State of Utah

GARY R. HERBERT
Governor

SPENCER J. COX
Lieutenant Governor

Department of
Environmental Quality

Alan Matheson
Executive Director

DIVISION OF WASTE MANAGEMENT
AND RADIATION CONTROL
Scott T. Anderson
Director

April 26, 2016

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

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

Dear Mr. Tharakan:

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

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

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

The following regulations are applicable to this incident:

1. 49 CFR 173.427(c)(1) – *Transportation requirements for low specific activity (LSA) Class 7 (radioactive) material and surface contaminated objects (SCO).*

(Over)

195 North 1950 West • Salt Lake City, UT
Mailing Address: P.O. Box 144880 • Salt Lake City, UT 84114-4880
Telephone (801) 536-0200 • Fax (801) 536-0222 • T.D.D. (801) 903-3978
www.deq.utah.gov

2. 49 CFR 173.443 - *Contamination control*
3. 10 CFR 71.43(f) – *General standards for all packages*
4. 10 CFR 71.71 - *Normal conditions of transport*

Contrary to 49 CFR 173.427(c)(1), 10 CFR 71.43(f) and 10 CFR 71.71, the Cameco-Smith Ranch Facility sent an 11e.(2) shipment to the White Mesa Mill in a roll-off container that did not contain the material under routine (normal) conditions of transport.

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

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

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

Sincerely,

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

STA/RMJ/ka

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

c: Worthy Glover, Jr., MMHRM, CPM, Health Office San Juan Public Health Department
Rick Meyer, Environmental Health Director, San Juan Public Health Department
David Ariotti, P.E., DEQ District Engineer
Ms. Linda Gersey, U.S. NRC Region IV, Division of Nuclear Materials Safety
Ryan S. Schierman, State of Wyoming, Wyoming Department of Environmental Quality, Natural Resources Program Manager
Jennifer Opila, Colorado Department of Public Health & the Environment, Hazardous Materials & Waste Management Division, Radiation Program, Program Manager

Ryan Johnson <rmjohnson@utah.gov>

Notification of leaking 11e.(2) shipment arriving at the White Mesa Uranium Mill

1 message

Ryan Johnson <rmjohnson@utah.gov> Tue, Mar 29, 2016 at 2:07 PM
To: Linda.Gersery@nrc.gov, ryan.schierman@wyo.gov
Cc: "Goble, Phillip" <pgoble@utah.gov>, Scott Anderson <standerson@utah.gov>

Linda,

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

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

—

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

Disclaimer:

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

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

April 4, 2016

Sent VIA E-MAIL AND EXPRESS DELIVERY

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

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

Dear Mr. Anderson:

Attachment 1 to this letter provides Energy Fuels Resources USA Inc.'s ("EFRI's") follow-up documentation to previous notifications to DWMRC Personnel by David Turk on March 29, 2016 regarding Cameco 11e.(2) shipping issues.

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

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

Yours very truly,

ENERGY FUELS RESOURCES (USA) INC.
Kathy Weinel
Quality Assurance Manager

CC: David Frydenlund
Harold Roberts
David Turk
Logan Shumway
Scott Bakken

ATTACHMENT 1

DOCUMENTATION FOR INCIDENT OF MARCH 29, 2016

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

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

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

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

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

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

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

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

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

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

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

At no time during the incident was there a danger to life.

The materials which were noted on the Highway 191 surfaces, as well as those on Mill property, were cleaned up following the incident by Mill Personnel.

Chronology of the Incident

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

(B)

- At approximately 0945 hours on Tuesday March 29, 2016, the RSO allowed the load onto the property pursuant to approval from DWMRC Personnel. The main reason for the allowing the truck and IMC onto the Mill property was that rain was starting to fall and washing some of the material off of the container and onto the ground. In order to prevent a larger cleanup, the decision was made to move the truck and IMC to the Mill Restricted Area.
- The area on US Highway 191 and the EFRI entrance way was washed and any contaminated soil (approximately 5 to 6 cubic yards) was excavated and taken into the Mill Restricted Area and then out to Cell 3 for disposal. The cleanup area extended approximately ¼ of a mile north on US Highway 191. The area was surveyed after the rain/snow storm stopped. Data from these scans is summarized below.

Summary of Scan Results

Location	Background Units	Pre-Cleanup Results Units	Post-Cleanup Results Units
EFRI Entrance Road	212 dpm/100cm^2 and 10 µR/hr	5,850 dpm/100cm^2 and 0.04 mrem/hr	≤ Bkg and 23 µR/hr
US Highway 191 turnout	212 dpm/100cm^2 and 10 µR/hr	9,360 dpm/100cm^2 and 0.08 mrem/hr	≤ Bkg and 20 µR/hr
US Highway 191	212 dpm/100cm^2 and 10 µR/hr	5,850 dpm/100cm^2 and 0.04 mrem/hr	≤ Bkg and 10 µR/hr
Greenfield Truck	212 dpm/100cm^2 and 0.04 mrem/hr	35,100 dpm/100cm^2 and 5.0 mrem/hr	≤ Bkg and ≤ 0.04 mrem/hr
Greenfield IMC	212 dpm/100cm^2 and 0.04 mrem/hr	58,500 dpm/100cm^2 and 5.0 mrem/hr	Is still in the process of being cleaned

- The inbound IMC was dumped on Cell 3 and the then moved to the vicinity of the Old Decontamination pad in order for EFRI to perform a detailed decontamination of the unit once conditions improve. The truck was taken through the Old Decontamination wash station. The truck was released from the site at 1130 hours. All release surveys on the truck met applicable standards.
- At approximately 1830 hours on March 29, 2016, Greenfield Logistics reported the incident to DOT National Response Center. Kevin Williams at the National Response Center took the call and issued Case # 1144028. Shane Johnson of Greenfield Logistics received a call from DOT to review the details of the report. Per e-mail communications from Greenfield Logistics, DOT considers the incident report closed.
- At approximately 0900 hours on March 30, 2016, Ms. Weinel spoke with Mr. Travis Coleman. Mr. Coleman was notified that this was the second incident of this type involving this material. EFRI recommended Smith-Ranch Personnel conduct an internal investigation into this incident to prevent recurrence.
- The US. Nuclear Regulatory Commission ("NRC") requested that Cameco retrace the route of the shipment to investigate the potential for additional released material. The Cameco team obtained a detailed account of the route. In the event that additional released material was identified, Cameco's Emergency Response contractor was standing by to respond.
- On April 1, 2016 a Cameco team comprised of the Smith Ranch RSO, Mr. Travis Coleman, a Smith Ranch Health Physics Technician ("HPT"), Mr. Chris Pendleton, and Mr. Ken Vaughn, the Cameco Director of Communications traveled to the Mill in Blanding Utah. They arrived at 1830 on Friday, April 1, 2016.
- The Cameco team surveyed Highway 191 from the Mill entrance to the 4-way intersection in Blanding in ¼ mile increments. No readings above background were noted.
- On April 2, 2016, the Cameco team retraced the shipping route and surveyed at points along the road. Additional data were collected in and around Meeker, Colorado due to the Greenfield

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driver stating he had to stop quickly to avoid a deer in that area. Due to the potential for additional spillage, this area was surveyed at a higher frequency.

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

Conclusion

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

Shipper No. 31??

STRAIGHT BILL OF LADING

ORIGINAL—NOT NEGOTIABLE

Carrier No. ________

Greenfield Logistics
(Name of Carrier) (SCAC)

Date 3/28/16

on Collect on Delivery shipments, the letters COD must appear before consignee's name or as otherwise provided in Item 430, Sec. 1.	From: Shipper CAMECO RESOURCES, INC.
To: Consignee Energy Fuels	Street: 762 Ross Rd
Street 6425 South HWY 191	City Douglas State WY Zip Code 82633
City Blanding State UT Zip Code 84511	24 hr. Emergency Contact Tel. No: 905-885-8745

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	UN2912, RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-1), CLASS 7	9.9m³ (13yd³)			
		RADIONUCLIDE: RESIDUAL NATURAL URANIUM & ASSOCIATED DAUGHTER PRODUCTS				
		PHYSICAL FORM: SOLID				
		CHEMICAL FORM: NATURAL URANIUM OXIDE $UO_4 \cdot 2H_2O$				
		TOTAL ACTIVITY:1.83E9Bq (.05Ci)				
		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 X NO ☐

REMIT C.O.D. TO: ADDRESS

Note-(1) Where the rate is dependent on value, shippers are required to state specifically in 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 NMFC 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/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

ON BEHALF OF SHIPPER
[signature]
Signature

COD Amt: $

C.O.D. FEE:
PREPAID ☐
COLLECT ☐ $

Subject to Section 7 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.

(Signature of Consignor)

TOTAL CHARGES: $

FREIGHT CHARGES
FREIGHT PREPAID except when box at right is checked ☐ Check box if charges are to be collect

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 the 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 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 [signature]	PER Douglas B. Angell
DATE 3/28/16	DATE 3/28/16

DATE 3/15/16

CONTAINER # GFLU-1560

LOCATION Selenium Plant

TOTAL YARDS 13 yd

POWER RESOURCES
(dba, Cameco Resources)

Yards
1" =
Yard
1' =
2' =
3' =
3.5' =
4' =
Full

Seal #
0061151
0061167

End View

7.5'
90"

54" 4.5'

15.5'
Side View

4.5' 54"

Barium

15.5'

Smith Ranch
By-product co

Cameco

CAMECO RESOURCES
Smith Ranch-Highland Operation
Mail:
P.O. Box 1210
Glenrock, WY
82637 USA

Tel: (307) 358-6541
Fax: (307) 358-4533
www.cameco.com

RELEASE AUTHORIZATION FOR BY-PRODUCT MATERIAL

(Complies with D. O. T. Hazardous Material Regulations, 49 CFR Parts 100-199)

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

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

SHIPPING DATE: 3/28/16
SRH SHIPMENT #: 3/16-7
TOTAL MAXIMUM ACTIVITY OF LOAD: 1.83E9 (0.05Ci)

CONTENTS:

☑ UN 2912, Radioactive Material, Low Specific Activity (LSA-1), Class 7 Shipment contains by-product material from an in-situ uranium mine.

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

☐ UN 2913, Radioactive Material, Surface Contaminated Objects (SCO-1), Class 7 Shipment contains by-product material from an in-situ uranium mine.

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

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

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

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

DRIVER RESPONSIBILITY STATEMENT

I, Douglas B. Angell, driver for Greenfield Logistics

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

DATE: 3/28/11

SIGNATURE: Douglas B Angell

Cameco

Cameco Resources

WYOMING OPERATIONS
BYPRODUCT MATERIAL SHIPMENT TRUCK SURVEY

METER MODEL 3
METER SN 229817
CALIBRATION DATE 9/11/15

SHIPMENT NO. 3116-8
LOCATION: Selenium Plant
DATE: 3/28/16

RSO/RST SIGNATURE

METER MODEL 3
METER SN 235586
CALIBRATION DATE 2/9/16

BACKGROUND 0.05 mR/hr

BACKGROUND 0 dmp/100 cm²

Swipe Survey Yes (No)

Green Field
CARRIER NAME
3
TRACTOR NO.

0.09 mR/hr Driver's Seat

4.0 mR/hr Surface

0.5 mR/hr 6.6' (2 Meters)

425 dpm/100 cm² Surface

1560

0.5 mR/hr 6.6' (2 meters)

5.0 mR/hr Surface

425 dpm/100 cm²

5.0 mR/hr Surface

0.6 mR/hr 6.6' (2 Meters)

283 dpm/100 cm²

Quality Control Checklist (49CFR 173.475)
As Per SHEQ Management System Volume IV-Transportation

The container is in good condition?	✓
The container has been closed properly?	✓
The container has been filled properly?	✓
Exterior contamination/ Radiation levels below the limits?	✓

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

0.4 mR/hr 6.6' (2 Meters)

3.0 mR/hr Surface

708 dpm/100 cm² Surface

Cameco

Transportation Accident Response Guide (Instructions to the Driver)

1.) Introduction

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

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

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

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

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

- From a single consignor having the exclusive use of a transport vehicle or of an aircraft, or of a hold or compartment of an inland watercraft, or of a hold, compartment, or defined deck area of a seagoing vessel; and

- For which all initial, intermediate, and final loading and unloading is carried out by or under the direction of the consignor, consignee, or his designated agent.

Transportation Accident Response Guide (Instructions to the Driver)

Special remarks concerning exclusive use:

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

Transportation Accident Response Guide (Instructions to the Driver)

2.) Emergency Response Procedures Provided to Carrier

TO WHOM IT MAY CONCERN:

- Rescue and lifesaving may be conducted with minimal potential hazards from the cargo on this truck. If possible, avoid breathing dust from spilled cargo. **DO NOT DELAY RESCUE EFFORTS!**
- After needed rescue, lifesaving, first aid or fire fighting, please read the attached instructions in the event of cargo spillage.
- Please note that this truck is equipped with emergency equipment. It is accessible in the storage area on the neck of the trailer or is _____ (write in location if not located in the trailer neck storage area).

