LANL MLU Truck Shipment Surveys Document

Date: 10/26/2021

To: Kelly Wohlwend, LANL MLU Team Lead

From: Amber Allardice, SNL RP Project Lead (TA-5)

Subject: MLU Truck Shipment Surveys

The following SNL document contains requested radiological survey information, as part of the documentation for the LANL MLU shipment performed by the LANL MLU team the week of October 18th. The surveys were performed in TA-5 October 19th – 21st, 2021. The surveys were for the official shipments of 4 loaded TRUPACTs and 2 empty TRUPACTs. Surveys were completed after the trucks were hitched to their respective trailers.

- LANL MLU Shipment Survey (Trailer #370): I-20211019-12
- LANL MLU Shipment Survey (Trailer #329): I-20211019-13

All information contained was completed, reviewed, and approved by SNL RP personnel, and is intended for receipt and use by the LANL MLU Team and DOT personnel at their discretion.

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Radiological Survey Report

Survey I-20211019-12

General Information

Title: LANL MLU Shipment Suvery (Trailer #370)

Survey Date/Time: 10/19/2021 06:00

Lead Surveyor: Bowman, Brian

Location: 6593/Outside

Work Order/Task #: N/A

TWD or RTWD #: SPRF-RTWD-027, Rev.O

Purpose: Shipping

Requestor Org: 01381

Status: Approved by: Walton, Edward, 10/21/2021

Ready for Review by: Bowman, Brian, 10/21/2021

Additional Surveyors

Surveyor
Rollins, Andrew

Instruments Used

#	Instrument Model	Instrument Serial #	Inst Type	Probe Model	Probe Serial #	Probe Type	Calibration Date	Efficiency β/γ	Efficiency α
1	RO20	12310	D	N/A	N/A	D	1/10/2022	N/A	N/A
2	RADEYE PX	10367	D	NRD	2214	D	1/10/2022	N/A	N/A
3	3030	276345	C	43-10-1	113586	C	12/10/2021	0.21	0.31
4	3030	276345	C	43-10-1	113586	C	12/10/2021	0.21	0.31

Instruments Used - Notes

#	Notes
1	BKGD = <0.1 mR/hr
2	BKGD = <0.1 mrem/hr
3	BKGD CPM (a/B) = 0/41 (used on 10/19/21)
4	BKGD CPM (a/B) = 0/45 (used on 10/21/21)

Radiological Survey Report

Comments:

DOT shipment survey of trailer containing three TRUPACT containers.

Shipment #: SALA210001
Truck Plate #: TN H4347HY
Trailer Plate #: E201224T

Shipment survey started on 10/19/21 and completed on 10/21/21.

Trailer #370 contains TRUPACT containers #134, 207, and 208.

TRUPACT container #208 is empty.

Radionuclides of Concern:
Fission Products: Zr, Nb, Mo, Tc, Ru, Rh, Te
Transuranics: Isotopes of Pu

Contamination Limits:
20dpm/100cm2 (alpha), 200dpm/100cm2 (beta-gamma)

Swipes counted using the 30-30.
30-30 MDA sheets are attahced.

All swipes read below removable contamination limits.

Attachments:
1.) MLU Trailer Shipment Survey Diagram
2.) 30-30 MDA Sheet (19OCT21) Used for swipes 1-18
3) 30-30 MDA Sheet (21OCT21) Used for swipes 23-25

Itemized Details - Items

#	Item Location/Description	Comments
1	Back Left Tire	
2	TRUPACT #208	
3	TRUPACT #207	
4	TRUPACT #134	
5	Truck Bed- Left Side	
6	Truck Bed- Left Side	
7	Truck Bed- Left Side	
8	Truck Bed- Left Side	
9	Truck Bed- Left Side	
10	Truck Bed- Right Side	
11	Truck Bed- Right Side	
12	Truck Bed- Right Side	
13	Truck Bed- Right Side	
14	Truck Bed- Right Side	
15	TRUPACT #208	
16	TRUPACT #207	
17	TRUPACT #134	
18	Back Right Tire	
19	Trailer Front	Dose rate survey only.
20	Trailer Back	Dose rate survey only.
21	Trailer Top	Dose rate survey only.
22	Trailer Bottom	Dose rate survey only.
23	Truck Cab- Floorboard	
24	Truck Cab- Steering Wheel	
25	Truck Cab- Driver Seat	

