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VIA PDF AND FEDERAL EXPRESS

September 14, 2009

Mr. Dane Finerfrock, Executive Secretary  
Utah Radiation Control Board  
Utah Department of Environmental Quality  
168 North 1950 West  
P.O. Box 144810  
Salt Lake City, UT 84114-4810

Dear Mr. Finerfrock:

**Re: Renewal Application for Radioactive Materials License (RML) No. UT1900479: Health Physics Interrogatories – Round 2; and Engineering Comment Interrogatories – Round 1**

Reference is made to our letter of August 14, 2009 in response to the Executive Secretary's correspondence of July 2, 2009 with attached Health Physics and Engineering Comment Interrogatories.

As contemplated by our response to Health Physics Interrogatory Statement No. 7, enclosed please find a draft Section 6.0 to the White Mesa Mill Radiation Protection Manual relating to release surveys from the Mill's restricted area.

If you should have any questions or require additional information, please contact the undersigned.

Yours very truly,

**DENISON MINES (USA) CORP.**

By:

A handwritten signature in black ink, appearing to read "David C. Frydenlund".

David C. Frydenlund  
Vice President, Regulatory Affairs and Counsel

cc: Ron F. Hochstein  
Harold R. Roberts  
Steven D. Landau  
David E. Turk

## **6. RELEASE SURVEYS**

### **6.1 General**

This Section contains the following procedures for the release of equipment and product drums from the Mill: (1) restricted release of exclusive use vehicles; and (2) unrestricted release of tractors, trailers, intermodal containers (“IMCs”) and other vehicles, other equipment and product drums.

Items can be released from the Mill’s restricted area provided that those items meet certain requirements as spelled out in Regulatory Guide 8.30, *Health Physics Surveys in Uranium Recovery Facilities* and NRC’s *Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material*, August 1987.

Release surveys will be conducted to make sure that no contaminated equipment is released from the facility. This Section 6 sets out the surveying procedures to be used in order to verify that the equipment or product drum meets the applicable release criteria prior to exiting the Mill’s restricted area.

### **6.2 Survey Equipment**

Release surveys are performed using a variety of detecting instruments, as listed in Appendix 1 and specified below. Each instrument is checked using a calibrated alpha or beta/gamma source, as applicable, for proper function and operation prior to use, as described in Sections 6.3.1(c) and 6.3.2(b) below. In the case of alpha instruments, this calibration check is also used to derive the daily conversion from counts per minute (cpm) observed by the meter to actual disintegrations per minute (dpm) being emitted. The cpm indicated by the alpha meter is multiplied by the product of the cpm indicated during the instrument check divided by the actual dpm emitted by the check/calibration source.

In the case of alpha detecting instruments, adjustments to the surface area being measured must also be made to convert from the particular detector’s surface area to the reference surface area of 100 square centimeters. Therefore when converting a measurement to the units of dpm/100 cm<sup>2</sup>, an area adjustment factor must be applied to the measurement. For example, for the Ludlum instrument with a 43-1 detector of 75 cm<sup>2</sup> surface area, multiply the value by 1.33 (i.e. 100 cm<sup>2</sup> divided by 75cm<sup>2</sup>).

The beta/gamma detecting instruments used at the Mill read directly in mrem/hour.

Each instrument has a manufacturer's user's manual which describes the function, use and capability of each instrument. These manuals must be understood by the surveyor before any surveying proceeds.

### **6.3 Pre-Survey Procedures**

#### **6.3.1 Alpha Surveys**

At the outset, prior to performing an alpha survey:

- a) Turn the meter on and check the meter battery condition;
- b) Check the alpha detector mylar surface for pinholes, etc. Replace if necessary and repeat calibration;
- c) As specified in Section 3.1.2.3.2, perform a function check using a calibrated alpha source;
- d) If the check is acceptable, use the conversions indicated above to convert from cpm to dpm in conjunction with the area adjustment factor to determine the necessary correction factor to convert the cpm recorded to the actual number of dpm/100cm<sup>2</sup> and proceed to monitoring; and
- e) The ability of the alpha meter to detect alpha radiation will be compromised if the surface area to be surveyed is wet. If an area to be surveyed for alpha contamination is wet, then, prior to surveying:
  - (i) Wait for the area to dry on its own;
  - (ii) Wipe the area dry with a towel; or
  - (iii) Use a hand held torch or similar device to dry the area.

#### **6.3.2 Beta/Gamma Surveys**

- a) Turn the meter on and check the meter battery condition;

- b) As specified in Section 3.1.4.1, perform a function check using a calibrated beta/gamma source.
- c) If the check is acceptable, proceed to monitoring.