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

This vehicle contains radioactive materials, which may be in the form of dry uranium oxide (yellowcake, U_3O_8), yellowcake, **brine, resin,** slurry, or byproduct (waste) material. The color of concentrated material is yellow. The slurry is a liquid material containing solid yellowcake. The material cannot burn or explode. *In the event of an accident involving spillage of material, the following actions are recommended in the order given if appropriate:*

1. Lifesaving, Rescue, and Firefighting

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

If you believe you may have been contaminated with the material, please remove any contaminated clothing and place in plastic bag, use soap and water to wash contaminates

from hands or exposed area, and notify the Cameco Resources Emergency Response Team (CR ERT) upon their arrival at the accident site. To avoid ingestion of the material, do not eat, drink, or smoke while near the spill.

Transportation Accident Response Guide (Instructions to the Driver)

2. *Contact the Local Law Enforcement Agency*

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

Nebraska State Police:	(308) 632-1211 or (402) 471-4545
Wyoming State Police:	1-800-442-9090
Colorado State Police:	(303) 239-4500
(Emergency Dispatch – 24 hours)	(303) 239-4501
Utah Highway Patrol:	(801) 965-4518

3. *Cover the Spilled Material*

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

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

4. *Fill Out the Attached Questionnaire*

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

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

- The carrier is:

_____

- The shipper is:

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

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

6. When Help Arrives

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

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

Thank you very much.

3.) Accident Evaluation Guide

1. Name of Trucking Company:_____
2. Truck Number or Tag No:_____
3. Name of Driver:_____
4. Name of Police Department Notified:_____
5. Phone Number of Police Notified:_____
6. Place of Accident:_____
7. Is the Driver Injured?_____
8. Other Injured?_____
9. Bill of Lading Number:_____
10. Destination of Shipment:_____
11. Time of Accident:_____
12. Was There a Fire?_____
13. Is It Raining or Was Water Used to Put Out Fire or Wash Off Road?_____
14. Are Drums Outside of the Truck?_____
15. About How Many?_____
16. Are Contents of Drums or Tanks Spilled?_____
17. Has the Spill Been Covered?_____
18. Is the Spill on the Ground?_____
19. Is the Spill in Water?_____Lake?_____Stream?_____
20. Is the Spill Near a Building?_____
21. Is the Accident Area Lighted at Night?_____
22. Name of Nearest Large City?_____
23. Other Comments:_____
24. Your Name Please_____
    a. Can You Be Reached By Phone Near the Accident Site?_____
    b. Phone number: _____
    c. Home or Business Phone:_____
    d. Your Address:_____

Date:_____

Transportation Accident Response Guide (Instructions to the Driver)

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

Mine Management

		Work Phone	
1.	Craig Hiser Mine Manager	(307)358-6541 ext. 415	[redacted]
2.	Travis Coleman RSO	(307)358-6541 ext. 431	[redacted]
3.	Ken Garoutte Safety, Health, Environment and Quality Manager	(307)358-6541 ext. 476	[redacted]
4.	Smith Ranch Central Plant Operator 24 hours per day / 7 days per week	(307)358-6541 ext. 450	[redacted]

North Butte Operations

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

Casper Management

		Work Phone	
1.	Brent Berg President	(307)333-7735	[redacted]
2.	Mike Thomas SHEQ Manager- DIV	(307)333-7665	[redacted]

Transportation Accident Response Guide (Instructions to the Driver)

Emergency Response Telephone Number Guide

State Agencies	Telephone No.
Colorado:	
State Polic[redacted]	(303) 239-4500
Health Department (24 hours)	(877) 518-5608
[redacted]	
Illinois:	
Highway Patrol General Headquarters	
Deputy D[redacted]	(217) 557-6630
Crash Report #	(217) 785-0614
Iowa: [redacted]	
State Patrol Headquarters (Des Moines)	(515) 725-6090
Calls made after 4:30pm will automatically transfer to 911	
Kansas: [redacted]	
Highway Patrol General Headquarters	(785) 296-6800
After hour[redacted]r highway help	
Di[redacted]pike help	
Michigan:	
Highway [redacted]	(517) 241-8000
(24 hours)	
Minnesota: [redacted]	
Highway Patrol	(651) 201-7100
Dept. of [redacted] Admin. Office	
Missouri: [redacted]	
General Headquarters	(573) 751-3313

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Transportation Accident Response Guide (Instructions to the Driver)

Emergency Response Telephone Number Guide

State Agencies	**Telephone No.**
Nebraska:	
Highway Patrol - Scottsbluff, NE.	(308) 632-1211
Lincoln, NE.	(402) 471-4545
Health and Human Services (8 a.m. - 5 p.m. Central)	(402) 471-2168
(After Business Hours - Call Hwy. Patrol - Lincoln)	(402) 471-4545
NDEQ (8 a.m. – 5 p.m. Central)	(402) 471-2186
(After Business Hours - Call Hwy. Patrol - Lincoln)	(402) 471-4545
South Dakota:	
Division Headquarters	(605) 773-3105
Utah:	
Highway Patrol – Price, UT. (Section 9)	(801) 965-4532
Division of Radiation Control (24 hour)	(801) 536-4123
Wisconsin:	
State Patrol Division Headquarters	(608) 266-3212
Wyoming:	
State Highway Police	1-800-442-9090
WDEQ (24 hour)	(307) 777-7781
Wyo. Emergency Mgmt. Agency (Homeland Security)	(307) 777-4900
Wyoming Department of Transportation	(307) 777-4484

Transportation Accident Response Guide (Instructions to the Driver)

Federal & Canadian Agencies	**Telephone No.**
Nuclear Regulatory Commission Operations Center - Bethesda, Md.	(301) 816-5100 or (301) 951-0550 or (301) 415-0550
Department of Transportation - National Response Center	(800) 424-8802 or (202) 267-2675
Ontario: Provincial Police (24 hours)	(888) 310-1122

ON-SITE Transportation Accident Response Guide
For Pulling Unit Operators

1.) Introduction

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

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

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

TO WHOM IT MAY CONCERN:

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

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

Lifesaving, Rescue, and Firefighting

This may be done with minimal potential hazards from the material. If possible, avoid breathing and/or swallowing material that may be adhered to byproduct material or wellfield equipment. The radioactive material on the skin or clothing is relatively harmless and simple washing methods will remove it. If you believe you may have been contaminated with the material, please notify first responders upon their arrival at the accident site. To avoid ingestion of the material, do not eat, drink, or smoke while near the spill.

This vehicle contains radioactive materials, which may be in the form of natural uranium and associated daughter products. The color of the material may be red/orange or white/yellow. The material cannot burn or explode. *In the event of an accident involving spillage of material, the following actions are recommended in the order given if appropriate:*

Contact Supervisor

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

Initial response

In the event of spilled radioactive materials, clean-up methods, monitoring, sampling and release levels will be performed under the direction of the RSO or designee. Addition requirements may also be applicable as per SHEQ Management System volume VIII.

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WYOMING OPERATIONS
EMERGENCY INFORMATION FOR CARRIERS

Approvals
Operations:
Project RSO: T Coleman
Revision Date: 1/7/2016

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

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WYOMING OPERATIONS
EMERGENCY INFORMATION FOR CARRIERS

NOTIFICATIONS

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

   ☐ **URANIUM ORE CONCENTRATE (U_3O_8 OR YELLOWCAKE). "LOW SPECIFIC ACTIVITY" (LSA) RADIOACTIVE MATERIAL**

   ☑ **SOLID WASTE BYPRODUCT MATERIAL FROM THE PROCESSING OF URANIUM "LOW SPECIFIC ACTIVITY" (LSA) RADIOACTIVE MATERIAL OR SURFACE CONTAMINATED OBJECT (SCO-1)**

   ☐ **ION EXCHANGE RESIN CONTAINING ABSORBED URANIUM ON RESIN SURFACE "LOW SPECIFIC ACTIVITY (LSA-1) RADIOACTIVE MATERIAL**

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

TRAVIS COLEMAN	**RADIATION SAFETY OFFICER**	**OFFICE (307)358-6541 ext.431**
KEN GAROUTTE	**SHEQ MANAGER**	[redacted]
CRAIG HISER	**MINE MANAGER**	[redacted]

GUIDE 162 — RADIOACTIVE MATERIALS (LOW TO MODERATE LEVEL RADIATION)

NA8095

POTENTIAL HAZARDS

HEALTH

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

FIRE OR EXPLOSION

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

PUBLIC SAFETY

- CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.
- Priorities for rescue, life-saving, first aid, and control of fire and other hazards are higher than the priority for measuring radiation levels.
- Radiation Authority must be notified of accident conditions, and is usually responsible for radiological decisions.
- Isolate spill or leak area immediately for at least 25 to 50 meters (80 to 160 feet) in all directions. • Stay upwind. • Keep unauthorized personnel away.
- Detain or isolate uninjured persons or equipment suspected to be contaminated; delay decontamination and cleanup until instructions are received from Radiation Authority.

PROTECTIVE CLOTHING

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

EVACUATION

Large Spill

- Consider initial downwind evacuation for at least 100 meters (330 feet).

Fire

- When a large quantity of this material is involved in a major fire, consider an initial evacuation distance of 300 meters (1000 feet) in all directions.

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EMERGENCY R

FIRE

- Presence of radioactive material will not change a
- Move containers from fire area if you can do it with
- Do not move damaged packages; move undamage

Small Fires

- Dry chemical, CO_2, water spray or regular foam.

Large Fires

- Water spray, fog (flooding amounts).
- Dike fire-control water for later disposal.

SPILL OR LEAK

- Do not touch damaged packages or spilled materi

Liquid Spills

- Cover with sand, earth or other noncombustible ab
- Dike to collect large liquid spills.
- Cover powder spill with plastic sheet or tarp to min

FIRST AID

- Medical problems take priority over radiological co
- Use first aid treatment according to the nature of th
- Do not delay care and transport of a seriously injur
- Apply artificial respiration if victim is not breathing
- Administer oxygen if breathing is difficult.
- In case of contact with substance, wipe from skin i running water for at least 20 minutes.
- Injured persons who contacted released material n contacted persons, equipment and facilities.
- Ensure that medical personnel are aware of the ma take precautions to protect themselves.

Conforms to ANSI Z400.1/Z129.1-2010 Standard - United States, Canada

Safety Data Sheet

Uranium Peroxide Hydrate

1. Product and company identification

Product name	:	Uranium Peroxide Hydrate
Common name	:	UO_4, peroxide yellowcake, yellowcake, peroxide uranium ore concentrate, uranyl peroxide
Material uses	:	Concentrate produced from the milling of the uranium ore for processing at a refinery
MSDS #	:	Cameco 141 E
Supplier/Manufacturer	:	Rabbit Lake Operation c/o Cameco Corporation 2121 11th Street West Saskatoon, Saskatchewan Canada S7M1J3 Tel: (306) 633 2141 Fax: (306) 633 2248
		Cameco Resources Crow Butte Operation 86 Crow Butte Road Crawford, NE 69339 USA Tel: (308) 665-1393 Fax: (308) 665-2341
		Cameco Resources Smith Ranch Highland P.O. Box 1210 Glenrock, Wy 82637 USA Tel: (307) 358 6541 Fax: (307) 358 4533
MSDS authored by	:	KMK Regulatory Services Inc.
In case of emergency	:	1 905 885 8745

2. Hazards identification

Emergency overview

Physical state	:	Solid (Powder)
Color	:	Yellow
Odor	:	No odor

GHS Label Elements

Pictogram	:	
Signal word	:	DANGER
Hazard statements	:	Toxic by inhalation and ingestion Danger of cumulative effects May damage kidneys
Precautionary measures	:	Do not breathe dust. Do not ingest. Do not get on skin or clothing. Use only with adequate ventilation. Do not eat, drink or smoke when using this product. Avoid contact with eyes. Keep container closed. Wash thoroughly after handling.
OSHA/HCS status	:	This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200)
Routes of entry	:	Dermal contact, via cuts abrasion or open wounds. Eye contact. Inhalation. Ingestion.