Beta-Gamma Activity

Counting Data Attached: ☐ Yes ☑ No
Eff. for Removable: **Inst:** 3 **Eff:** 0.21
Eff. for Total: **Inst:** N/A **Eff:** N/A

Radionuclide: Cs-137
Default Bkg Value: 41
Default Bkg Units: cpm/100cm2

#	Data	Data Units	Bkg.	Bkg. Units	T/R	Activity	Activity Units
1	39	cpm/100 cm2	41	cpm/100 cm2	R	***ND***	dpm/100 cm2
2	32	cpm/100 cm2	41	cpm/100 cm2	R	***ND***	dpm/100 cm2
3	35	cpm/100 cm2	41	cpm/100 cm2	R	***ND***	dpm/100 cm2
4	36	cpm/100 cm2	41	cpm/100 cm2	R	***ND***	dpm/100 cm2
5	40	cpm/100 cm2	41	cpm/100 cm2	R	***ND***	dpm/100 cm2
6	29	cpm/100 cm2	41	cpm/100 cm2	R	***ND***	dpm/100 cm2
7	32	cpm/100 cm2	41	cpm/100 cm2	R	***ND***	dpm/100 cm2
8	47	cpm/100 cm2	41	cpm/100 cm2	R	***28.6***	dpm/100 cm2
9	52	cpm/100 cm2	41	cpm/100 cm2	R	***52.4***	dpm/100 cm2
10	31	cpm/100 cm2	41	cpm/100 cm2	R	***ND***	dpm/100 cm2
11	24	cpm/100 cm2	41	cpm/100 cm2	R	***ND***	dpm/100 cm2
12	38	cpm/100 cm2	41	cpm/100 cm2	R	***ND***	dpm/100 cm2
13	31	cpm/100 cm2	41	cpm/100 cm2	R	***ND***	dpm/100 cm2
14	43	cpm/100 cm2	41	cpm/100 cm2	R	***9.5***	dpm/100 cm2
15	33	cpm/100 cm2	41	cpm/100 cm2	R	***ND***	dpm/100 cm2
16	52	cpm/100 cm2	41	cpm/100 cm2	R	***52.4***	dpm/100 cm2
17	31	cpm/100 cm2	41	cpm/100 cm2	R	***ND***	dpm/100 cm2
18	37	cpm/100 cm2	41	cpm/100 cm2	R	***ND***	dpm/100 cm2
23	37	cpm/100 cm2	45	cpm/100 cm2	R	***ND***	dpm/100 cm2
24	36	cpm/100 cm2	45	cpm/100 cm2	R	***ND***	dpm/100 cm2
25	30	cpm/100 cm2	45	cpm/100 cm2	R	***ND***	dpm/100 cm2

Alpha Activity

Counting Data Attached: ☐ Yes ☑ No
Eff. for Removable: **Inst:** 3 **Eff:** 0.31
Eff. for Total: **Inst:** N/A **Eff:** N/A