## 6.4 Restricted Release

Exclusive use vehicles, i.e., vehicles that are part of a dedicated run between the Mill and another site may be released under a restricted release. Under a restricted release, the exterior of the vehicle will be surveyed for total activity. Provided that the cargo area is covered, the inside of the cargo area need not be surveyed for restricted release.

### 6.4.1 Restricted Release Standards

#### **Alpha (combined fixed and removable)**

Average 2,200 dpm/100cm<sup>2</sup>

Applies to an area of not more than 100 cm<sup>2</sup>

#### **Beta/Gamma**

Maximum at each accessible surface  
0.5 mrem/hr

On external surface

### 6.4.2 Restricted Release Procedure

A restricted release survey can be performed on, but is not limited to, ore trucks, IMCs and closed box trailers, that have been designated as exclusive use conveyances.

1. For restricted release surveys, use a Ludlum Model 3 with a 43-5 probe or the equivalent, which measures both alpha and beta/gamma. Because this instrument measures both alpha and beta/gamma, a separate beta/gamma survey is not performed for restricted release surveys. Compliance with both the alpha release standard and the beta/gamma release standard set out in Section 6.4.1 is determined by the single survey with this instrument.
2. Perform the pre-survey procedures outlined in Section 6.3 above. Because the Ludlum Model 3 with a 43-5 probe measures both alpha and beta/gamma, it must be calibrated for alpha and for beta/gamma.
3. The radiation technician will start by obtaining the proper release form (see Section 6.6 of this procedure for the various release forms). The technician will then obtain the needed

information to complete the release form. This information will usually be the tractor trailer identification markings. There should be one number for the tractor and one for the trailer.

4. As a safety precaution, the technician will have the driver exit the vehicle prior to approaching the equipment. If the driver does not leave the vehicle, the technician will contact the RSO to have the driver removed from the vehicle.
5. The survey will begin by taking the required radiation detection instrumentation and addressing the tractor.
  - a) The tractor survey should begin by surveying the tires. This will consist of slowly moving the combined alpha/beta/gamma detector approximately  $\frac{1}{4}$  inch off of the surface of the tread of the tire. While doing this, the technician should be watching the needle movement on the detector. The display on the Ludlum Model 3 with a 43-5 probe simultaneously shows cpm, which is used to determine alpha activity, and mrem/hr which is used to determine combined beta/gamma activity. Also, the technician should be looking at the treads of the tire for any rocks or other objects protruding from the tire. Any such rocks and other objects should be removed from the tread. The technician will then place the rocks and any other objects into a bucket behind the Guardhouse to be taken up to the ore storage area at the end of each shift;
  - b) After the tread is completed, the outside and inside facing surfaces of the tire should be surveyed in the same manner;
  - c) After the tire has been surveyed and observed, the technician should then survey the interior of the wheel well. Here too, the detector should be held approximately  $\frac{1}{4}$  inch off of the surface of the tractor. At the same time, the technician should be observing the wheel well for any visible contamination. If visible contamination is found, the tractor must be sent back to either secondary decontamination or back to the decontamination pad for another washing. If no visible contamination is found, then the technician should move to the next tire and start the process over.
  - d) The procedures set out in paragraphs a), b) and c) should be repeated for every tire on the tractor.
  - e) The technician will then survey the tractor itself, by slowly moving the detector, at a distance of approximately  $\frac{1}{4}$  inch, over the sides and/or underneath the carriage of the

tractor. Sufficient measurements must be taken in the most appropriate locations to yield a representative assessment of the contamination levels. For tractors, this means at least 3 measurements must be taken on each side of the tractor for a total of at least 6 measurements. In addition, the technician should look for any visible contamination, noting in particular any areas where ore may collect. If any visible contamination is found, the tractor must be redirected to either secondary decontamination or back to the decontamination pad;