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Potential acute health effects

Inhalation	:	Harmful if inhaled. Kidney damage can occur due to chemical toxicity. Dissolution halftime of $UO_4.xH_2O$ is fast for the synthetic lung fluid solubility test. Dust inhalation can result in an internal dose from alpha, beta and gamma radiation.
Ingestion	:	Harmful if swallowed. Kidney damage can occur due to chemical toxicity.
Skin	:	Skin dermatitis may result from skin contact.
Eyes	:	Irritating to eyes

Potential chronic health effects

Chronic effects	:	May cause target organ damage, based on animal data. Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation.
Carcinogenicity	:	Not listed as a carcinogenic material by IARC or OSHA. Soluble and insoluble compounds of uranium are listed as potential occupational carcinogens by NIOSH, and confirmed human carcinogens by ACGIH, based on evidence from epidemiological studies.
Mutagenicity	:	No known significant effects or critical hazards.
Teratogenicity	:	No known significant effects or critical hazards.
Developmental effects	:	No known significant effects or critical hazards.
Fertility effects	:	No known significant effects or critical hazards.
Target organs	:	May cause damage to following organs: kidneys

Over-exposure signs/symptoms

Inhalation	:	Adverse symptoms may include the following: respiratory tract irritation, coughing
Ingestion	:	Chemical toxicity is largely shown in kidney damage that may not be reversible
Skin	:	Prolonged contact can result in dermatitis
Eyes	:	Adverse symptoms may include the following: pain or irritation watering redness
Medical conditions aggravated by over-exposure	:	Pre-existing disorders involving any target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product.

See toxicological information (Section 11)

3. Composition/information on ingredients

United States

Name	CAS number	%
Uranium Peroxide Hydrate	19525-15-6	>95

Canada

Name	CAS number	%
Uranium Peroxide Hydrate	19525-15-6	>95

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

4. First aid measures

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

Skin contact	:	In case of contact, immediately flush skin with plenty of water for at least 20 minutes.
Inhalation	:	Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Get medical attention immediately.
Ingestion	:	Wash out mouth with water. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical doctor or poison control center immediately.
Protection of first-aiders	:	No action shall be taken involving any personal risk or without suitable training. If it is suspected that dust is present, it may be dangerous to the person providing aid to give mouth-to mouth resuscitation. Rescuer should wear and appropriate mask or self-contained breathing apparatus. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.
Notes to physician	:	No specific treatment. Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

5. Fire-fighting measures

Flammability of the product	:	Not flammable

Extinguishing media

Suitable	:	CO_2, dry chemical, foam, alcohol-type foam, water fog
Not suitable	:	None known.
Special exposure hazards	:	Possible presence of radioactive uranium dust. No action shall be taken involving any personal risk or without suitable training.
Hazardous thermal decomposition products	:	Uranium peroxide hydrate decomposes to produce uranium trioxide (UO_3) powder and oxygen (O_2) gas at high temperatures. Steam will be generated from water of hydration.
Special protective equipment for fire-fighters	:	Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-shield operated in positive pressure mode.
Special remarks on fire hazards	:	Uranium peroxide hydrate decomposes to produce uranium trioxide (UO_3) powder and oxygen (O_2) gas at high temperatures. The O_2 gas will increase the explosive limit range and rate of burning for flammable and combustible materials in the vicinity.

6. Accidental release measures

Personal precautions	:	No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Do not breathe dust. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment (see Section 8).
Environmental precautions	:	Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers by covering with a suitable cover. Drums of the material are to be shipped to the nearest Cameco Corporation facility or other licensed repository that can handle the material. Forward any contaminated clothing or equipment in separate marked drums. Inform the relevant authorities if the product has caused environmental pollution in sewers, waterways soil or air.

Methods for cleaning up

Small Spill	:	Move containers from spill area. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Dispose of via a licensed waste disposal contractor. Note: See Section 1 for emergency contact information and Section 13 for waste disposal.

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

7. Handling and storage

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

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

8. Exposure controls/personal protection

United States

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

Canada

Occupational exposure limits		TWA (8 hours)			STEL (15 mins)			Ceiling			
Ingredient	List name	ppm	mg/m3	Other	ppm	mg/m3	Other	ppm	mg/m3	Other	Notations
Uranium peroxide hydrate, as U	US ACGIH 3/2012		0.2			0.6					
	AB 4/2009		0.2			0.6					
	BC 4/2012		0.2			0.6					
	ON 7/2010		0.2			0.6					
	QC 9/2011		0.2			0.6					

Consult local authorities for acceptable exposure limits.

Recommended monitoring procedures	:	If this product contains ingredients with exposure limits, personal, workplace, atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment. Reference should be made to appropriate monitoring standards. Reference to national guidance documents for methods for the determination of hazardous substances will also be required.
Engineering measures	:	Use only with adequate ventilation. Use process enclosures or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. This may require HEPA filtration of exhaust air.
Hygiene measures	:	Wash hands, forearms and face thoroughly after handling, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location. Contamination monitoring may be required for activities with direct exposure.

Personal protection

Respiratory	:	Use a properly fitted particulate filter respirator complying with an approved standard. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.
Hands	:	Chemical-resistant impervious gloves complying with an approved standard should be worn at all times when handling. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining the protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. Recommended : Rubber or neoprene for normal industrial use
Eyes	:	Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles
Skin	:	Personal protective equipment for body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. Recommended: long sleeved coveralls
Environmental exposure controls	:	Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

9. Physical and chemical properties

Physical state	:	Solid (Powder)
Flash point	:	Not applicable
Burning time	:	Not applicable
Burning rate	:	Not applicable
Auto-ignition temperature	:	Not applicable
Flammable limits	:	Not applicable
Color	:	Yellow
Odor	:	Odorless
Taste	:	Not applicable

Molecular weight	:	338 g/mole
Molecular formula	:	$UO_4.2H_2O$
pH	:	Not applicable
Boiling/condensation point	:	Decomposes
Melting/freezing point	:	Decomposition temperature: 160 to 230 °C (320 to 446 °F)
Critical temperature	:	Not applicable
Specific Gravity	:	4 to 4.4
Vapor pressure	:	Not applicable
Volatility	:	Not applicable
Odor threshold	:	Not applicable
Evaporation rate	:	Not applicable
SADT	:	Not applicable
Viscosity	:	Not applicable
Ionicity (in water)	:	Not applicable
Dispersibility properties	:	Not applicable
Solubility	:	Negligible
Partition coefficient (log K_{ow})	:	Not applicable
Physical/chemical properties comments	:	Not applicable

10. Stability and reactivity

Chemical stability	:	The product is stable under normal* conditions. * Normal conditions in an operating environment. pressure 0,9 bar to 1.1 bar, oxygen 21% v/v, temperature from 0 to 30 °C
Conditions to avoid	:	Avoid extremely high temperatures.
Incompatible materials	:	Strong mineral acids such as nitric, sulphuric or hydrochloric acids.
Hazardous decomposition products	:	Under normal conditions of storage and use, hazardous decomposition products should not be produced. Uranium peroxide hydrate decomposes to produce uranium trioxide (UO_3) powder and oxygen (O_2) gas at temperatures at high temperatures.
Possibility of hazardous reactions	:	Under normal conditions of storage and use, hazardous reactions will not occur.

11. Toxicological information

Acute toxicity

Uranium is a nephrotoxin (a kidney poision). Studies indicate that long term exposure may result in kidney impairment. While an LD_{50} of 70 mg/kg has been estimated for soluble uranium salts[Kathren and Burklin (2008)], but insoluble uranium compounds were found to be practically non-toxic, indicating LD_{50} for insoluble salts such as uranium peroxide hydrate should be much higher.

Chronic toxicity

There is no data available

Irritation/Corrosion

Skin : There is no data available

Eyes : There is no data available

Respiratory : There is no data available

Sensitizer

Skin : There is no data available

Respiratory : There is no data available

Carcinogenicity

Classification

Product/ingredient name	ACGIH	IARC	EPA	NIOSH	NTP	OSHA
Uranium peroxide hydrate	A1	-	-	+	-	-

Mutagenicity

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

Teratogenicity

There is no data available

Reprodcutive toxicity

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

IDLH : 10 mg U/m³

12. Ecological information

Ecotoxicity :

Aquatic ecotoxicity

Green algae LOEC 70-170 µg/L; mussels EC_{50} 380- 600 µg/L (Warne et al. 2009)

Persistence/degradability

Sediments act as sinks for insoluble uranium compounds.

13. Disposal considerations

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

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

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

14. Transport information

Regulatory information	UN number	Proper shipping name	Classes	PG*	Label	Additional information

DOT Classification	UN2912	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-1) (non fissile or fissile excepted)	7	-		
TDG Classification	UN2912	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-1) (non fissile or fissile excepted)	7	-		
IMDG Class	UN2912	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-1) (non fissile or fissile excepted)	7	-		Emergency schedules (EmS) F-1, S-S
IATA-DGR Class	UN2912	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-1) (non fissile or fissile excepted)	7	-		

PG*: Packing group Exemptions to the above classification may apply. AERG : 162

15. Regulatory information

United States

HCS Classification	:	Toxic material Carcinogen Target organ effects
U.S. Federal regulations	:	TSCA 8(a) CDR Exempt/Partial exemption: Not determined United States Inventory (TSCA8b): Not determined
Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs)	:	Not listed
Clean Air Act Section 602 Class I Substances	:	Not listed
DEA List II Chemicals (Precursor Chemicals)	:	Not listed
DEA List II Chemicals (Essential Chemicals)	:	Not listed

SARA 302/304
Composition/information on ingredients

No products were found

SARA 304 RQ : Not applicable

SARA 311/312

Classification : Not applicable

Composition/information on ingredients

No products were found.

State regulations

Massachusetts : This material is not listed

New York : This material is not listed

New Jersey : This material is not listed

Pennsylvania : This material is not listed

California Prop. 65 : No products were found

Canada

WHMIS(Canada) : Class D-1B: Material causing immediate and serious toxic effects (Toxic)
Class D-2A: Material causing other toxic effects (Very Toxic)

Canadian lists

Canadian NPRI : This material is not listed.

Canadian ARET : This material is not listed.

CEPA Toxic substances : This material is not listed.

Alberta Designated Substances : This material is not listed.

Ontario Designated Substances : This material is not listed.

Quebec Designated Substances : This material is not listed.

Canada Inventory : This material is listed or exempted.

International regulations

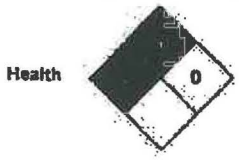
International lists : Australia inventory (AICS): Not determined.
China inventory (IECSC): Not determined.
Japan inventory: Not determined.
Korea inventory: Not determined.
Malaysia Inventory (EHS Register): Not determined.
New Zealand Inventory of Chemicals (NZIoC): Not determined. Philippines inventory (PICCS): Not determined.
Taiwan inventory (CSNN): Not determined.

16. Other information

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

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

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

National Fire Protection Association (U.S.A) : 

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Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