Radionuclide: Pu-239
Default Bkg Value: 0
Default Bkg Units: cpm/100cm2

#	Data	Data Units	Bkg.	Bkg. Units	T/R	Activity	Activity Units
1	0	cpm/100 cm2	0	cpm/100 cm2	R	***ND***	dpm/100 cm2
2	0	cpm/100 cm2	0	cpm/100 cm2	R	***ND***	dpm/100 cm2
3	0	cpm/100 cm2	0	cpm/100 cm2	R	***ND***	dpm/100 cm2
4	0	cpm/100 cm2	0	cpm/100 cm2	R	***ND***	dpm/100 cm2
5	1	cpm/100 cm2	0	cpm/100 cm2	R	***3.2***	dpm/100 cm2
6	0	cpm/100 cm2	0	cpm/100 cm2	R	***ND***	dpm/100 cm2
7	1	cpm/100 cm2	0	cpm/100 cm2	R	***3.2***	dpm/100 cm2
8	0	cpm/100 cm2	0	cpm/100 cm2	R	***ND***	dpm/100 cm2
9	0	cpm/100 cm2	0	cpm/100 cm2	R	***ND***	dpm/100 cm2
10	0	cpm/100 cm2	0	cpm/100 cm2	R	***ND***	dpm/100 cm2
11	0	cpm/100 cm2	0	cpm/100 cm2	R	***ND***	dpm/100 cm2
12	0	cpm/100 cm2	0	cpm/100 cm2	R	***ND***	dpm/100 cm2
13	1	cpm/100 cm2	0	cpm/100 cm2	R	***3.2***	dpm/100 cm2
14	2	cpm/100 cm2	0	cpm/100 cm2	R	***6.5***	dpm/100 cm2
15	2	cpm/100 cm2	0	cpm/100 cm2	R	***6.5***	dpm/100 cm2
16	1	cpm/100 cm2	0	cpm/100 cm2	R	***3.2***	dpm/100 cm2
17	0	cpm/100 cm2	0	cpm/100 cm2	R	***ND***	dpm/100 cm2
18	0	cpm/100 cm2	0	cpm/100 cm2	R	***ND***	dpm/100 cm2
23	0	cpm/100 cm2	0	cpm/100 cm2	R	***ND***	dpm/100 cm2
24	0	cpm/100 cm2	0	cpm/100 cm2	R	***ND***	dpm/100 cm2
25	2	cpm/100 cm2	0	cpm/100 cm2	R	***6.5***	dpm/100 cm2

Radiation Survey

Background: <0.1
Background Units: mR/hr
Radiation Type: Gamma

#	Radiation Type	Reading	Units	Distance From Source	Comment
5	Gamma	<0.1	mR/hr	OC/1m/2m	Dose rate consistient at all distances measured.
10	Gamma	<0.1	mR/hr	OC/1m/2m	Dose rate consistient at all distances measured.
19	Gamma	<0.1	mR/hr	OC/1m/2m	Dose rate consistient at all distances measured.
20	Gamma	<0.1	mR/hr	OC/1m/2m	Dose rate consistient at all distances measured.
21	Gamma	<0.1	mR/hr	OC	Distances of 1m and 2m not accessible due to height of trailer/load.
22	Gamma	<0.1	mR/hr	OC/1m	Distance of 1m was on ground under trailer. 2m reading not accessible.
23	Gamma	<0.1	mR/hr	GA	Dose rate in all areas of the truck cab.

