unirradiated natural uranium or depleted uranium or natural thorium or their solid or liquid compounds or mixtures; or
- (iii) Radioactive material other than fissile material, for which the  $A_2$  value is unlimited; or
- (iv) Other radioactive material, excluding fissile material in quantities not excepted under §173.453, in which the activity is distributed throughout and the estimated average specific activity does not exceed 30 times the values for activity concentration specified in §173.436, or 30 times the default values listed in Table 8 of §173.433.

3.24 Classification: Low Specific Activity

Goal: Complete a NRC Form 540 Shipping Paper.

(2) LSA-II:

- (i) Water with tritium concentration up to 0.8 TBq/L (20.0 Ci/L); or
- (ii) Other radioactive material in which the activity is distributed throughout and the average specific activity does not exceed  $10^{-4} A_2/g$  for solids and gases, and  $10^{-5} A_2/g$  for liquids.

### 7.3 Marking and Labeling: Definitions

Goal: Apply the correct markings on packages.

*Marking* means a descriptive name, identification number, instruction, caution, weight, specification or UN mark, or a combination of any of these on the outer surface of a package of hazardous materials.

The term *labeling*, as used in the DGR, refers to a prescribed graphical hazard warning or handling label which is applied to the outside of the shipping container.

Markings and labels:

- List the contents of the package
- Indicate that the packaging meets approved standards
- Provide safe handling and stowage information
- Identify the nature of hazard

### 7.4 Marking and Labeling: General Marking Requirements

Goal: Apply the correct markings on packages.

Each package must be clearly marked according to the *general marking requirements*:

- *Proper Shipping Name(s)* of the item is required.
- Applicable *UN Number preceded by the prefix UN* is required.
- *Full name and address of the shipper and the consignee* is required.
- If the package exceeds 50 kg, or 110 lbs, the *permissible gross weight* must be marked on the package.
- When *dry ice* is used as a refrigerant, the additional marking and labeling requirements of DGR 7.1.5.1(e) are required.
- If your material is considered a hazardous substance as per the USG-04 variations, *RQ* must appear either before or after the proper shipping name. For example, *RQ, UN 2915 Radioactive Material Type A Package*.

7.1 Marking and Labeling: Goals

Upon completion of this module, you will be able to do the following:

- Apply the correct markings on packages.
- Apply the correct hazard labels on packages.
- Describe the radiation levels associated with radiation-warning labels.
- Determine the Transport Index for a package.
- Apply the correct handling labels on packages.
- Identify placards used on radioactive material shipments.

7.2 Marking and Labeling: Overview

Goal: Apply the correct markings on packages.

Package *markings* and *labels* convey information on packages, such as the Proper Shipping Name, identification number, and hazard class (Class 7) of a hazardous material. This information identifies that a package contains a hazardous material.

Package markings and labels are used by carriers and other people to ensure compliance with loading and stowage requirements.

The information provided by package markings and hazard warning labels can be used by emergency responders when shipping papers are destroyed or otherwise not immediately available.





### 7.17 Marking and Labeling: Hazard Labels

Goal: Describe the radiation levels associated with radiation-warning labels.

The *radiation hazard label* is designed to inform personnel of the radioactive contents of a package.

There are four different kinds of hazard labels:

- *I-White*
- *II-Yellow*
- *III-Yellow*
- *Fissile*

The first three labels are divided into categories based on radiation levels emanating from the surface of the package, as well as at 1 meter from the package.



### 7.18 Marking and Labeling: Transport Index (TI)

Goal: Determine the Transport Index for a package.

One of the criteria used for selecting the category of hazards label is the Transport Index. The *Transport Index*, often called the *TI*, is an assigned number given to a package. The TI is marked on Category II-Yellow and III-Yellow labels.

It is used to:

- *Determine whether transport under exclusive use is required*
- *Establish spacing requirements during storage in transit*
- *Define the number of packages allowed in a freight container or aboard an aircraft*
- *Determine if the package must be transported in a cargo aircraft only*

7.22 Marking and Labeling: Hazard Label Radiation Limits

Goal: Determine the Transport Index for a package.