6. After the tractor is completed, the technician should move to the trailer and IMC, if applicable.
  - a) The trailer's tires and wheel wells will be surveyed in the same manner as the tractor's tires and wheel wells, as set out in Sections 6.4.2 (5) (a), (b), (c) and (d);
  - b) The trailer itself should be surveyed by slowly moving the detector, at a distance of approximately  $\frac{1}{4}$  inch, over the sides, bottom and if possible the tops of the unit. Sufficient measurements must be taken in the most appropriate locations to yield a representative assessment of the contamination levels. For ore trucks and other end dump trailers, see the locations specified on the Equipment Survey for Restricted Release form attached to the Mill's *End Dump Trailer Acceptance, Handling & Release* procedure No.: PBL-9, and for IMCs see the survey locations specified on the Intermodal Container Survey for Restricted Release form attached to the Mill's *Intermodal Container Acceptance, Handling & Release* procedure No.: PBL-2, for the locations to be surveyed. Copies of those forms are attached to this procedure;
  - c) The technician should be aware that there may be numerous areas where material may collect. The technician should observe all of these locations for visible contamination. On ore trucks, the technician should make sure to look under the support legs, rear bumper, along the edge of the end dump tailgate and the mud flaps. These areas tend to be collection places for ore as it is being unloaded.; and
  - d) If any visible contamination is found, the unit must be redirected to either secondary decontamination or back to the decontamination pad.
7. After the technician has surveyed all tires and wheel wells, and the sides, bottom and top (if at all possible) of the trailer or IMC with the radiation detection instrumentation, and the surveys satisfy the criteria in Section 6.4.1 and there is no visible contamination, the

technician will report to the guardhouse and document the findings on the appropriate paperwork which has already been determined.

8. The technician will then make sure the driver surveys him or herself following proper individual scanning methods. At that point, the technician will authorize the driver to re-enter the vehicle. The technician will then open the gate and the vehicle will be allowed to exit the facility.

## 6.5 Unrestricted Release

Vehicles, trailers, IMCs, other equipment and product drums may be released from the Mill's restricted area on an unrestricted basis only if surveys are performed as described below and the release criteria specified in Section 6.5.1 are satisfied.

### 6.5.1 Unrestricted Release Criteria

#### Alpha (fixed and removable):

Average	5,000 dpm/100cm <sup>2</sup> alpha	Average over no more than 1 m <sup>2</sup>
Maximum	15,000 dpm/100 cm <sup>2</sup> alpha	Applies to an area of not more than 100 cm <sup>2</sup>
Removable	1,000 dpm/100 cm <sup>2</sup> alpha	Determined by smearing with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the smear.

#### Beta/Gamma

Average	0.2 mrem/hr	Average at 1 cm
Maximum	1.0 mrem/hr	Maximum at 1 cm

### 6.5.2 Unrestricted Release of Tractors, Trailers, Intermodal Containers and Other Vehicles

1. The radiation department will be notified at least 24 hours prior to the time that an unrestricted release is required for any tractor trailer that has been hauling under a dedicated haul.

2. For unrestricted release, separate alpha and beta/gamma surveys will be performed. For the alpha survey, use a Ludlum Model 177 with a 43-1 75cm<sup>2</sup> probe, or the equivalent. For the beta/gamma survey, use a Ludlum Model 3 with a 44-6 probe, or the equivalent.
3. Perform the pre-survey procedures described in Section 6.3 above.
4. An unrestricted release for a trailer will start with surveys of the exterior with the appropriate radiation detection instrumentation. This will include an alpha survey and a beta/gamma survey.
  - a) The technician will first survey the tires, wheel wells, sides, bottom and top of the trailer for alpha using the same techniques mentioned under Section 6.4.2 above. The tractor (or any other non-conveyance vehicle) will also be surveyed in the same manner as set out in Section 6.4.2 (5). However,
    - (i) instead of using the combined alpha and beta/gamma meter, the alpha meter will be used; and
    - (ii) instead of applying the restricted release standards specified in Section 6.4.1 above to the surveys of the tractor and trailer, the criteria for unrestricted release specified in Section 6.5.1 above for alpha will apply. The alpha meter will measure the total alpha (both fixed and removable). If the total alpha reading is less than the standard for removable alpha alone, then the release standard will have been met. However, if the total alpha activity exceeds the standard for removable alpha alone, then additional swipes will be performed at the locations that exceeded the standard to determine the removable component of the total alpha contamination (see paragraph (6)(a) below); and
  - b) The technician will then repeat the survey described in a) using the beta/gamma meter and will apply the unrestricted release criteria specified in Section 6.5.1 for beta/gamma. This will be done by slowly moving the detector over the same areas that were surveyed with the alpha detector. The technician will hold the instrument approximately 1 cm above the surface. The technician will survey the same general areas as specified in the release forms.

If a survey fails to meet the standards set out in Section 6.5.1 above, or if there is any visible contamination, then the trailer or IMC must be sent back to the decontamination wash station. If the material will not wash out, then more advanced methods of decontamination will be used.

This could include, but is not limited to, sandblasting of the trailer or IMC to remove contamination.