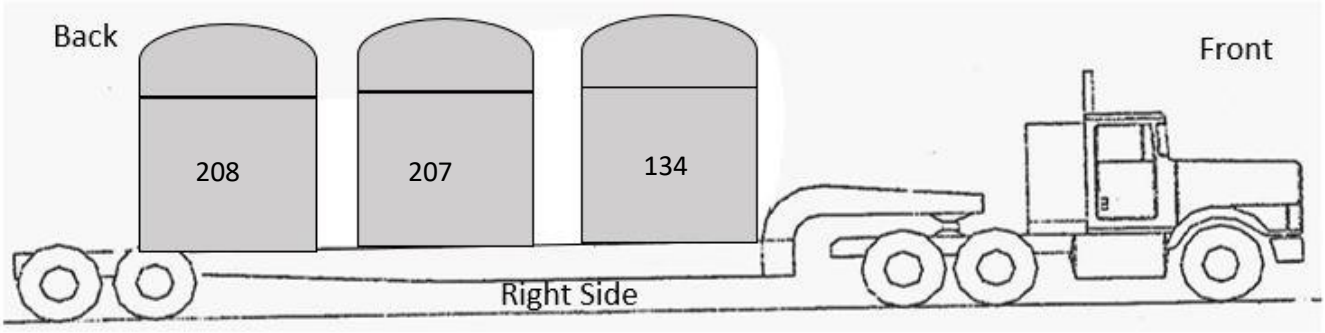
Additional Radiation Survey

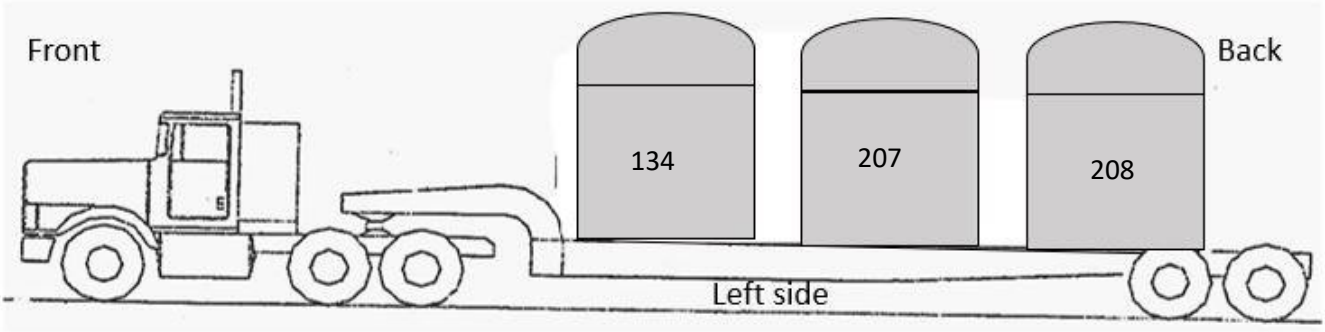
Background: <0.1
Unit: mrem/hr
Radiation Type: Neutron

#	Radiation Type	Reading	Units	Distance From Source	Comment
5	Neutron	<0.1	mrem/hr	OC/1m/2m	Dose rate consistient at all distances measured.
10	Neutron	<0.1	mrem/hr	OC/1m/2/m	Dose rate consistient at all distances measured.
19	Neutron	<0.1	mrem/hr	OC/1m/2m	Dose rate consistient at all distances measured.
20	Neutron	<0.1	mrem/hr	OC/1m/2m	Dose rate consistient at all distances measured.
21	Neutron	<0.1	mrem/hr	OC	Distances of 1m and 2m not accessible due to height of trailer/load.
22	Neutron	<0.1	mrem/hr	OC/1 m	Distance of 1m was on ground under trailer. 2m reading not accessible.
23	Neutron	<0.1	mrem/hr	GA	Dose rate in all areas of the truck cab.

Attachments

Order	Filename	Description	Pages
1	MLU Shipout Survey Diagram Trailer 370.pdf	MLU Shipout Survey Diagram	1
2	30-30 MDA Sheet LANL MLU Shipout Survey.pdf	30-30 MDA Sheet 19OCT21	1
3	30-30 MDA Sheet LANL Shipment I-20211019-12.pd	30-30 MDA Sheet 21OCT21	1





Notes: TRUPACT #208 is empty. Dose rates recorded on the front, back, left, right, top, and bottom are the highest detectable dose rates for that side/area. Dose rate survey performed in occupied areas of the cab.

LUDLUM 3030 MDA CALCULATION WORKSHEET

Instrument #: 276345 Calibration Expires: 12/10/21 Location: Bldg. 6593 / Outside

Probe Type: 43-10-1 Probe #: 113586

CALCULATION BY: Vanessa Molina **DATE:** 10/19/21

Expected Sample Radionuclide (α): Pu-239 α Detector Efficiency for expected radionuclide (cpd): 0.31 (Pu239)

Expected Sample Radionuclide (β): Cs-137 β Detector Efficiency for expected radionuclide (cpd): 0.21 (Cs137)

Background Count Time (min): 1 If background and sample count times are the same, use MDA calculation method 4.6.1.

Sample Count Time (min): 1 If background and sample count times are different then use MDA calculation method 4.6.2.

Daily check background count rate shall be used for MDA determination.