$TI = 0^*$   
 \*radiation level at 1m  $\leq 0.5 \mu\text{Sv/h}$  (0.05 mrem/h)  
**surface radiation  $\leq 5 \mu\text{Sv/h}$**   
 (0.5 mrem/h)



$0 < TI \leq 1.0$   
 $5 \mu\text{Sv/h}$  (0.5 mrem/h) < **surface radiation  $\leq 0.5 \text{ mSv/h}$**   
 (50 mrem/h)



$1 < TI \leq 10.0$   
 $0.5 \text{ mSv/h}$  (50 mrem/h) < **surface radiation  $\leq 2 \text{ mSv/h}$**   
 (200 mrem/h)  
 If the surface radiation level  $> 2 \text{ mSv/h}$  (200 mrem/h), or the  $TI > 10$ ,  
 the package will be a category III -Yellow and must be shipped  
*Exclusive Use.*

7.23 Marking and Labeling: Hazard Label Radiation Limits

Goal: Determine the Transport Index for a package.

Transport index	Maximum radiation level at any point on the external surface	Label category <sup>1</sup>
0 <sup>2</sup> .....	Less than or equal to 0.005 mSv/h (0.5 mrem/h).	WHITE-I.
More than 0 but not more than 1 .....	Greater than 0.005 mSv/h (0.5 mrem/h) but less than or equal to 0.5 mSv/h (50 mrem/h).	YELLOW-II.
More than 1 but not more than 10 .....	Greater than 0.5 mSv/h (50 mrem/h) but less than or equal to 2 mSv/h (200 mrem/h).	YELLOW-III.
More than 10 .....	Greater than 2 mSv/h (200 mrem/h) but less than or equal to 10 mSv/h (1,000 mrem/h).	YELLOW-III (Must be shipped under exclusive use provisions; see 173.441(b) of this subchapter).

<sup>1</sup> Any package containing a "highway route controlled quantity" (§ 173.403 of this subchapter) must be labelled as RADIOACTIVE YELLOW-III.

<sup>2</sup> If the measured TI is not greater than 0.05, the value may be considered to be zero.

Refer to 172.403

Goal: Apply the correct hazard labels on packages

- **Subsidiary Hazards** – Include subsidiary labels, adjacent to Radioactive labels, unless excepted
- **All require two labels on opposite sides**
- For a freight container, the labels must be affixed to all four sides of the container.

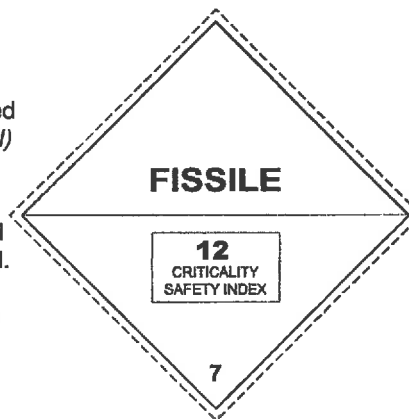


7.27 Marking and Labeling: Criticality Safety Index (CSI)

Goal: Apply the correct hazard labels on packages.

Packages that contain fissile material (that are not fissile exempt) are required to bear the *Criticality Safety Index (CSI) Label*.

The Criticality Safety Index is assigned to a package containing fissile material. It is used to keep too many fissile packages from being shipped together in the same transportation vehicle.



Fissile packages require two Criticality Safety Index labels on the same side as the radioactive hazard labels. The CSI value must be entered on the label in the rectangular box.

HMR

Refer to 172.403 and 172.441

DGR



Goal: Identify placards used on radioactive material shipments.

Placarding serves to notify emergency managers that a hazardous material or dangerous good is onboard a motor vehicle or inside a freight container.

Remember that the offeror provides the placards to the motor carrier (49 CFR §172.506(a)).

The unique RADIOACTIVE placard is required under the following conditions:

- Package(s) bearing the Radioactive Yellow III label
- LSA and SCO consigned exclusive use

Goal: Identify placards used on radioactive material shipments.

Each freight container, unit load device, transport vehicle or rail car **containing any quantity** of a hazardous material must be placarded *unless there is an Exception.*

HMR

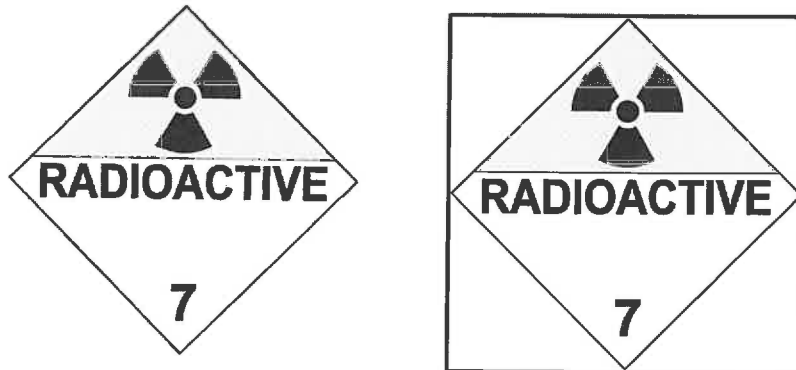
Refer to section 172.500 et. al.