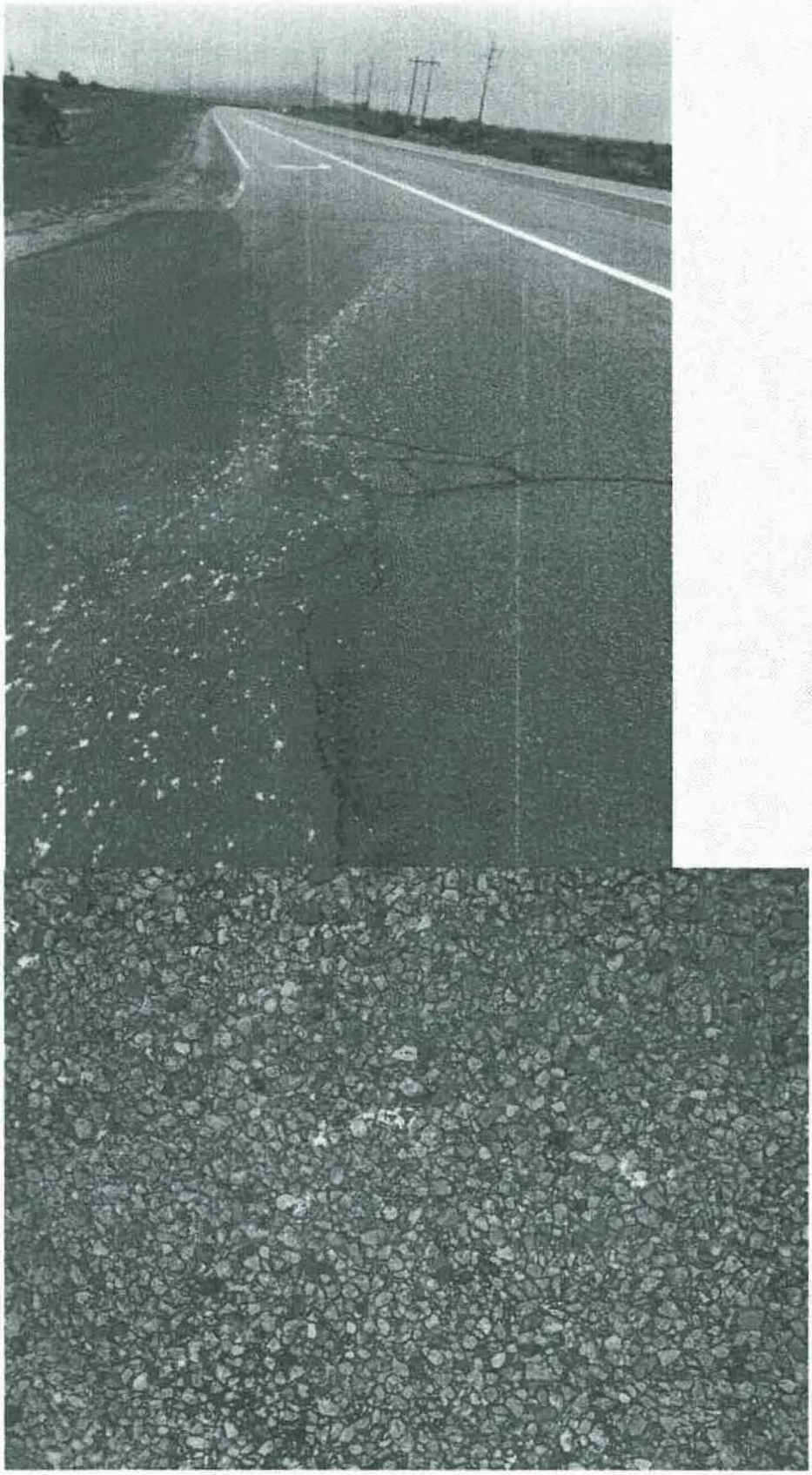
History

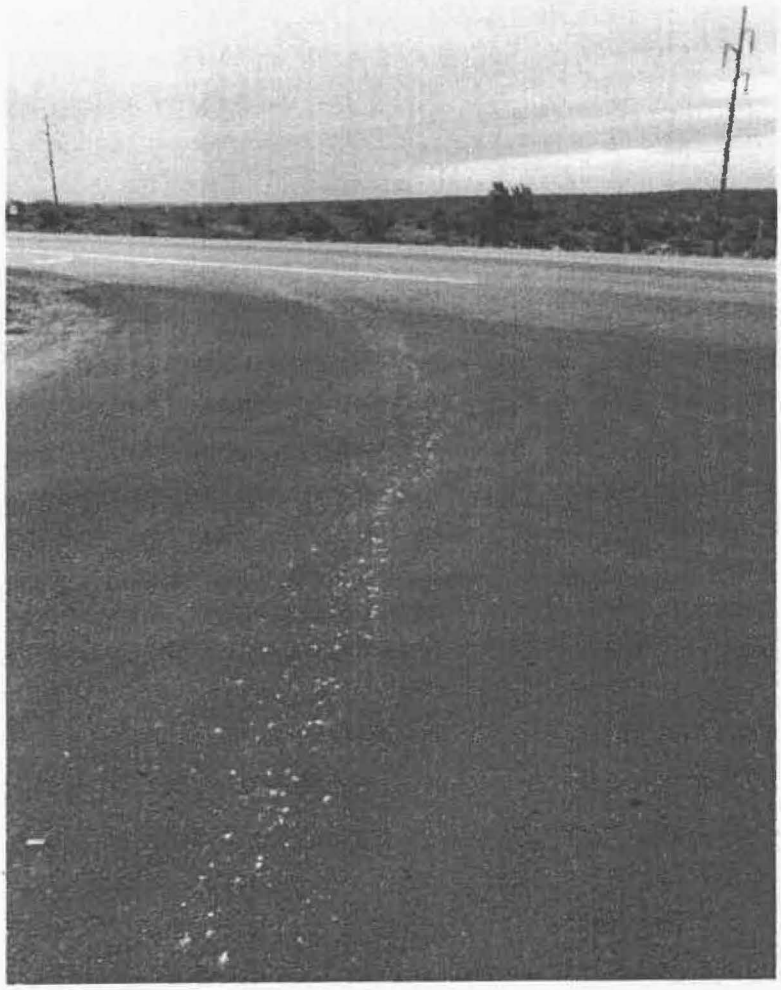
Date of Issue	:	01 October 2015
Date of previous issue	:	12 December 2013
Version	:	3
Revised Section(s)	:	2, 16

Notice to reader

To the best of our knowledge the information contained herein is accurate. However, neither the above named supplier, no any of the subsidiaries assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

MSDSpro



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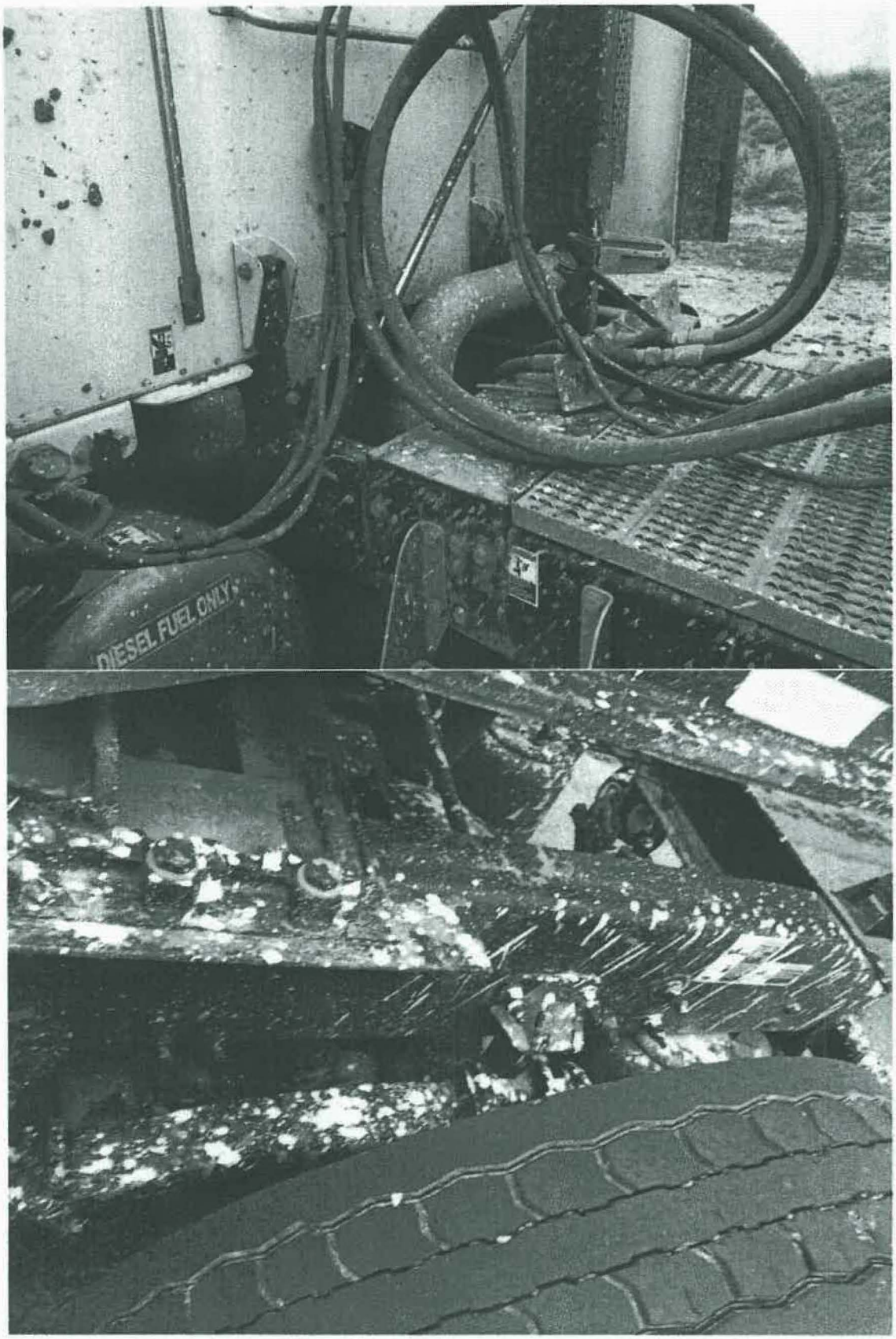
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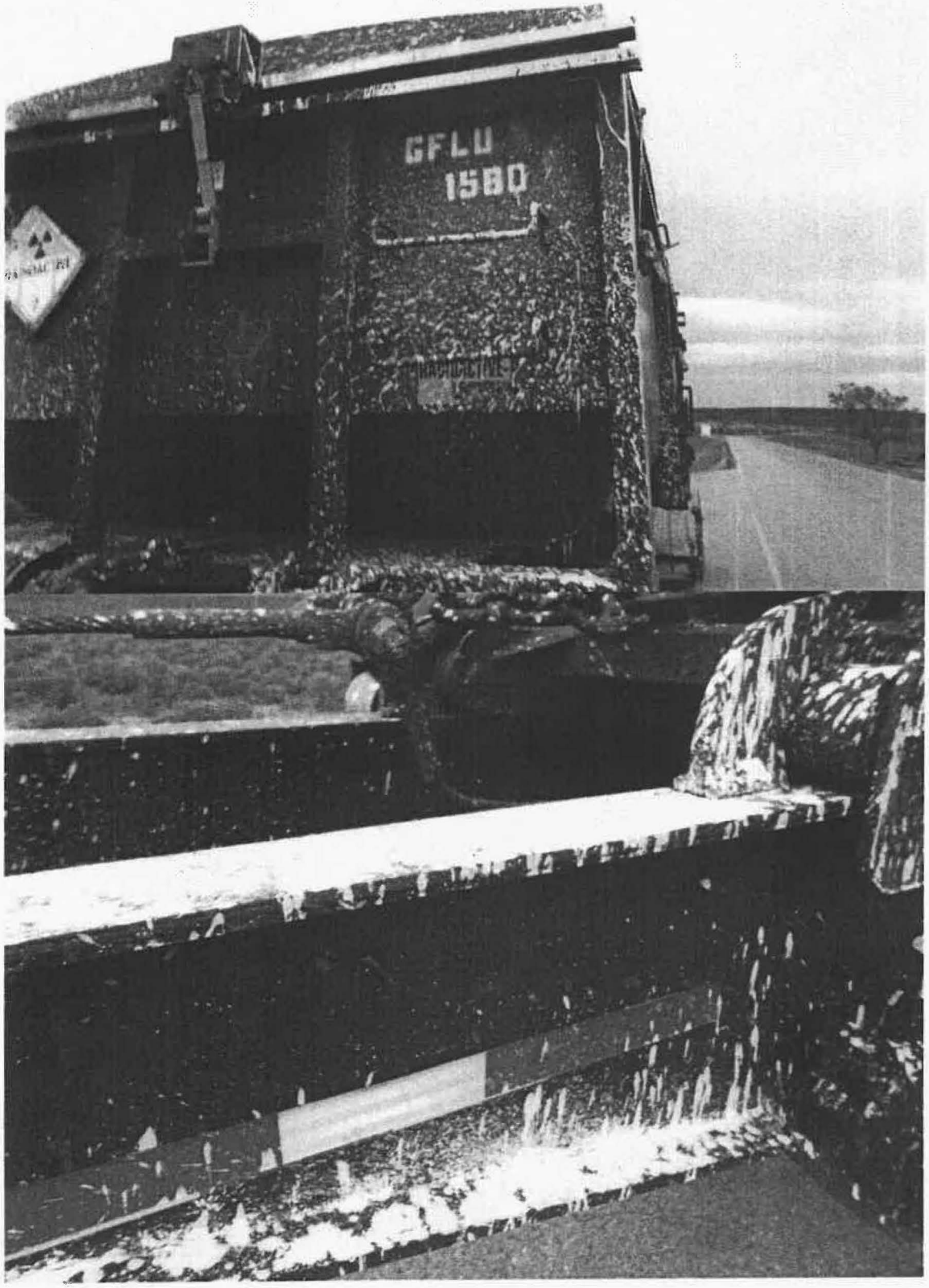
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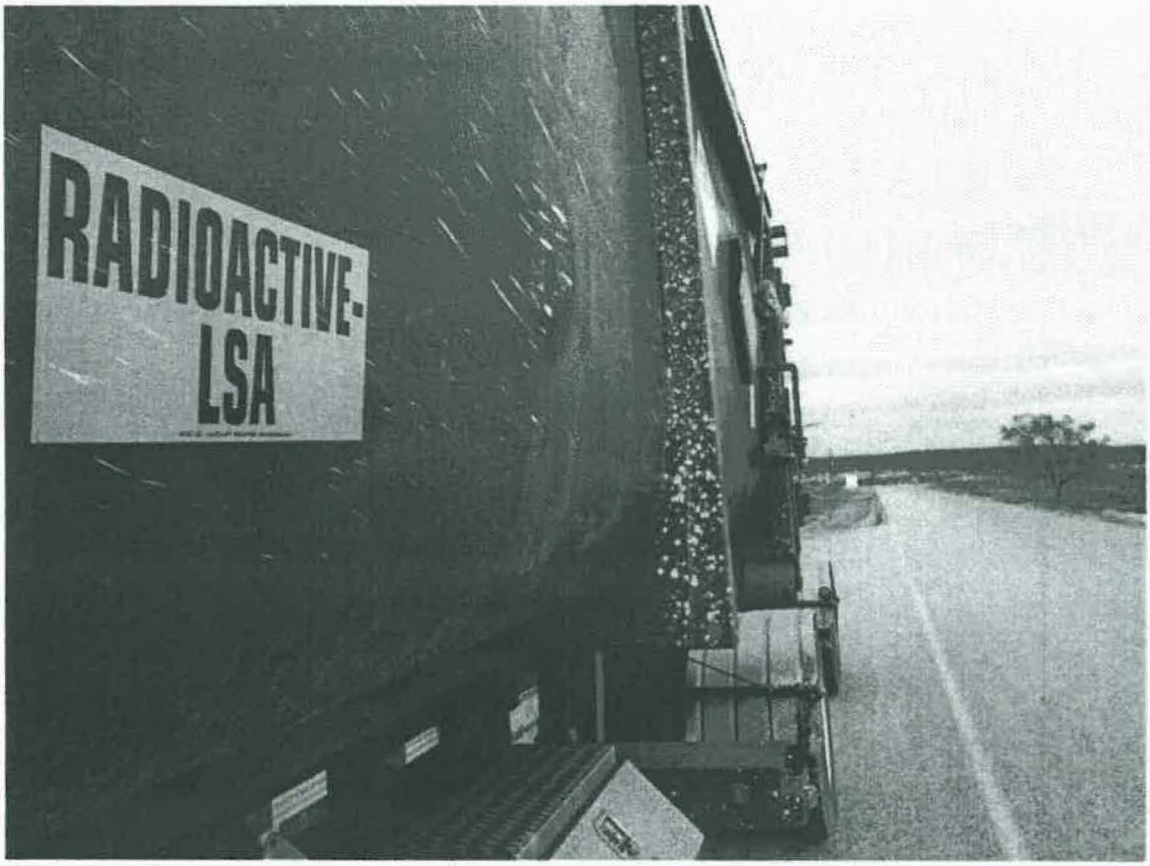
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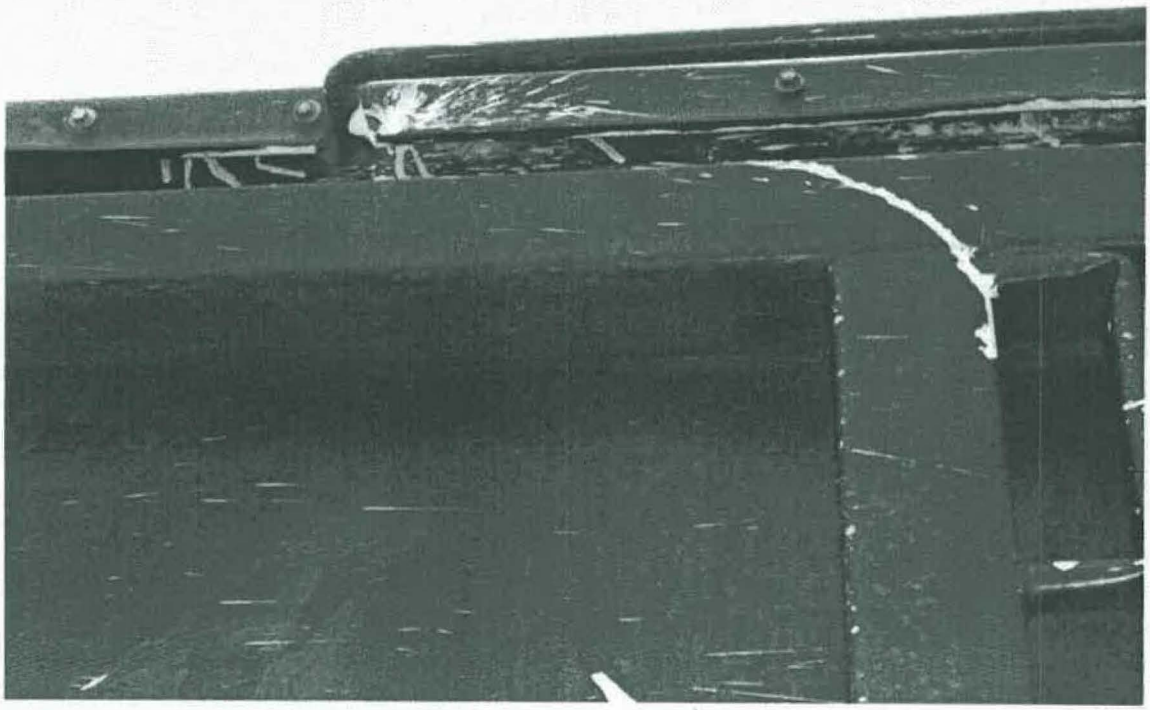