α 0 cpm β 41 cpm

Method 4.4.2:
Use when background and sample count times are the same.

$$MDA = \frac{2.71 + 4.65\sqrt{(R_b * t_b)}}{t_b * E}$$

Method 4.4.3:
Use when background and sample count times are different.

$$MDA = \frac{2.71 + 3.29\sqrt{(R_b * t_s)\left(1 + \frac{t_s}{t_b}\right)}}{t_s * E}$$

Where:

MDA = Minimum Detectable Activity level in dpm

R_b = Background count rate in counts per minute

t_s = Sample count time in minutes

t_b = Background count time in minutes

E = Detector efficiency (α or β) in counts per disintegration (cpd)

Instrument MDA Calculation Results	**Acceptable**	**MDA Acceptance Limits†** (from Table 6-1, RPPM)	
α MDA: 9	Y ☑ N ☐ N/A ☐	**Nuclide**	**dpm**
β MDA: 155	Y ☑ N ☐ N/A ☐		
		Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	20
		Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	200
		Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above. Includes mixed fission products containing Sr-90.	1000
		U-natural, U-235, U-238 and associated decay products	1000 (alpha)

†Assumes swipe area is 100 cm²

List Applicable Survey Number(s): ~~I-20111019-3~~ MB 10/19/21 I-20211019-3 I-20211019-12

REVIEWED BY: [signature] **DATE:** 10/19/2021

Radiation Protection Line Support Project Leader (or Designee)

LUDLUM 3030 MDA CALCULATION WORKSHEET

Instrument #: 278104 Calibration Expires: 2/10/22 Location: Bldg. 6593

Probe Type: 43-10-1 Probe #: 105184

CALCULATION BY: David Tafoya **DATE:** 10/21/21

Expected Sample Radionuclide (α):	Pu-239	α Detector Efficiency for expected radionuclide (cpd):	0.31 (Pu-239)
Expected Sample Radionuclide (β):	Cs-137	β Detector Efficiency for expected radionuclide (cpd):	0.21 (Cs-137)
Background Count Time (min):	1	If background and sample count times are the same, use MDA calculation method 4.6.1.	
Sample Count Time (min):	1	If background and sample count times are different then use MDA calculation method 4.6.2.	

Daily check background count rate shall be used for MDA determination.

α 0 cpm β 37 cpm

Method 4.4.2:
Use when background and sample count times are the same.

$$MDA = \frac{2.71 + 4.65\sqrt{(R_b * t_b)}}{t_b * E}$$

Method 4.4.3:
Use when background and sample count times are different.

$$MDA = \frac{2.71 + 3.29\sqrt{(R_b * t_s)\left(1 + \frac{t_s}{t_b}\right)}}{t_s * E}$$

Where:

MDA = Minimum Detectable Activity level in dpm

R_b = Background count rate in counts per minute

t_s = Sample count time in minutes

t_b = Background count time in minutes

E = Detector efficiency (α or β) in counts per disintegration (cpd)

Instrument MDA Calculation Results

α MDA : 9

β MDA: 148

Acceptable

Y ☑ N ☐ N/A ☐

Y ☑ N ☐ N/A ☐

MDA Acceptance Limits†
(from Table 6-1, RPPM)

Nuclide	dpm
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	20
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	200
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above. Includes mixed fission products containing Sr-90.	1000
U-natural, U-235, U-238 and associated decay products	1000 (alpha)

†Assumes swipe area is 100 cm^2

List Applicable Survey Number(s): I-20211019-12

REVIEWED BY: [signature] **DATE:** 10/21/2021

Radiation Protection Line Support Project Leader (or Designee)

Radiological Survey Report

Survey I-20211019-13

General Information

Title: LANL MLU Shipment Suvery (Trailer #329)

Survey Date/Time: 10/20/2021 06:00

Lead Surveyor: Bowman, Brian

Location: 6593/Outside

Work Order/Task #: N/A

TWD or RTWD #: SPRF-RTWD-027, Rev.O

Purpose: Shipping

Requestor Org: 01381

Status: Approved by: Walton, Edward, 10/21/2021

Ready for Review by: Bowman, Brian, 10/21/2021

Additional Surveyors

Surveyor
Rollins, Andrew

Instruments Used

#	Instrument Model	Instrument Serial #	Inst Type	Probe Model	Probe Serial #	Probe Type	Calibration Date	Efficiency β/γ	Efficiency α
1	RO20	12248	D	N/A	N/A	D	2/10/2022	N/A	N/A
2	RADEYE PX	10367	D	NRD	2214	D	1/10/2022	N/A	N/A
3	3030	276345	C	43-10-1	113586	C	12/10/2021	0.21	0.31
4	3030	276345	C	43-10-1	113586	C	12/10/2021	0.21	0.31

Instruments Used - Notes

#	Notes
1	BKGD = <0.1 mR/hr
2	BKGD = <0.1 mrem/hr
3	BKGD CPM (a/B) = 0/48 (used 10/20/2021)
4	BKGD CPM (a/B) = 0/45 (used 10/21/2021)

Comments:

DOT shipment survey of trailer containing three TRUPACT containers.