**7.35 Marking and Labeling: Placards**

Goal: Identify placards used on radioactive material shipments.

Vehicles transporting radioactive material to and from the aircraft may need to be placarded. A *placard* is a large graphic sign that is displayed on the outside of a vehicle or on a large freight container loaded with hazardous materials.



**7.36 Marking and Labeling: Placarding Requirements**

Goal: Identify placards used on radioactive material shipments.

Not all shipments of radioactive material require vehicle placarding. Vehicles are required to display radioactive material placards if they contain:

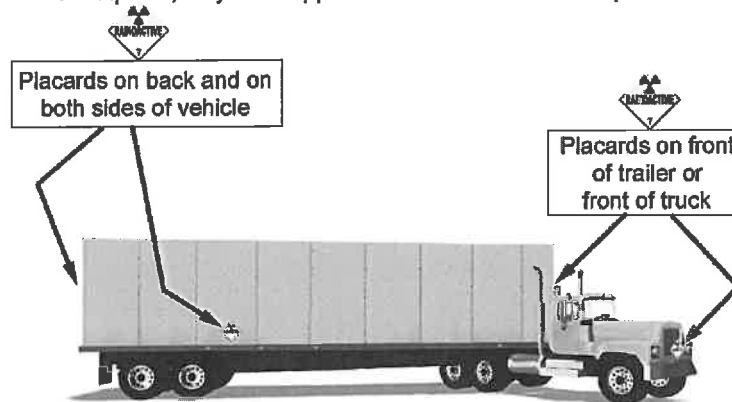


- *III-Yellow labeled containers*
- *Highway Route Controlled Quantities*
- *Certain categories of Low Specific Activity shipments*

When required, they must appear on all four sides of the transport vehicle. Large freight containers used by air carriers must be placarded when they contain radioactive material other than Excepted packages.

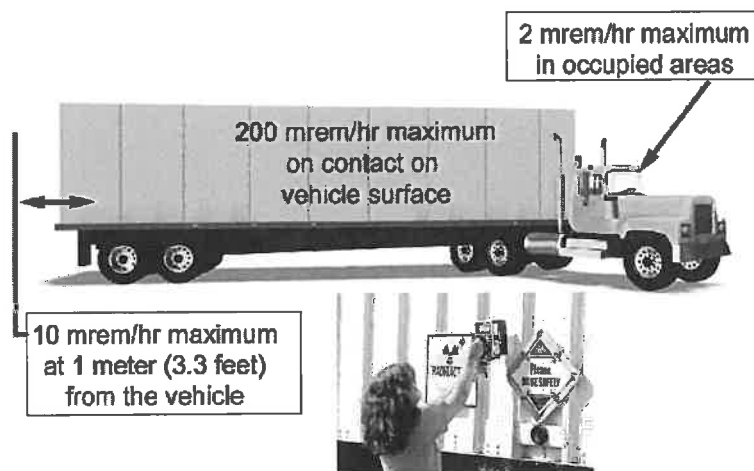
Goal: Identify placards used on radioactive material shipments.

- Not all shipments of radioactive material require vehicle placarding
- Vehicle placarding not required for:
  - EMPTY, White-I, and Yellow-II packages
- When required, they must appear on all four sides of transport vehicle



Goal: Identify placards used on radioactive material shipments.

### Non-exclusive use vehicle



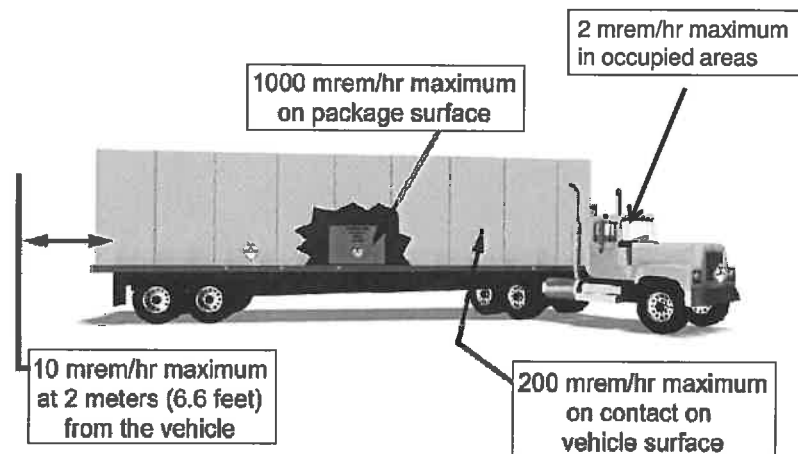
Goal: Identify placards used on radioactive material shipments.