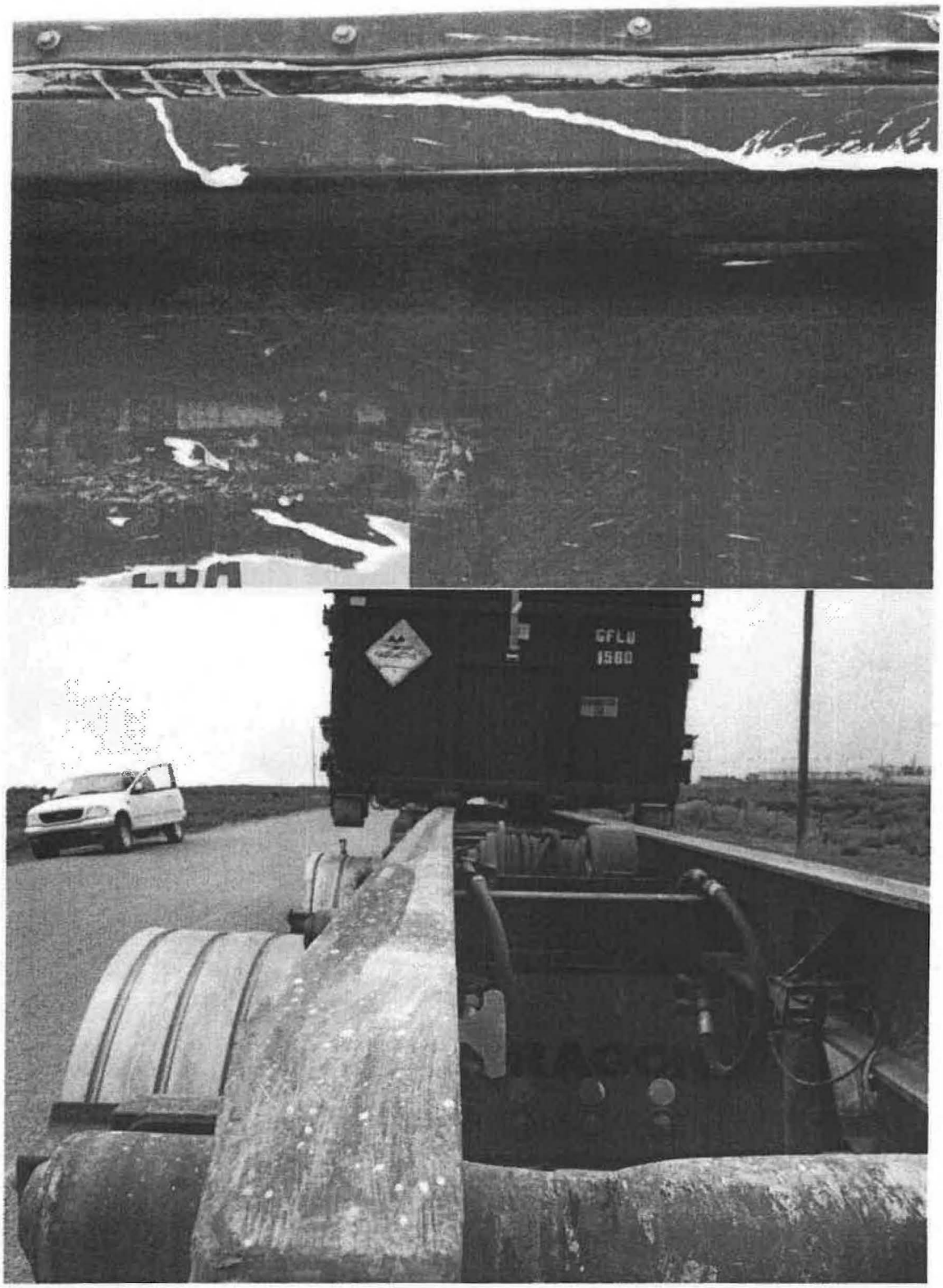
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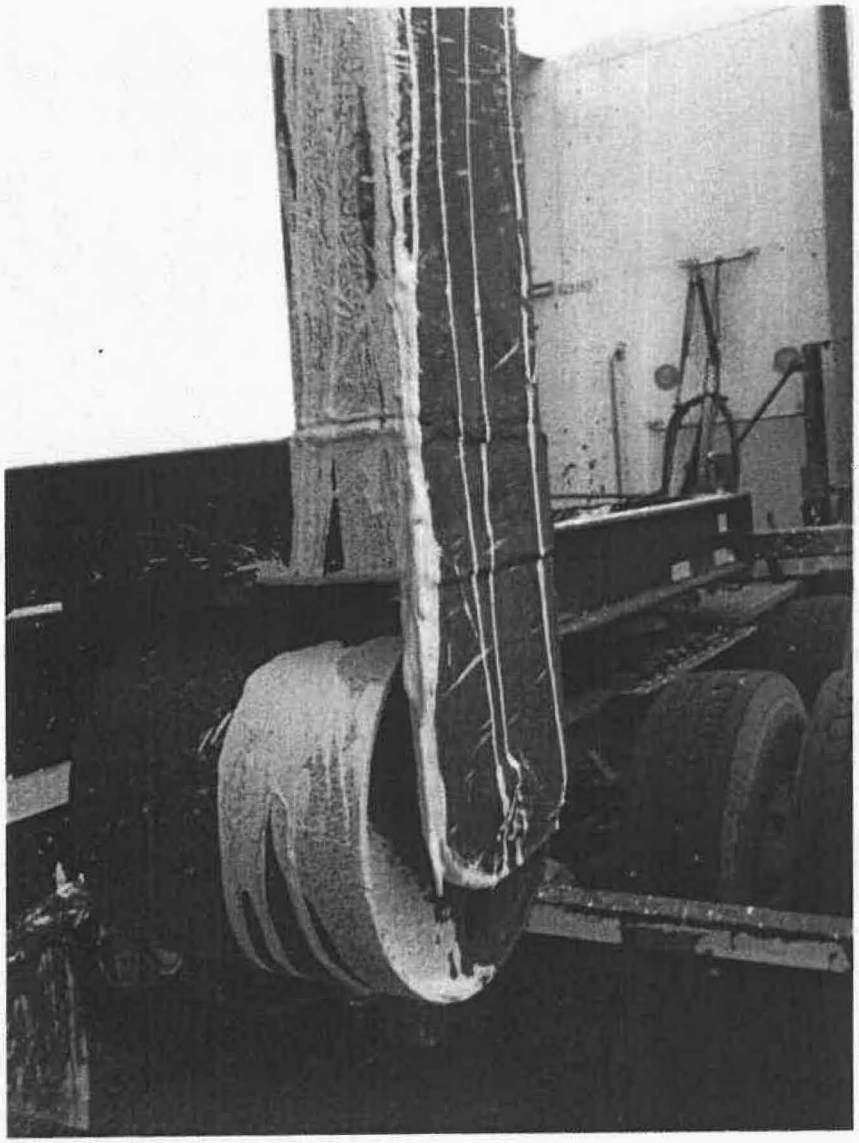