5. For an unrestricted release, the interior of the trailer, intermodal container or closed box trailer, must also be surveyed. The survey will consist of dividing the trailer into sections. Each section will be surveyed in the same manner, as follows:
  - a) Step one will have the technician using the alpha probe and slowly moving the probe over the trailer or IMC. The technician should keep the probe approximately  $\frac{1}{4}$  inch from the surface of the trailer. Sufficient measurements must be taken in the most appropriate locations to yield a representative assessment of the contamination levels. The number and locations of these readings is listed on the release forms (for end dump trailers, see the Equipment Survey for Restricted Release form attached to the Mill's *End Dump Trailer Acceptance, Handling & Release* procedure No.: PBL-9, and for IMCs see the survey locations specified on the Intermodal Container Survey for Restricted Release form attached to the Mill's *Intermodal Container Acceptance, Handling & Release* procedure No.: PBL-2, for the locations to be surveyed. Copies of those forms are attached to this procedure);
  - b) The technician will document the alpha readings in the section by indicating them on the appropriate paperwork. If a survey fails to meet the standards set out in Section 6.5.1 above, or if there is any visible contamination, then the trailer or IMC must be sent back to the decontamination wash station. If the material will not wash out, then more advanced methods of decontamination will be used. This could include, but is not limited to, sandblasting of the trailer or IMC to remove contamination; and
  - c) After the alpha survey work is completed, the beta/gamma survey will proceed. This will be done by slowly moving the detector over the trailer section as the technician had done with the alpha detector. The technician will hold the instrument approximately 1 cm above the surface of the trailer or IMC. The technician will survey the same general areas as specified in the release forms and that were surveyed for alpha contamination. This information will then be documented on the form in its proper location. If a survey fails to meet the standards set out in Section 6.5.1 above, then the trailer or IMC must be sent back to the decontamination wash station. If the material will not wash out, then more advanced methods of decontamination will be used. This could include, but is not limited to, sandblasting of the trailer or IMC to remove contamination.

6. After the technician has completed both the alpha and the beta/gamma surveys, the technician will perform a removable alpha survey on the trailer. This will be done by
  - a) swiping any area on the inside or outside of the conveyance that was found by the surveys to be over the facility's removable alpha release requirements. The alpha survey will detect both fixed and removable alpha contamination. Because the piece of equipment will not have any visible contamination (any piece of equipment that has visible contamination will have been sent back for re-decontamination), the swipe will be used to determine if the removable alpha exceeds the removable alpha limit; and
  - b) Even if no areas are found by the meter survey to be over the limit for removable alpha contamination, the technician should pull removable swipe samples from the inside of the conveyance at a minimum of 10% of the sections in the trailer, using the procedures set out in Section 2.3.3.3. Each removable swipe should cover 100 square centimeters.

These removable samples will then be taken to the radiation department for reading. If a swipe fails to meet the standards set out in Section 6.5.1 above for removable alpha contamination, then the trailer or IMC must be sent back to the decontamination wash station. If the material will not wash out, then more advanced methods of decontamination will be used. This could include, but is not limited to, sandblasting of the trailer or IMC to remove contamination.

7. After the completion of the surveys described above, the technician will document his or her findings on the appropriate paperwork. If all data collected is within the facility's release requirements, the technician will then place a red sticker on the driver's side, front panel of the trailer or IMC. The sticker will be dated and signed by the releasing technician. The technician will then file the paperwork in the radiation department files under the corresponding release surveys.
8. The driver will then perform an appropriate individual survey. Once that survey has been completed, the technician will open the gate and allow the tractor trailer to leave the facility.

### **6.5.3 Unrestricted Release of Equipment**

An equipment release is the same as an unrestricted release of tractors, trailers, IMCs and other vehicles specified in Section 6.5.2 (4) above, except that the item to be released is a piece of operating equipment rather than a feed material haulage conveyance.

1. The technician will first be notified by the individual or group who wants the piece of equipment to be released from the site. These groups or individuals may need the equipment to go off site for repair, exchange or sale. The equipment must first go through a decontamination process before it arrives at the front gate for surveying. The decontamination may include, but is not limited to, a water wash, sand blasting, acid wash, etc., as necessary in the circumstances.
2. The same survey instruments will be used as specified in Section 6.5.2 (2) above.
3. Perform the pre-survey procedures specified in Section 6.3 above.
4. The technician must visually observe all sections, top, bottom and all sides of the piece of equipment to make sure that there is no visible contamination. The technician needs to also observe that there is no oil, grease or other material that may mask contamination. The piece of equipment should be free of all such material prior to being released. If any such contamination is observed, the piece of equipment must be sent back for re-decontamination.
5. Prior to commencing the surveys, the technician will take a photograph of the piece of equipment to be released.
6. The technician will then survey the piece of equipment using the same methods described in Section 6.5.2 (4). Sufficient measurements must be taken in the most appropriate locations to yield a representative assessment of the contamination levels. Because each piece of equipment may be different or unique, the technician will use his or her judgment as to the survey locations. The technician will describe the locations surveyed on the release form.
7. If any areas surveyed are found to be over the facility's removable release requirements, then a swipe will be performed using the procedures set out in Section 2.3.3.3. The alpha survey will detect both fixed and removable alpha contamination. Because the piece of

equipment will not have any visible contamination (any piece of equipment that has visible contamination will have been sent back for re-decontamination), the swipe will be used to determine if the removable alpha exceeds the removable alpha limit.;