If the shipper is unable to comply with any of the controls, the only alternative is exclusive use transportation. 49 CFR §173.403 defines exclusive use as:

*Sole use by a single consignor of a conveyance for which all initial, intermediate, and final loading and unloading are carried out in accordance with the direction of the consignor or consignee...*

Goal: Identify placards used on radioactive material shipments.

### Exclusive use vehicle



Goal: Identify placards used on radioactive material shipments.

- UN ID number may appear close to placard
- Orange sign with black lettering

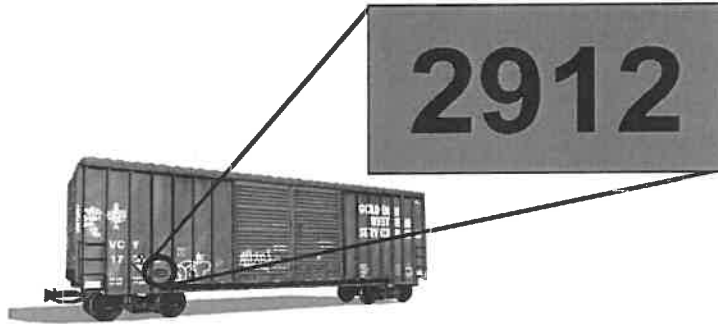




Exhibit A - Byproduct Material Shipping and Disposal Manifest Form

Company Name: Comeco Resources  
 Source Location: Smith Ranch Highland  
 Address: 742 Ross Road  
 City: Douglas State: WY Zip: 82633  
 Contact: Arlene Fournce Phone: 307-358-6541  
 Shipping Date: 10/30/13

Transporter: Greenfield Logistics  
 Shipment Identification #: 10113-266  
 Address: P.O. Box 910332  
 City: Saint George State: UT Zip: 84791  
 Contact: Chris Hartley Phone: 801-592-2453  
 Estimated Arrival Date & Time: 10/30/13 4:00

Quantity Measurement		Description of Material	Proper Shipping Name and Hazard Class (DOT Shipping Name & EPA Description)	Total Activity (Ci)	For PMC Use Only	
Weight (lb)	Volume (ft <sup>3</sup> )				Weight (lb)	Volume (ft <sup>3</sup> )
	351	Sol 756 Ppe 258	Round ERG Radioactive material Low Specific Activity (LSA-I) class 7	0.3256		
			Radioactive: Residual Natural Uranium and associated daughter products			
Shipment Totals						
Weight (lb)	351					
Volume (ft <sup>3</sup> )						

This is to certify that the material described on this Byproduct Material Shipping and Disposal Manifest Form is in accordance with the Agreement dated 4-7-13, as amended, and the terms and conditions thereof which are applicable hereto and incorporated herein.

Authorized Signature: My gja Title: HPT Date: 10/30/13

Shipment Totals		For PMC Use Only		Burial Data	
Gross Weight (lb)		Load Evaluation	Remarks	Date Received:	
Tare Weight (lb)		Byproduct Material Description Inadequate	<u>25% Ppe</u>	Location:	<u>10-31-2013</u>
Net (lb)		Contamination or Leakage Detected		N:	E:
Volume (ft <sup>3</sup> )	351	Markings Inadequate		N:	E:
Shipment I.D. #	<u>10/13-66</u>	Test Data Received		Elevation:	
		Vehicle Suitable for Release from Area		Cell No:	

**STRAIGHT BILL OF LADING**  
ORIGINAL--NOT NEGOTIABLE

Shipper No. 10/13-660

Carrier No. \_\_\_\_\_

Greenfield Logistics  
(Name of Carrier) (SCAC)

Date 10/30/13

on Collect on Delivery shipments, the letter's COD must appear before consignee's name or as otherwise provided in Item 430, Sec. 1.  <b>To: Consignee</b> <u>Pathfinder Mines Corporation</u>  Street <u>Shirley Basin Mill Facility</u>  City <u>Shirley Basin</u> State <u>WY</u> Zip Code <u>81615</u>	<b>From: Shipper</b> <u>CAMECO RESOURCES, INC.</u>  Street: <u>762 ROSS ROAD</u>  City <u>DOUGLAS</u> State <u>WY</u> Zip Code <u>82633</u>  24 hr. Emergency Contact Tel. No: <u>905-885-8745</u>
--	--