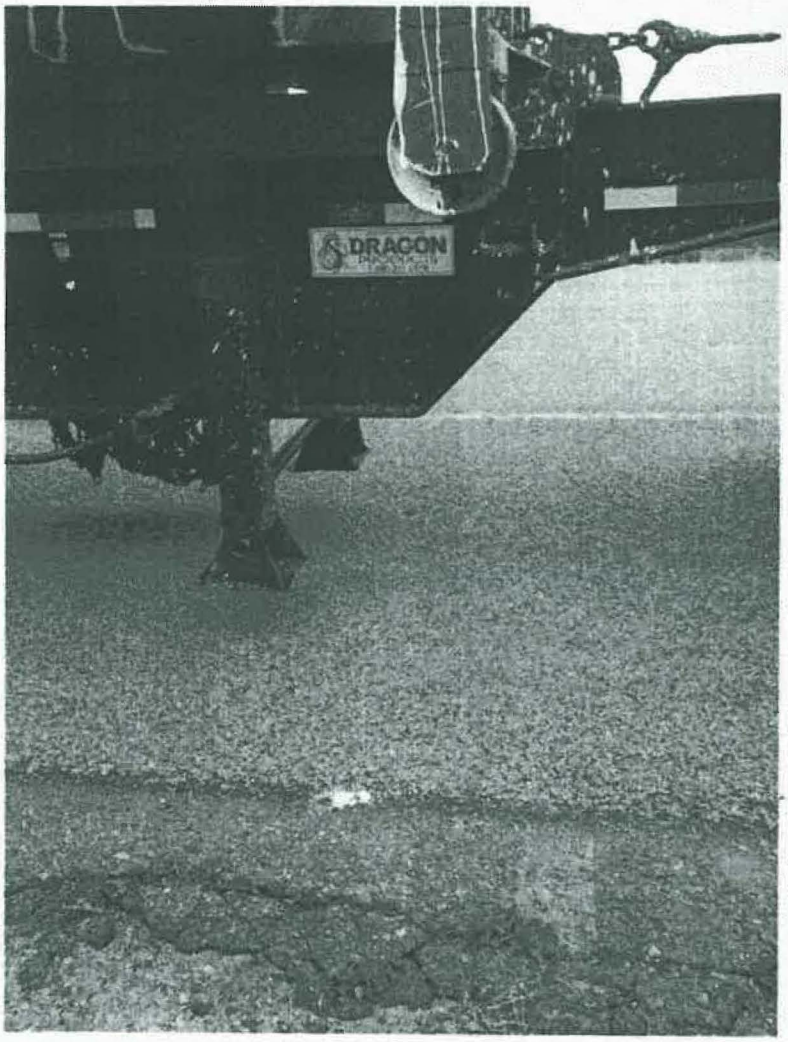
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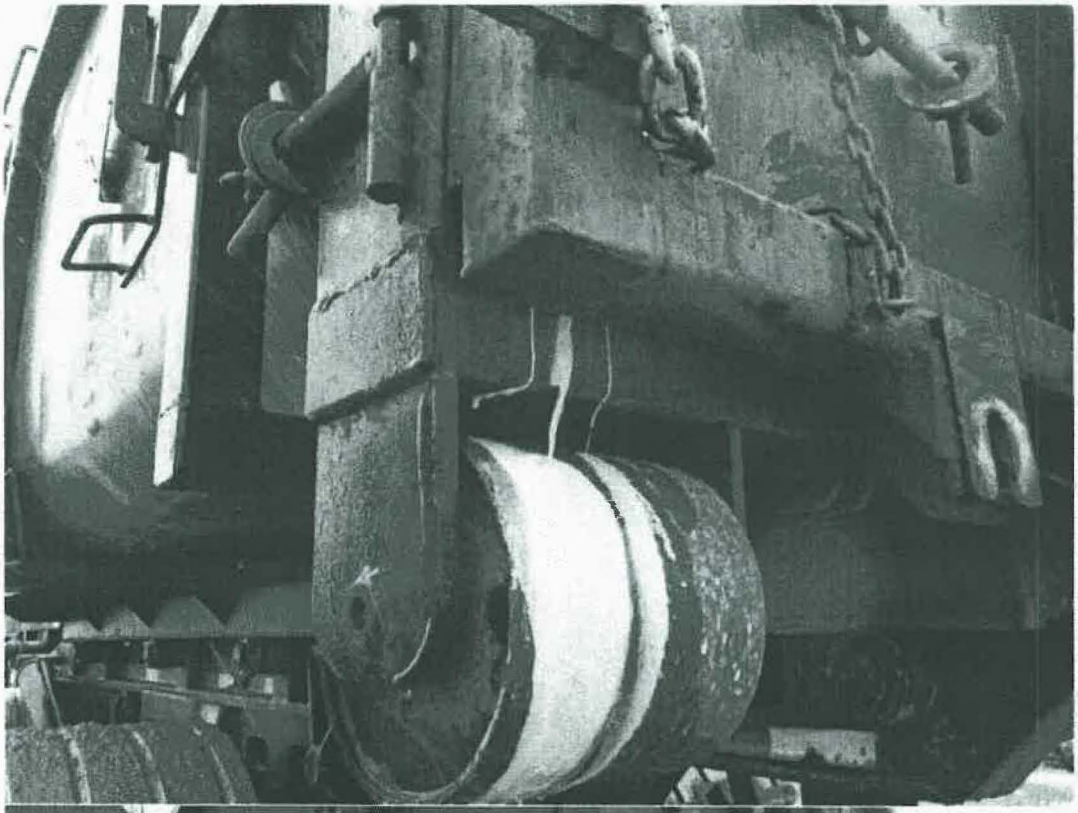

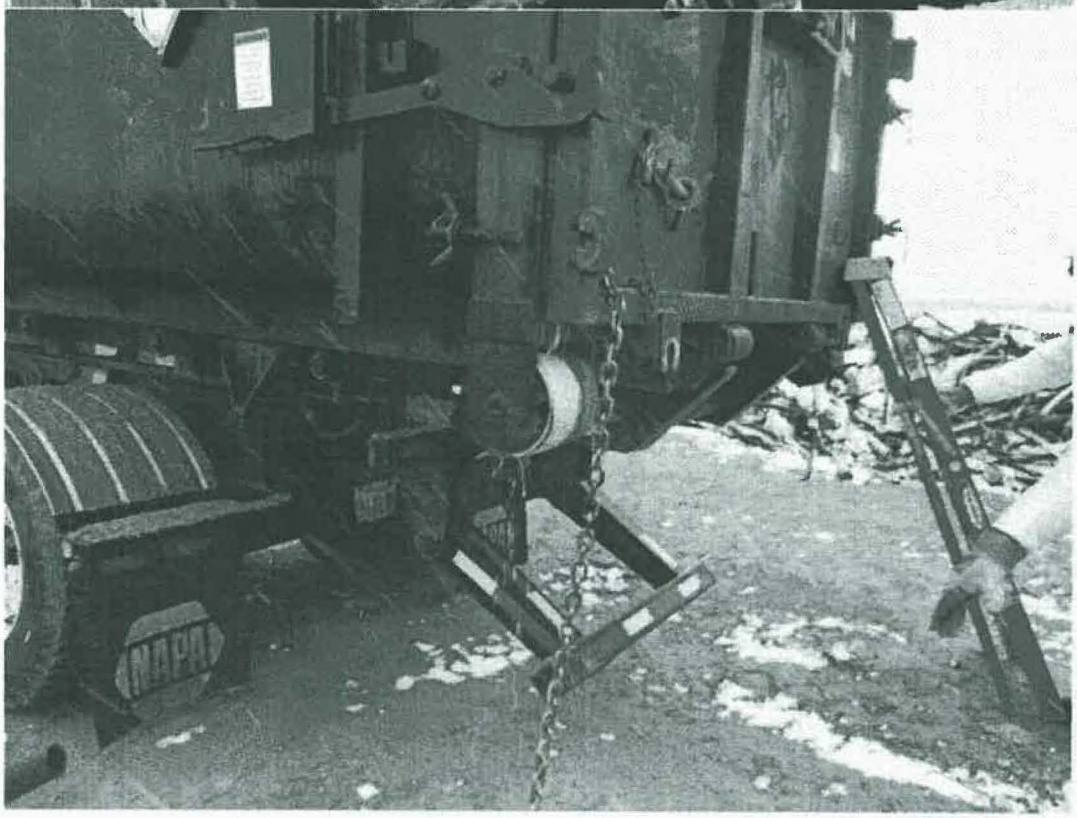
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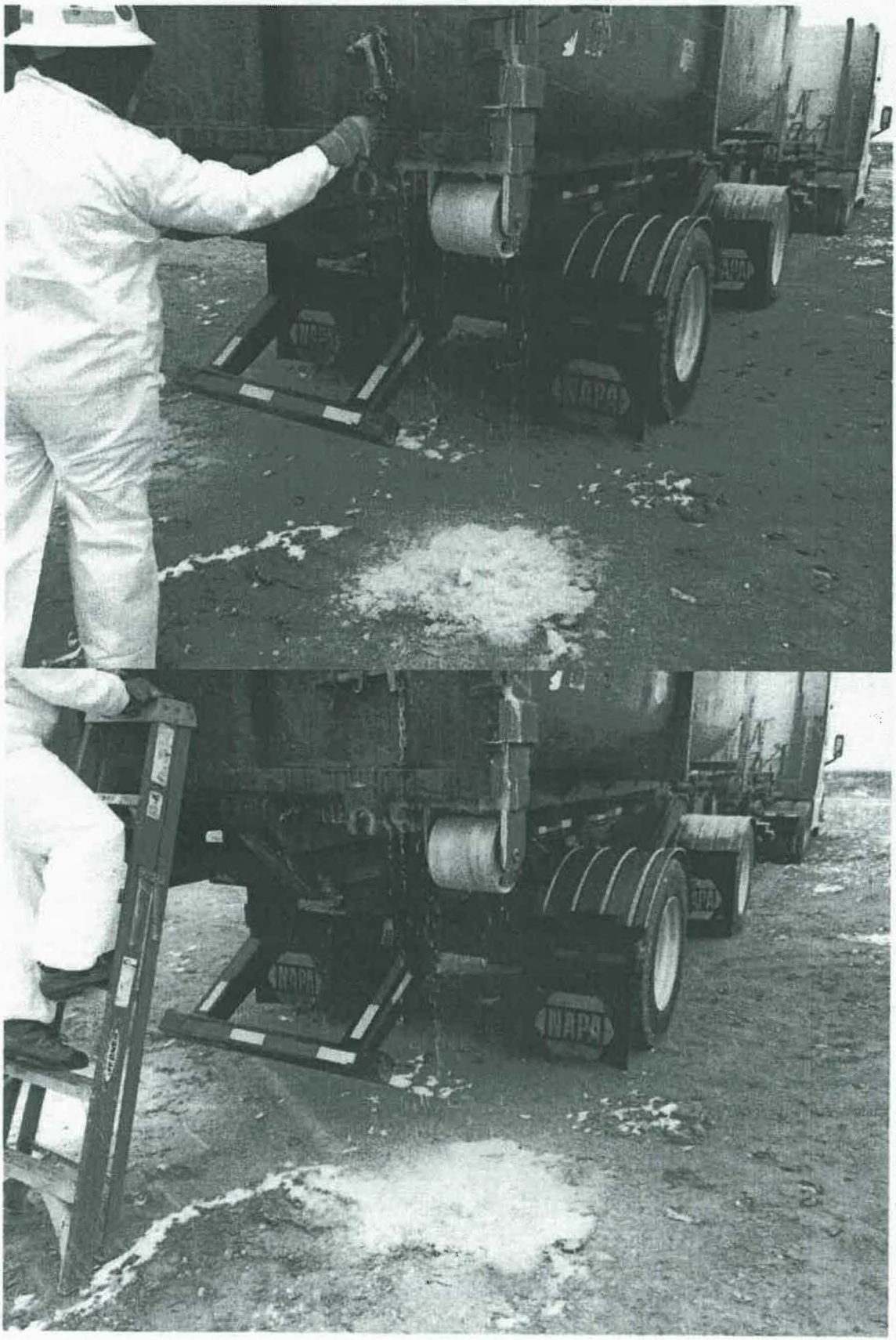