8. If at any time, either visual contamination is observed or contamination is found by one of the radiation detection instruments or a swipe to exceed the unrestricted release standards, the piece of equipment must be sent back for additional decontamination. If at any time the technician sends a piece of equipment back for additional cleaning, the technician should document this and why he or she sent it back on the comment section of the equipment release form.
9. After the piece of equipment has been successfully cleaned and surveyed, the technician will allow the piece of equipment to be released from the Mill's restricted area.
10. The technician will place the form and the photograph in the equipment release book in the radiation department.

#### **6.5.4 Release of Product Drums**

All uranium and vanadium product drums and any other product drums will be released for unrestricted release only, and must satisfy the standards set out in Section 6.5.1 above. In addition, vanadium product drums must also satisfy the release criteria specified in the Mill's *Release and Shipping of Vanadium Blackflake* procedure No. PBL-15.

1. The same survey instruments will be used as specified in Section 6.5.2 (2) above.
2. Perform the pre-survey procedures specified in Section 6.3 above.
3. The Technician will perform an alpha scan of the drum by slowly moving the alpha detector, at a distance of approximately ¼ inch, over the sides and top of the drum. Sufficient measurements must be taken in the most appropriate locations to yield a representative assessment of the contamination levels. For product drums this means that all drums must be surveyed. Each drum will be surveyed on at least 2 different locations on the lid and an average reading for the lid recorded. The technician will then measure at least 4 different locations on the sides of the drum and get an average reading for the drum itself. The technician will survey any area that is discolored, dented or creased to verify that there is no contamination present. If a survey fails to meet the standards set out in Section 6.5.1 above (or in the *Release and Shipping of Vanadium Blackface* procedure), then the drum must be cleaned. If the drum still does not

pass the survey, the drum is to be replaced. That means that Operations will collect the contaminated drum and return it to the packing area and will repack the material into a new drum. The old drum will then be taken to the Tailings area to be crushed and disposed of.

4. In addition to the alpha surveys, a minimum of 25% of all product drums must also be swiped for alpha contamination using the procedures set out in Section 2.3.3.3. If a product drum fails to meet the removable alpha standards set out in Section 6.5.1 above for any swipe, then the drum must be cleaned. If the drum still does not pass the survey, the drum is to be replaced. That means that Operations will collect the contaminated drum and return it to the packing area and will repack the material into a new drum. The old drum will then be taken to the Tailings area to be crushed and disposed of.

5. After the alpha survey work is completed, the beta/gamma survey will proceed. This will be done by slowly moving the detector over the drum as the technician had done with the alpha detector. The detector will be placed at 1 cm from the drum and then moved slowly over the same locations on the lid and drum as were surveyed by the alpha meter. The highest reading will be documented for the areas. This information will then be documented on the form in its proper location. If a product drum fails to meet the standards set out in Section 6.5.1 above for any survey, then the drum must be cleaned. If the drum still does not pass the survey, the drum is to be replaced. That means that Operations will collect the contaminated drum and return it to the packing area and will repack the material into a new drum. The old drum will then be taken to the Tailings area to be crushed and disposed of.

## 6.6 Forms

Attached are the various release survey forms to this section.

### Denison Mines (USA) Corp. Ore Haulage Survey for Restricted Release

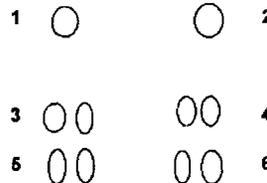
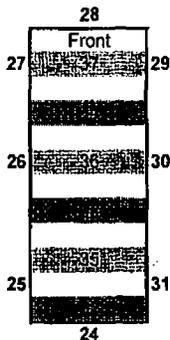
Date: \_\_\_\_\_

Trailer ID: \_\_\_\_\_ Surveyed By: \_\_\_\_\_

#### Outside Locations

Tractor ID # \_\_\_\_\_

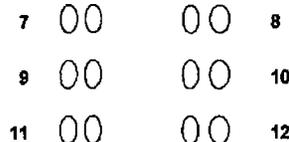
Designates  
Top  

Location #	Total Alpha/ Beta-Gamma cpm
24	
25	
26	
27	
28	
29	
30	
31	
32	
33	
34	
35	
36	
37	
Rails	