Route :		Vehicle: Number				
No. of units & container type	HM	Basic Description Proper Shipping Name, Hazard Class, Identification Number (UN or NA), Packing Group, per 172.101, 172.202, 172.203	Total Quantity (Weight, Volume, Gallons, etc.)	Weight (Subject to Correction)	RATE	Charges (For Carrier Use Only)
1 Roll off	XX	RQ,UN2912, RADIOACTIVE MATERIAL, Low SPECIFIC ACTIVITY (LSA-1)CLASS 7	9.940m <sup>3</sup> 13yd <sup>3</sup>			
		RADIONUCLIDE: RESIDUAL NATURAL URANIUM & ASSOCIATED DAUGHTER PRODUCTS				
		PHYSICAL FORM: SOLID				
		CHEMICAL FORM: NATURAL URANIUM OXIDE UO <sub>4</sub> -2H <sub>2</sub> O				
		TOTAL ACTIVITY: 1.20E10 Bq ( 0.325Ci)				
		TRANSPORT INDEX: N/A AS PER 49CFR172.203(d)(5)				
		PLACARDS: RADIOACTIVE 7				
		EXCLUSIVE USE SHIPMENT: THIS VEHICLE IS ASSIGNED FOR EXCLUSIVE USE OF CAMECO RESOURCES, INC. UNDER PROVISIONS OF 49 CFR 173.427 INCLUDING EXEMPTING FROM MARKING AND LABELING REQUIREMENTS				
		DO NOT LOAD OTHER FREIGHT IN THIS VEHICLE, TRANSFER EN ROUTE				

PLACARDS TENDERED: YES:  NO:

REMIT C.O.D. TO: ADDRESS \_\_\_\_\_

Note (1) Where the rate is dependant on value, shippers are required to state specifically on writing the agreed or declared value of the property, as follows: The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding _____ per _____. (2) Where the applicable tariff provisions specify a limitation of the carrier's liability absent a release or a value declaration by the shipper and the shipper does not release the carrier's liability or declare a value, the carrier's liability shall be limited to the extent provided by such provisions. See NMFL Item 172. (3) Commodities requiring special or additional care or attention in handling or stowing must be so marked and packaged as to ensure safe transportation. See Section 2(e) of Item 360, Bills of Lading, Freight Bills, and Statements of Charges and Section 1(a) of the Contract terms and conditions for a list of such articles.	I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name and are classified, packaged, marked, and labeled/placard, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.  ON BEHALF OF SHIPPER <u>[Signature]</u> Signature	COD Amt: \$ _____  Subject to Section 7 of the conditions of this shipment in to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement: The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.	C.O.D. FEE: PREPAID <input type="checkbox"/> COLLECT <input type="checkbox"/> \$ _____  TOTAL CHARGES: \$ _____  FREIGHT CHARGES FREIGHT PREPAID <input type="checkbox"/> Check box if charges except when box is checked COLLECT <input type="checkbox"/> are to be collect
		(Signature of Consignor) _____	

RECEIVED, subject to the classifications and tariffs in effect on the date of issue of this Bill of Lading, the property described above in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated above which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of this property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed as to each carrier of all or any of, said property over all or any portion of said route to destination and as to each party at any time interested in all or any said property, that every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of the shipment.  
 Shipper hereby certifies that he is familiar with all the lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

SHIPPER: CAMECO RESOURCES, INC.	CARRIER: GREENFIELD LOGISTICS
PER <u>[Signature]</u>	PER <u>[Signature]</u>
DATE <u>10/30/13</u>	DATE <u>10-30-13</u>

**STRAIGHT BILL OF LADING**  
ORIGINAL--NOT NEGOTIABLE

Shipper No. 10118-106

Carrier No. \_\_\_\_\_

**Greenfield Logistics**


Date 10/30/13

(Name of Carrier) (SCAC)


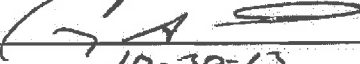
on Collect on Delivery shipments, the letters COD must appear before consignee's name or as otherwise provided in Item 430, Sec. 1.  To: Consignee <u>CAMECO RESOURCES, INC</u>  Street <u>762 Ross Road</u>  City <u>Douglas</u> State <u>WY</u> Zip Code <u>82633</u>	From: Shipper (From/on behalf of) <u>Cameco Resources</u>  Location: <u>Pathfinder Mines, SHIRLEY BASIN MILL FACILITY</u>  City <u>SHIRLEY BASIN</u> State <u>WY</u> Zip Code <u>81615</u>  24 hr. Emergency Contact Tel. No: <u>307-259-9220</u>
---	---