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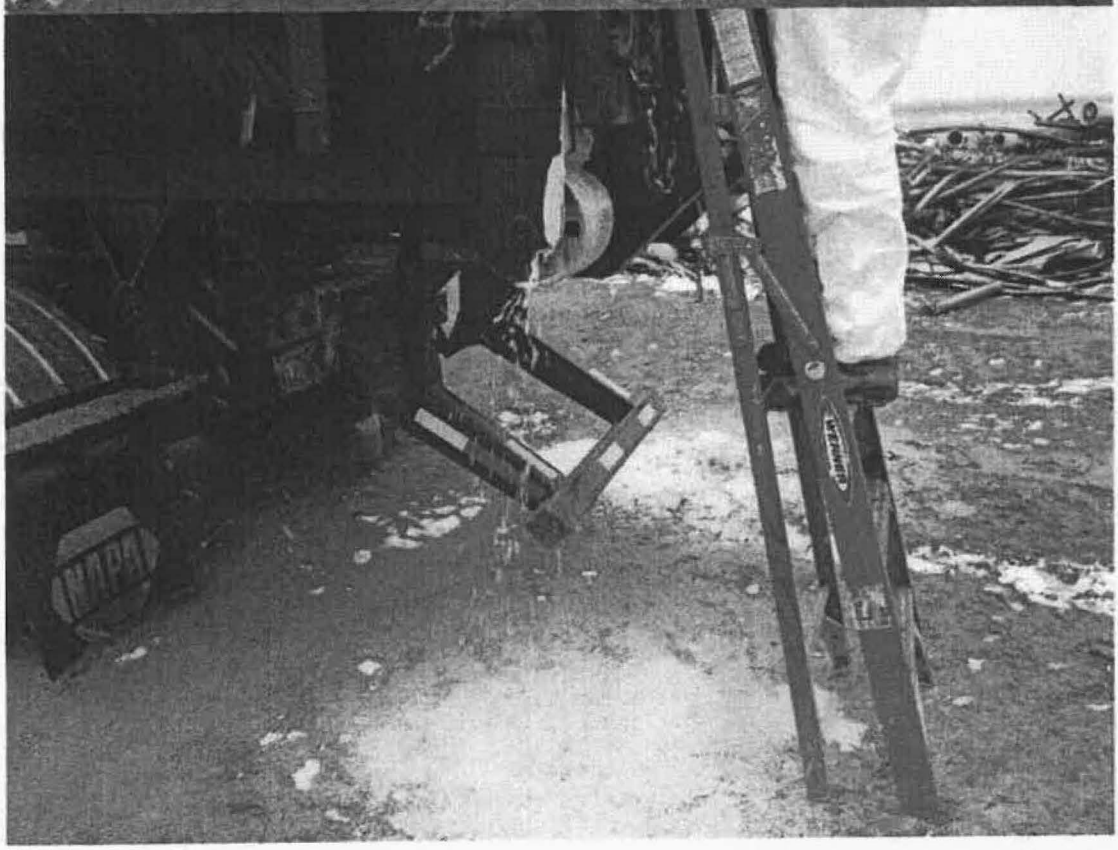
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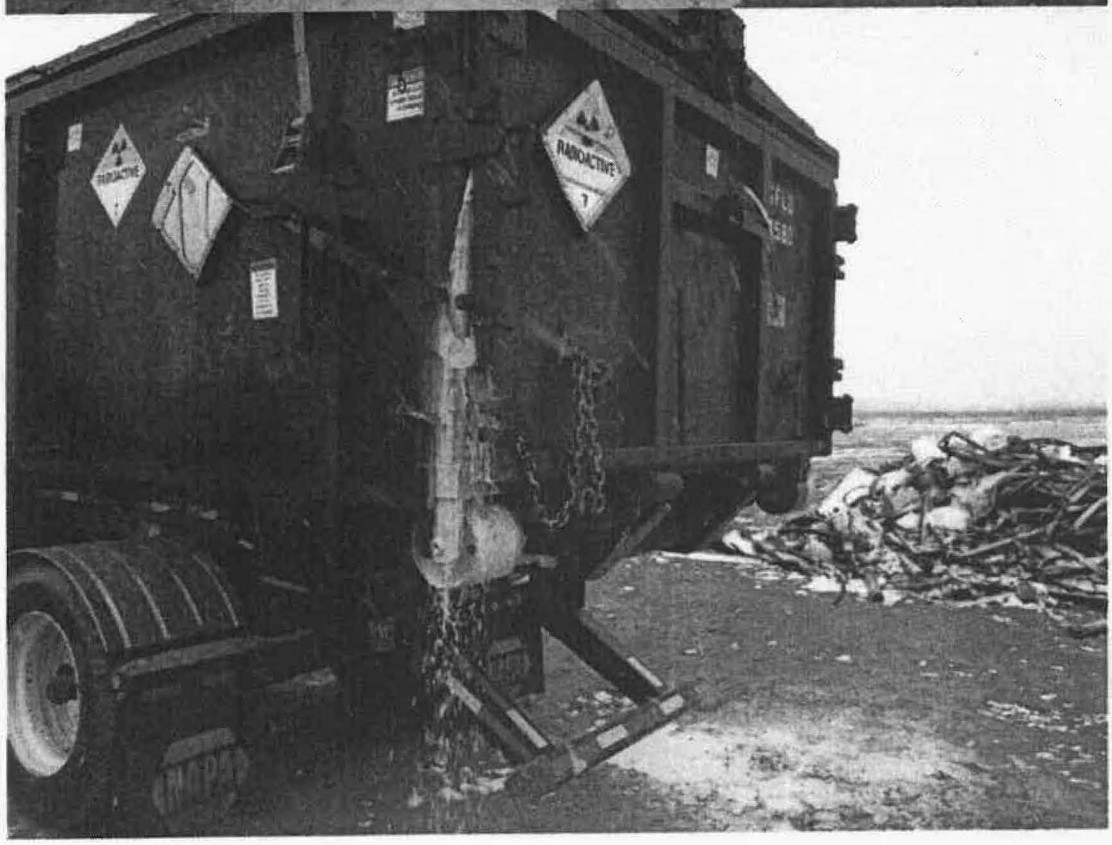
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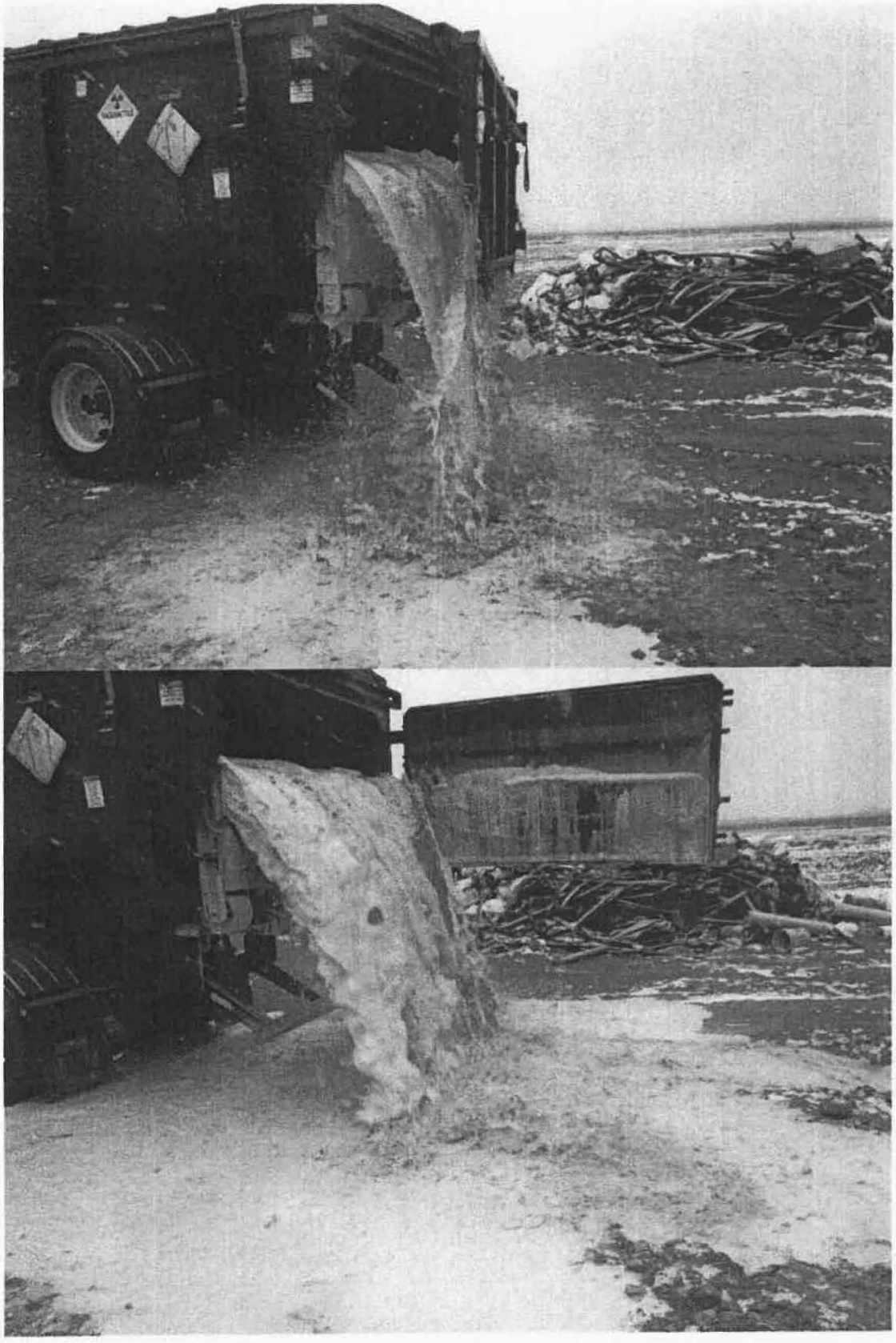