Location #	Total Alpha/ Beta-Gamma cpm
1:	
2:	
3:	
4:	
5:	
6:	
Truck Ext.:	

#### Trailer Tires



Removable alpha - 1000 dpm/100cm<sup>2</sup>  
 Fixed alpha 5000 dpm/100cm<sup>2</sup> average  
 15000 dpm/100cm<sup>2</sup> maximum

Beta-Gamma 0.2 mr/hr @ 1cm average  
 1.0 mr/hr @ 1 cm maximum

#### Instrument Data

Total Alpha/  
Beta/Gamma

Model #: \_\_\_\_\_  
 SN: \_\_\_\_\_  
 Cal. Date: \_\_\_\_\_  
 Source: \_\_\_\_\_  
 Efficiency: \_\_\_\_\_  
 Factor \_\_\_\_\_  
 Background: \_\_\_\_\_  
 MDA \_\_\_\_\_

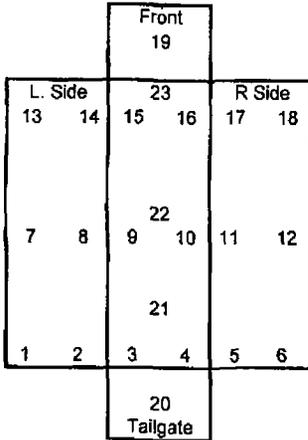
Location #	Total Alpha/ Beta-Gamma cpm
7	
8	
9	
10	
11	
12	

Comments : \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

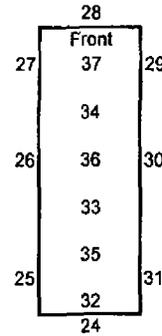
### Denison Mines (USA) Corp. Equipment Survey for Unrestricted Release

Date: \_\_\_\_\_ Container ID: \_\_\_\_\_ Surveyed By: \_\_\_\_\_

#### Inside Locations



#### Outside Locations



#### Truck and Tire Survey

1 0 0 2

3 0 0 0 4

5 0 0 0 6

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

Location #	Total Alpha dpm/100cm <sup>2</sup>	Removable Alpha dpm/100cm <sup>2</sup>	Beta Gamma
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
Total Alpha			

Location #	Total Alpha dpm/100cm <sup>2</sup>	Removable Alpha dpm/100cm <sup>2</sup>	Beta Gamma
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
33			
34			
35			
36			
37			
Rails			

Location #	cpm
1:	
2:	
3:	
4:	
5:	
6:	
Truck Ext.:	

#### TRAILER TIRES

7 0 0 0 8

9 0 0 0 10

11 0 0 0 12

#### Total Alpha/ Beta-Gamma

Location cpm

7
8
9
10
11
12
Chassis Ext.

Instrument: \_\_\_\_\_  
 SN: \_\_\_\_\_  
 Cal. Date: \_\_\_\_\_  
 Function Check ( 5 x 1 min.)  
 Th 230 @ 33000 dpm  
 Bkg Average: \_\_\_\_\_  
 Dpm Average: \_\_\_\_\_  
 Efficiency: \_\_\_\_\_  
 Eff Factor: \_\_\_\_\_  
 MDA: \_\_\_\_\_

Removable Alpha  
 Model: \_\_\_\_\_  
 SN: \_\_\_\_\_  
 Cal. Date: \_\_\_\_\_  
 Function Check ( 5 x 1 min.)  
 Alpha Bkg Ave: \_\_\_\_\_  
 Alpha eff: \_\_\_\_\_  
 Alpha Factor: \_\_\_\_\_

Total Beta/Gamma  
 Model #: \_\_\_\_\_  
 SN: \_\_\_\_\_  
 Cal. Date: \_\_\_\_\_  
 Source: \_\_\_\_\_  
 Reading: \_\_\_\_\_

#### Instrument Data

Comments : \_\_\_\_\_

Removable alpha - 1000 dpm/100cm<sup>2</sup>  
 Fixed alpha - 5000 dpm/100cm<sup>2</sup> average  
 15000 dpm/100cm<sup>2</sup> maximum

Beta - Gamma - 0.2 mr/hr @ 1cm average  
 1.0 mr/hr @ 1cm maximum



**DENISON MINES (USA) Corp.**  
 White Mesa Mill  
**Radiation Survey of Equipment Released for Unrestricted Use**

All equipment or material released from the White Mesa Mill to an unrestricted area must be surveyed for release in accordance with the following procedure.