Route :	Vehicle Number
---------	----------------

No. of units & container type	HM	Basic Description <small>Proper Shipping Name, Hazard Class, Identification Number (UN or NA), Packing Group, per 172.101, 172.202, 172.203</small>	Total Quantity <small>(Weight, Volume, Gallons, etc.)</small>	Weight <small>(Subject to Correction)</small>	RATE	Charges <small>(For Carrier Use Only)</small>
1		Roll off UN 2908, Radioactive Material, excepted package, empty package last contained natural uranium and associated daughter projects.				
		Empty roll of container				
		EXCLUSIVE USE SHIPMENT: THIS VEHICLE IS ASSIGNED FOR EXCLUSIVE USE OF CAMECO RESOURCES, INC. UNDER PROVISIONS OF 49 CFR 173.427 INCLUDING EXEMPTING FROM MARKING AND LABELING REQUIREMENTS				
		DO NOT LOAD OTHER FREIGHT IN THIS VEHICLE, TRANSFER EN ROUTE				

PLACARDS TENDERED: YES : <input checked="" type="checkbox"/> NO <input type="checkbox"/>	REMIT C.O.D. TO: ADDRESS
<small>Note-(1) Where the rate is dependant on value, shippers are required to state specifically on writing the agreed or declared value of the property, as follows: The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding _____ per. (2) Where the applicable tariff provisions specify a limitation of the carrier's liability absent a release or a value declaration by the shipper and the shipper does not release the carrier's liability or declare a value, the carrier's liability shall be limited to the extent provided by such provisions. See NMFL Item 172. (3) Commodities requiring special or additional care or attention in handling or stowing must be so marked and packaged as to ensure safe transportation. See Section 2(e) of Item 360, Bills of Lading, Freight Bills, and Statements of Charges and Section 1(a) of the Contract terms and conditions for a list of such articles.</small>	I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name and are classified, packaged, marked, and labeled/placard, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.  ON BEHALF OF SHIPPER  Signature
COD Amt \$	C.O.D. FEE: PREPAID / COLLECT \$
<small>Subject to Section 9 of the conditions if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement: The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges</small>	TOTAL CHARGES \$
_____ <small>(Signature of Consignor)</small>	FREIGHT CHARGES FREIGHT PREPAID (Check box if charges are to be collected)

RECEIVED, subject to the classifications and tariffs in effect on the date of issue of this Bill of Lading, the property described above in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated above which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of this property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed as to each carrier of all or any of, said property over all or any portion of said route to destination and as to each party at any time interested in all or any said property, that every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of the shipment. Shipper hereby certifies that he is familiar with all the lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

SHIPPER: <u>Cameco Resources</u>	CARRIER: <u>GREENFIELD LOGISTICS</u>
PER 	PER 
DATE <u>10/30/13</u>	DATE <u>10-30-13</u>

DATE

11/15/12

CONTAINER #

CEL4-001254

LOCATION

Boneyard

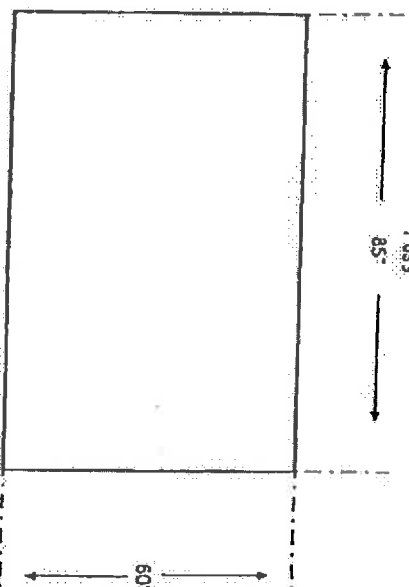
TOTAL YARDS

13



POWER RESOURCES  
(dba, Cameco Resources)

# Seal 294389  
214 2690  
214 2690



End View

7.083

85'

60'

18.933  
Side View

18.10'

13 cu/yd

Fond Material / Poly

VOLUME PER VERTICAL FOOT

Yards per Ft.	1"	2"	3"	3.5"	4"	Full
	0.48	0.94	1.40	1.72	1.97	24.70

Power Resources  
Smith Ranch - Mopane Uranium Project  
By-product container Cubic Yard Calculation