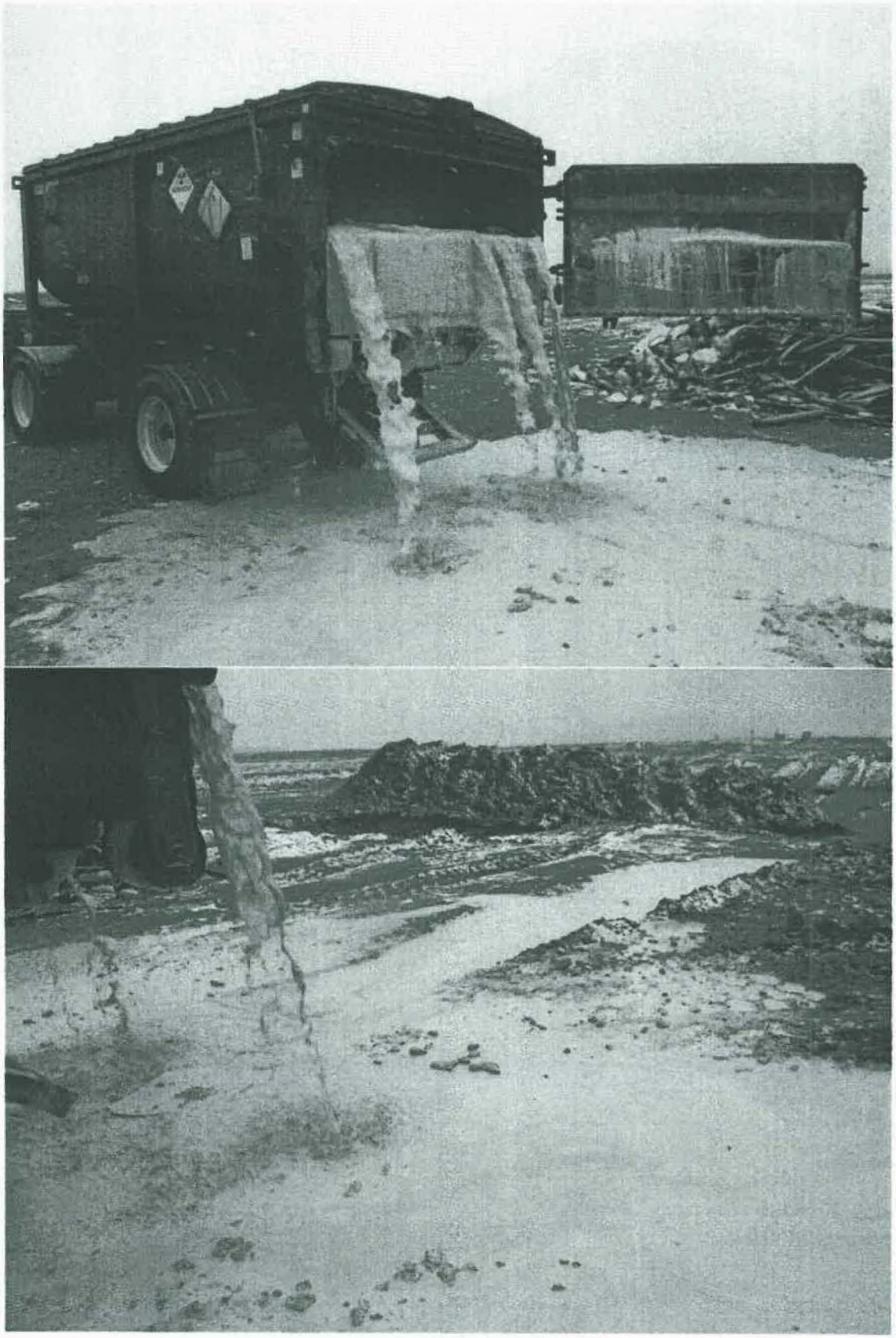

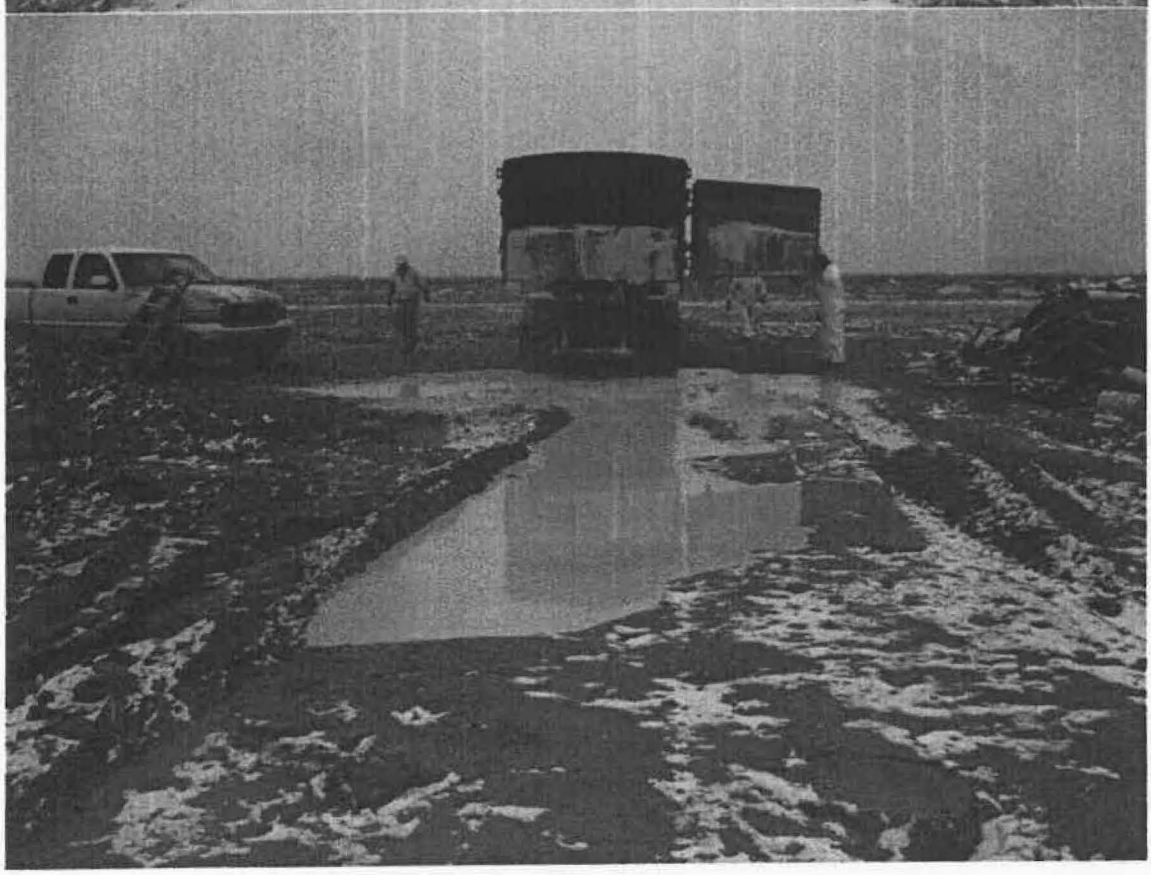

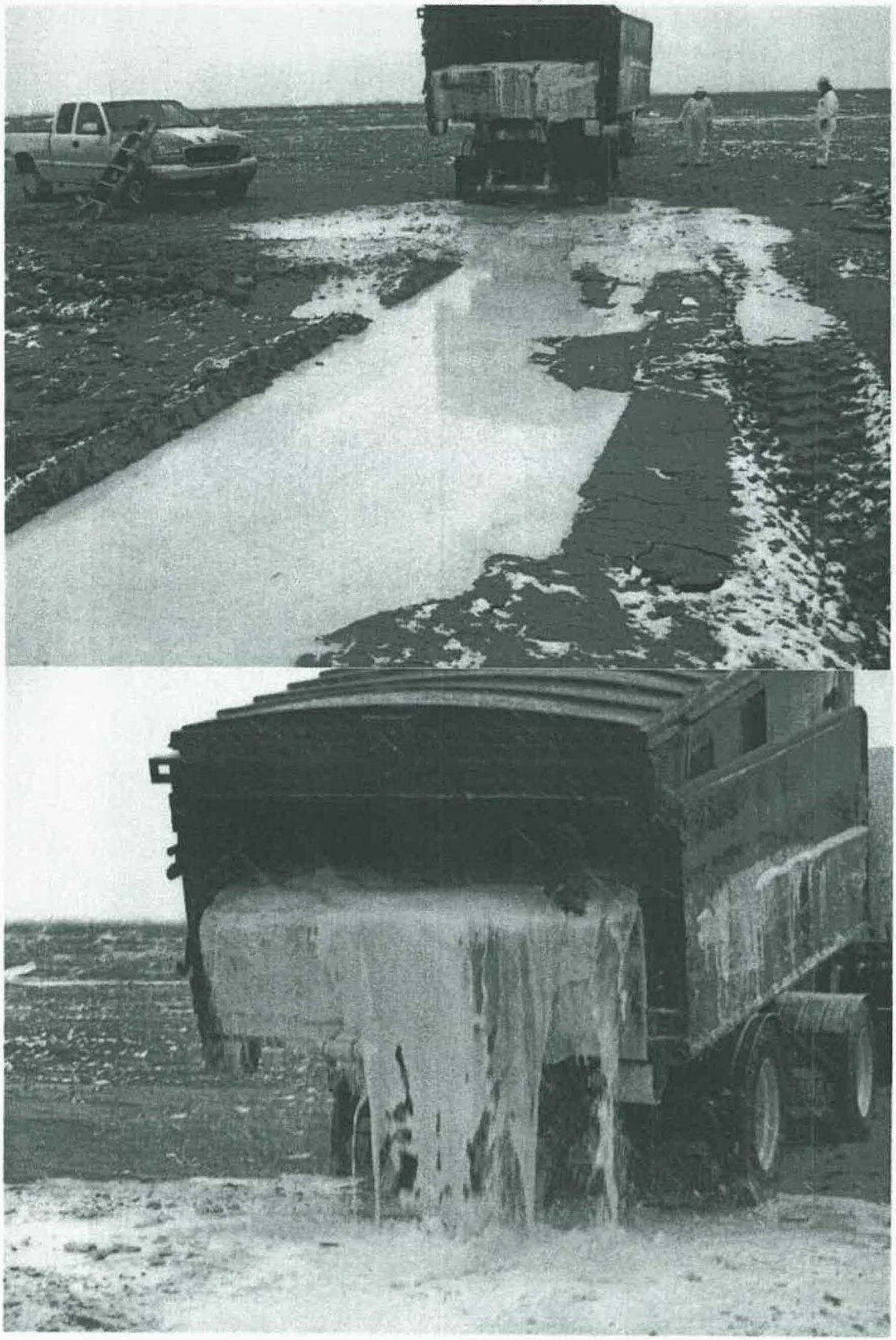

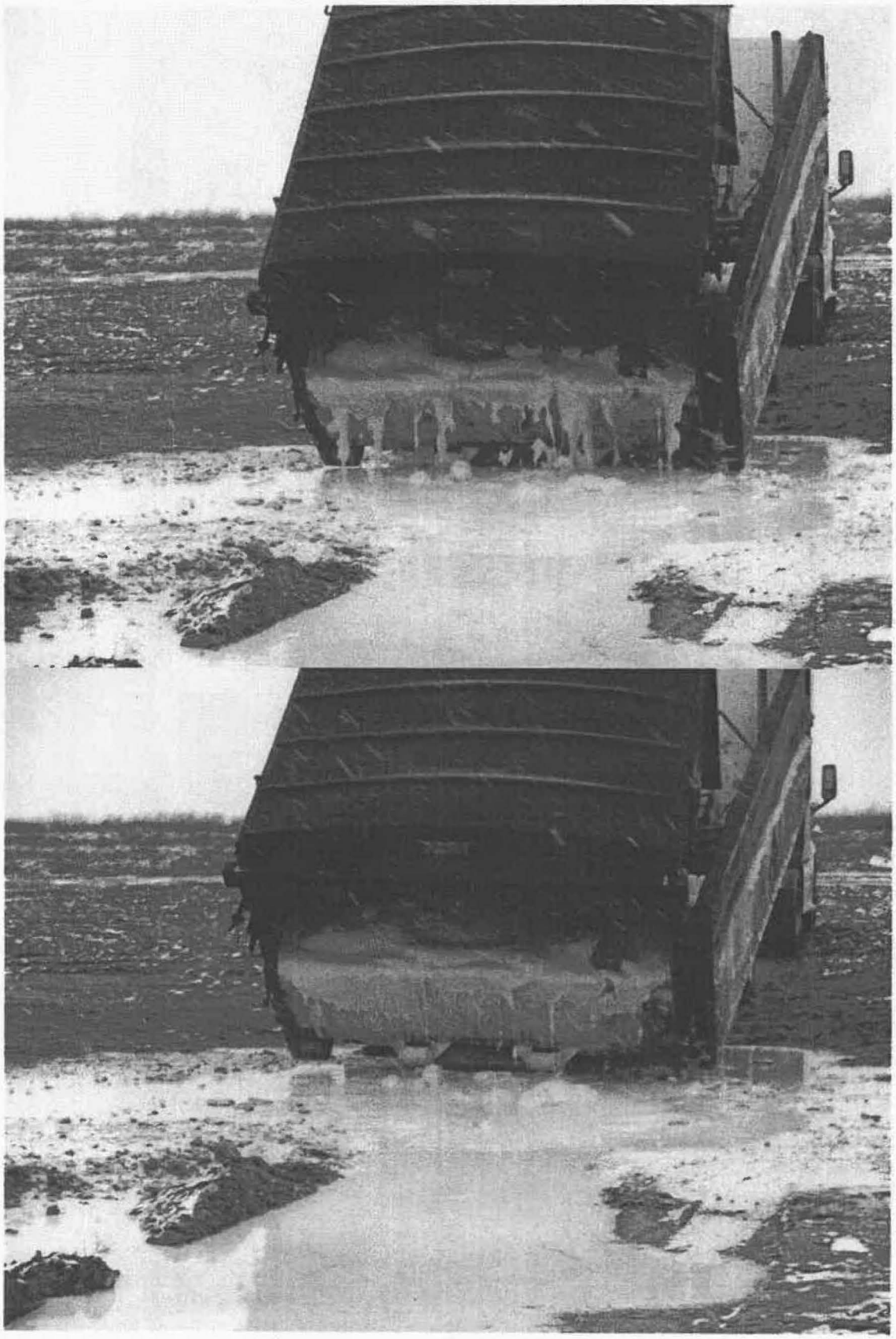

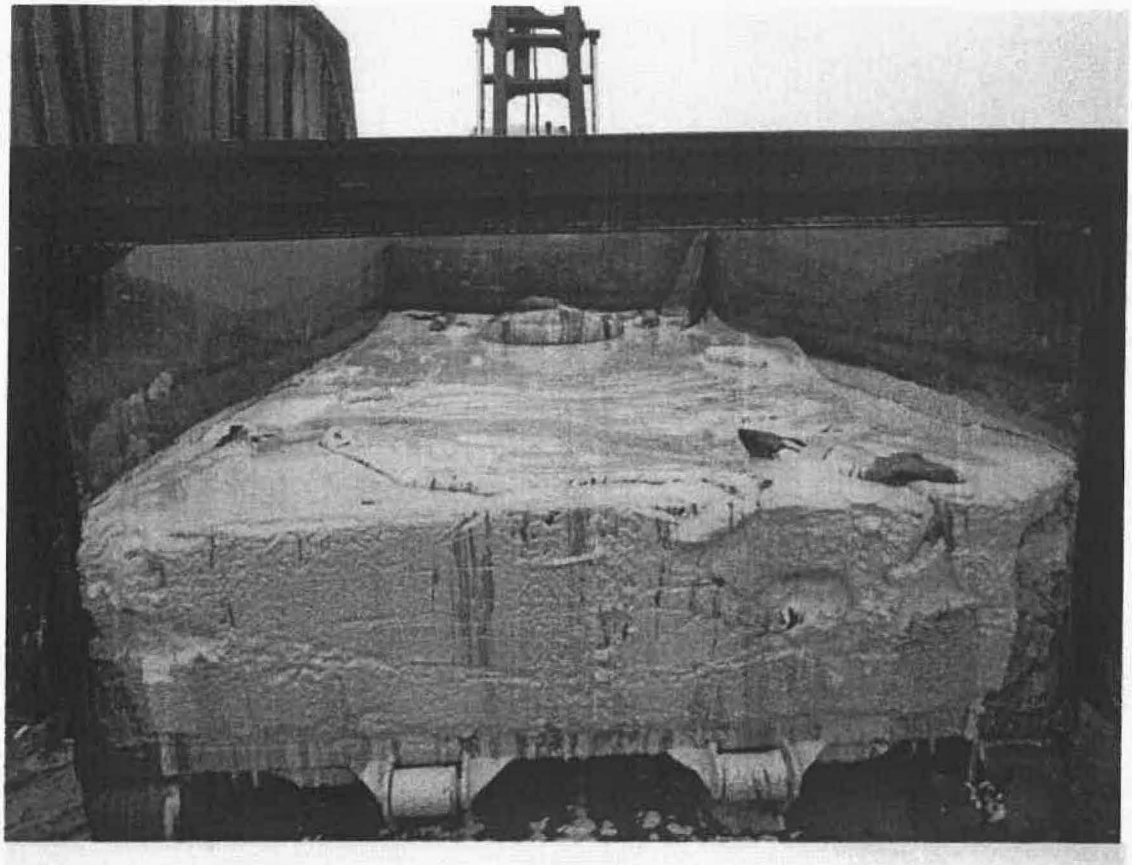


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