1. Monitor for Gross alpha contamination with the appropriate survey meter.
2. If calculated assay exceeds 1,000 dpm/100cm<sup>2</sup>, then perform swipe analysis at applicable points.
3. Decontaminate if a removable alpha exceeds 1,000 dpm/100cm<sup>2</sup> or fixed alpha exceeds 5,000 dpm/100cm<sup>2</sup>.
4. Release equipment or material if alpha contamination and Beta-Gamma levels are below the following limit:

Removable alpha – 1,000 dpm/100cm<sup>2</sup>  
 Fixed alpha- 5,000 dpm/100cm<sup>2</sup> average  
 15,000 dpm/100cm<sup>2</sup> maximum

Beta-Gamma- 0.2 mr/hr @1cm average  
 1.0 mr/hr @ 1cm maximum

Released from White Mesa Mill to:

\_\_\_\_\_

\_\_\_\_\_

Released by: \_\_\_\_\_

Date: \_\_\_\_\_

List of Equipment	Total Alpha dpm/100cm <sup>2</sup>	Removable Alpha dpm/100cm <sup>2</sup>	Beta/Gamma mr/hr
1.			
2.			
3.			
4.			
5.			

**Instrument Function checks**

**Alpha Meter:**  
 Inst. Model \_\_\_\_\_ SN \_\_\_\_\_  
 Th-230 Source SN \_\_\_\_\_  
 dpm \_\_\_\_\_ cpm \_\_\_\_\_ eff \_\_\_\_\_  
 Efficiency Factor \_\_\_\_\_  
 Bkg \_\_\_\_\_  
 MDA \_\_\_\_\_

**Beta-Gamma Meter:**  
 Inst. Model \_\_\_\_\_ SN \_\_\_\_\_  
 Cs-137 Source SN \_\_\_\_\_  
 Inst. Response \_\_\_\_\_

**Removable Alpha:**  
 Inst. Model \_\_\_\_\_ SN \_\_\_\_\_  
 Th-230 Source SN \_\_\_\_\_  
 dpm \_\_\_\_\_ cpm \_\_\_\_\_ eff \_\_\_\_\_  
 Efficiency Factor \_\_\_\_\_

Comments : \_\_\_\_\_

\_\_\_\_\_

# Source Material Assay & Radiological Survey of Vanadium

## Denison Mines (USA) Corp. Lot # :

Date: \_\_\_\_\_  
Surveyed By: \_\_\_\_\_

### Source Material Assay

Total Weight U : mg/kg \_\_\_\_\_  
Total Weight Th : mg/kg \_\_\_\_\_  
Total Source Material: \_\_\_\_\_  
\_\_\_\_\_

### Total Alpha

Instrument: \_\_\_\_\_  
SN: \_\_\_\_\_  
Cal. Date: \_\_\_\_\_  
Function Check ( 5 x 1 min.)  
Th 230 @ 33000 dpm  
Bkg Average: \_\_\_\_\_  
Dpm Average: \_\_\_\_\_  
MDA: \_\_\_\_\_

### Removable Alpha

Model: \_\_\_\_\_  
SN: \_\_\_\_\_  
Cal. Date: \_\_\_\_\_  
Alpha Bkg Ave: \_\_\_\_\_  
Alpha eff: \_\_\_\_\_  
Alpha Factor: \_\_\_\_\_  
MDA: \_\_\_\_\_

### Total Beta/Gamma

Model #: \_\_\_\_\_  
SN: \_\_\_\_\_  
Cal. Date: \_\_\_\_\_  
Source: \_\_\_\_\_  
Reading: \_\_\_\_\_  
Background: \_\_\_\_\_  
Note: \_\_\_\_\_

### Total Gamma

Model #: \_\_\_\_\_  
SN: \_\_\_\_\_  
Cal. Date: \_\_\_\_\_  
Source: \_\_\_\_\_  
Reading: \_\_\_\_\_  
Background: \_\_\_\_\_

Laboratory assay results for this lot of vanadium product are attached.