Cameco Resources

# WYOMING OPERATIONS BYPRODUCT MATERIAL SHIPMENT TRUCK SURVEY

METER MODEL	<u>3</u>	SHIPMENT NO.	<u>1413 to Pando</u>
METER SN	<u>255055</u>	LOCATION:	<u>10/13-66</u>
CALIBRATION DATE	<u>5/13/13</u>	DATE:	<u>10/13/13</u>
METER MODEL	<u>3</u>	RSO/RST	<u>[Signature]</u>
METER SN	<u>254961</u>	SIGNATURE	
CALIBRATION DATE	<u>5/14/13</u>	BACKGROUND	<u>0.3</u> mR/hr
		BACKGROUND	<u>0</u> dmp/100 cm <sup>2</sup>

Swipe Survey Yes  
No

0.03 mR/hr  
Driver's Seat

Crossfield  
CARRIER NAME  
103  
TRACTOR NO.

5.0 mR/hr  
Surface 3.0  
6.6' (2 Meters)

76 dpm/100 cm<sup>2</sup>  
Surface

5.0 mR/hr  
6.6' (2 meters) 15.0  
Surface

152 dpm/100 cm<sup>2</sup>

KS 1192  
1254

7.0 mR/hr  
Surface 2.0  
6.6' (2 Meters)

152 dpm/100 cm<sup>2</sup>

### Limits

- Gamma = 200 mR/hr at surface
- Gamma = 10 mR/hr at 2 meters
- Gamma = 2 mR/hr in cab
- Alpha = 1000 dpm/100cm<sup>2</sup> for swipe survey
- Alpha = 2200 dpm/100 cm<sup>2</sup> for instrument survey

3.0 mR/hr  
6.6' (2 Meters) 7.0  
Surface

76 dpm/100 cm<sup>2</sup>  
Surface

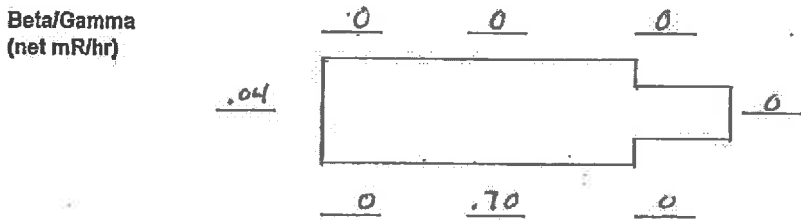
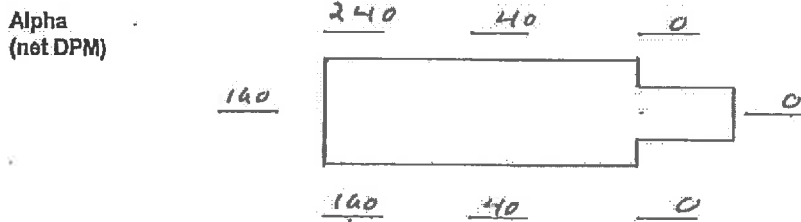
Pathfinder Mines Corporation  
Shirley Basin Mine  
Shirley Basin Mine  
Shirley Basin, Wyoming 82616  
(307) 356-4312

RELEASE SURVEY

Description: By Product Load Smith Ranch Camera  
Shipment ID: 10/13-6.6

	Alpha	Beta/Gamma
Instrument:	<u>Ludlum Mod 12 # 304326</u>	<u>ASP-1/44-9 # 2532</u>
Calibration due:	<u>8-15-2014</u>	<u>6-7-2014</u>
Check Source:	<u>7934</u>	<u>3245</u>
Source Reading:	<u>20 k cpm</u>	<u>3.0 mR/h</u>
Correction Factor:	<u>4</u>	
Background:	<u>20 cpm</u>	<u>.10</u>

Results:



Comments: Higher readings from residual soil inside container

Surveyed by: R.M. Date: 10-31-2013

**DRIVER RESPONSIBILITY STATEMENT**

I, Craig Buterbaugh, driver for Greenfield Log.

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: 10-30-31

SIGNATURE: 



Cameco

Cameco Resources

# WYOMING OPERATIONS EMERGENCY INFORMATION FOR CARRIERS

Approvals

Operations:

Project RSO: A. T. ...

Revision Date: 6/26/2013

## THIS VEHICLE CONTAINS: (CHECK THE APPROPRIATE DESCRIPTION OF THE CARGO)

- URANIUM ORE CONCENTRATE ( $U_3O_8$  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,  $CO_2$ , 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





### LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

Client: Power Resources dba Cameco Resources  
Project: Smith Ranch  
Lab ID: C13060168-001  
Client Sample ID: GFW 001192

Report Date: 07/09/13  
Collection Date: 06/04/13  
Date Received: 06/04/13  
Matrix: Soil

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
<b>PHYSICAL CHARACTERISTICS</b>							
Filterable	No					SW1311	06/11/13 10:52 / rw
<b>METALS - TOTAL</b>							
Uranium	34700	mg/kg-dry	D	1		SW6020	07/03/13 11:22 / cp
<b>METALS - TCLP EXTRACTABLE</b>							
Arsenic	ND	mg/L		0.2	5	SW6010B	06/13/13 15:48 / sf
Barium	ND	mg/L		1	100	SW6010B	06/13/13 15:48 / sf
Cadmium	ND	mg/L		0.1	1	SW6010B	06/13/13 15:48 / sf
Chromium	ND	mg/L		0.2	5	SW6010B	06/13/13 15:48 / sf
Lead	ND	mg/L		0.2	5	SW6010B	06/13/13 15:48 / sf
Mercury	ND	mg/L		0.02	0.2	SW7470A	06/12/13 16:16 / jl1
Selenium	0.8	mg/L		0.1	1	SW6010B	06/13/13 15:48 / sf
Silver	ND	mg/L		0.02	5	SW6010B	06/13/13 15:48 / sf
<b>RADIONUCLIDES</b>							
Radium 226	54.2	pCi/g-dry				E903.0	06/24/13 14:12 / trs
Radium 226 precision (±)	0.5	pCi/g-dry				E903.0	06/24/13 14:12 / trs
Radium 226 MDC	0.02	pCi/g-dry				E903.0	06/24/13 14:12 / trs
Thorium 230	104	pCi/g-dry				E908.0	06/19/13 08:48 / dmf
Thorium 230 precision (±)	37	pCi/g-dry				E908.0	06/19/13 08:48 / dmf
Thorium 230 MDC	0.7	pCi/g-dry				E908.0	06/19/13 08:48 / dmf
<b>TOTAL ORGANIC HALOGENS - TCLP</b>							
Organic Halides, Total	ND	mg Cl/L		0.05	0.13	SW9020B	06/25/13 14:51 / eli-g

**Report Definitions:**  
 RL - Analyte reporting limit.  
 QCL - Quality control limit.  
 MDC - Minimum detectable concentration

MCL - Maximum contaminant level.  
 ND - Not detected at the reporting limit.  
 D - RL increased due to sample matrix.

## **Most Recent RSO Certifications**



# PATHFINDER

PATHFINDER Mines Corporation

MEMORANDUM

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**DATE:** December 2, 2013      **File:** P:\Shirley Basin\Regulatory & Environment Data\SBM  
NRC\RSO Transportation Certification Nov 2013.docx

**TO:** Shirley Basin RSO File      **Copy:** RMO

**FROM:** Vincent Martin

**RE:** Department of Transportation HAZMAT Training Certification

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This notice is to confirm your attendance at the "Department of Transportation Regulations for Shipping of Hazardous Materials" training course on November 20-22, 2013 and to inform you that you successfully completed the course. This course, in addition to site-specific requirements and safety training, meets the DOT training requirement as specified in 49 CFR 172.704.

This is to also certify that you are now authorized to supervise receipt of 11e.(2) material (by-product material) at the Shirley Basin Disposal site. This certification is good until November 22, 2016. Retraining and recertification will be required at that time.

If there are any questions regarding this, please contact me at 306 343 4518.

---

Vincent Martin

**Russell Mark Owens**

*Has successfully completed the technical short course entitled*  
**Transportation and Packaging of Radioactive Materials**

*November 20, 2013 – November 22, 2013*

*This certificate presented in Las Vegas, Nevada, November 22, 2013*

*By Nevada Technical Associates, Inc.*



**Kenneth Smith, CHP RRFI**

*Instructor*

**Certificate Number: 1384930802**

**Russell Mark Owens**

*Has successfully completed the technical short course entitled*

**Radiation Safety Officer Refresher**

**November 18, 2013 – November 19, 2013**

*This certificate presented in Las Vegas, Nevada, November 19, 2013*

*By Nevada Technical Associates, Inc.*



**Kenneth Smith, CHP RRP1**

*Instructor*

**Certificate Number: 1384758023**