Comments : \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DATE \_\_\_\_\_

LOT NO. \_\_\_\_\_

BACKGROUND \_\_\_\_\_

EFFICIENCY FACTOR \_\_\_\_\_

Drum Number	Total Alpha dpm/100cm <sup>2</sup>	Removable Alpha dpm/100cm <sup>2</sup>	Dose Rate mr/hr Tops	Dose Rate mr/hr Sides
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
32				
33				

Average Gamma Dose Rate/Lot \_\_\_\_\_

Maximum Gamma Dose Rate/Lot \_\_\_\_\_

DATE \_\_\_\_\_

LOT NO. \_\_\_\_\_

BACKGROUND \_\_\_\_\_

EFFICIENCY FACTOR \_\_\_\_\_

Drum Number	Total Alpha dpm/100cm <sup>2</sup>	Removable Alpha dpm/100cm <sup>2</sup>	Dose Rate mr/hr Tops	Dose Rate mr/hr Sides
34				
35				
36				
37				
38				
39				
40				
41				
42				
43				
44				
45				
46				
47				
48				
49				
50				
51				
52				
53				
54				
55				
56				
57				
58				
59				
60				
61				
62				
63				
64				
65				
66				



Denison Mines Corp.  
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 Blanding, UT 84611  
 USA

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 Fax : 435 678-2224

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SHIPMENT SURVEY		LOT NO.	
CONTRACT NO.		TRUCK CARRIER	
TRACTOR NO.		TRAILER NO.	

ALPHA SURVEY INSTRUMENTS			
TOTAL		REMOVABLE	
MODEL NO.		MODEL NO.	
SERIAL NO.		SERIAL NO.	
CALIBRATION		CALIBRATION	
EFFICIENCY		EFFICIENCY	
FACTOR		FACTOR	
MDA			

ALLOWABLE LIMITS (FIXED) 5,000 DPM AVG. 15,000 DPM MAX (REMOVABLE) 1,000 DPM  
 1.0

$$\frac{\text{SURFACE AREA OF PROBE}}{100 \text{ cm}^2} \times \frac{\text{EFFICIENCY OF INSTRUMENT (\%)}}{100} = \text{FACTOR}$$

$$(\text{EFFICIENCY}/100\text{cm}^2)$$

$$\text{Factor X counts/minute} = \text{Disintegrations/minute}/100\text{cm}^2$$

GAMMA SURVEY (49 CFR 173.441 (b) (1))	
INSTRUMENT NO.	MEASURED IN MILLIREMS/ HOUR
SERIAL NO.	
CALIBRATION	(MR/HR)
TRAILER SURFACE	200 MR/HR ALLOWABLE
SIX FEET DISTANCE	10 MR/HR ALLOWABLE
DRIVERS SEAT	5 MR/HR ALLOWABLE
SLEEPER	5 MR/HR ALLOWABLE

ALL DRUMS WERE INSPECTED PRIOR TO LOADING. ALL DRUMS WERE TIGHTLY SEALED. NONE LEAKED AND THERE WAS NO LOOSE MATERIAL IN THE VEHICLE.

INSPECTOR SIGNATURE \_\_\_\_\_ DATE \_\_\_\_\_

# Denison Mines (USA) Corp.

## DRUM CONTAMINATION SURVEY

Type of Shipment: \_\_\_\_\_

Lot #: \_\_\_\_\_

Date: \_\_\_\_\_

Drum #	Total Alpha dpm/100 cm <sup>2</sup>		Removable Alpha dpm/100 cm <sup>2</sup>		β/γ Average mrem/hr
	Top	Sides	Top	Sides	
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					

\* If total Alpha is greater than or equal to 1,000 dpm/100 cm<sup>2</sup>, a removable smear is required.

**Alpha Meter**

Model #: \_\_\_\_\_  
 SN #: \_\_\_\_\_  
 Cal. Date: \_\_\_\_\_  
 Check Date: \_\_\_\_\_  
 Th 230 @ 33,000 dpm  
 dpm Average: \_\_\_\_\_  
 Efficiency: \_\_\_\_\_  
 Bkg: \_\_\_\_\_  
 MDA: \_\_\_\_\_

**Removable Alpha**

Model #: \_\_\_\_\_  
 SN #: \_\_\_\_\_  
 Cal. Date: \_\_\_\_\_  
 Check Date: \_\_\_\_\_  
 Th 230 @ 33,000 dpm  
 Efficiency: \_\_\_\_\_  
 Bkg: \_\_\_\_\_

**Beta/Gamma Meter**

Model #: \_\_\_\_\_  
 SN #: \_\_\_\_\_  
 Cal. Date: \_\_\_\_\_  
 Check Date: \_\_\_\_\_  
 Cs 137 SN #2  
 Reading: \_\_\_\_\_  
 Bkg: \_\_\_\_\_

Drum #	Total Alpha dpm/100 cm <sup>2</sup>		Removable Alpha dpm/100 cm <sup>2</sup>		$\beta/\gamma$ Average mrem/hr
	Top	Sides	Top	Sides	
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					
47					
48					
49					
50					

**Comments:**

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