Shipment survey started on 10/20/21 and completed on 10/21/21.

Shipment #: SALA210002
Truck Plate #: TN H4349HY
Trailer Plate#: E28283T

Trailer #329 contains TRUPACT containers #171, 184, and 193.

TRUPACT container #193 is empty.

Radionuclides of Concern:
Fission Products: Zr, Nb, Mo, Tc, Ru, Rh, Te
Transuranics: Isotopes of Pu

Contamination Limits:
20dpm/100cm2 (alpha), 200dpm/100cm2 (beta-gamma)

Swipes counted using the 30-30.
30-30 MDA sheets are attahced.

All swipes read below removable contamination limits.

Attachments:
1.) MLU Trailer Shipout Survey Diagram
2.) 30-30 MDA Sheet (20OCT21) Used for swipes 1-18
3.) 30-30 MDA Sheet (21OCT21) Used for swipes 23-25

Itemized Details - Items

#	Item Location/Description	Comments
1	Back Left Tire	
2	TRUPACT #193	
3	TRUPACT #184	
4	TRUPACT #171	
5	Truck Bed/Trailer- Left Side	
6	Truck Bed/Trailer- Left Side	
7	Truck Bed/Trailer- Left Side	
8	Truck Bed/Trailer- Left Side	
9	Truck Bed/Trailer- Left Side	
10	Truck Bed/Trailer- Right Side	
11	Truck Bed/Trailer- Right Side	
12	Truck Bed/Trailer- Right Side	
13	Truck Bed/Trailer- Right Side	
14	Truck Bed/Trailer- Right Side	
15	TRUPACT #193	
16	TRUPACT #184	
17	TRUPACT #171	
18	Back Right Tire	
19	Trailer (Front)	Dose rate survey only.
20	Trailer (Back)	Dose rate survey only.
21	Top	Dose rate survey only.
22	Under Trailer	Dose rate survey only.
23	Truck Cab- Floorboard	
24	Truck Cab- Steering Wheel	
25	Truck Cab- Driver Seat	

Beta-Gamma Activity

Counting Data Attached: ☐ Yes ☑ No
Eff. for Removable: **Inst:** 3 **Eff:** 0.21
Eff. for Total: **Inst:** N/A **Eff:** N/A

Radionuclide: Cs-137
Default Bkg Value: 48
Default Bkg Units: cpm/100cm2

#	Data	Data Units	Bkg.	Bkg. Units	T/R	Activity	Activity Units
1	39	cpm/100 cm2	48	cpm/100 cm2	R	***ND***	dpm/100 cm2
2	32	cpm/100 cm2	48	cpm/100 cm2	R	***ND***	dpm/100 cm2
3	35	cpm/100 cm2	48	cpm/100 cm2	R	***ND***	dpm/100 cm2
4	36	cpm/100 cm2	48	cpm/100 cm2	R	***ND***	dpm/100 cm2
5	40	cpm/100 cm2	48	cpm/100 cm2	R	***ND***	dpm/100 cm2
6	29	cpm/100 cm2	48	cpm/100 cm2	R	***ND***	dpm/100 cm2
7	32	cpm/100 cm2	48	cpm/100 cm2	R	***ND***	dpm/100 cm2
8	47	cpm/100 cm2	48	cpm/100 cm2	R	***ND***	dpm/100 cm2
9	52	cpm/100 cm2	48	cpm/100 cm2	R	***19***	dpm/100 cm2
10	31	cpm/100 cm2	48	cpm/100 cm2	R	***ND***	dpm/100 cm2
11	24	cpm/100 cm2	48	cpm/100 cm2	R	***ND***	dpm/100 cm2
12	38	cpm/100 cm2	48	cpm/100 cm2	R	***ND***	dpm/100 cm2
13	31	cpm/100 cm2	48	cpm/100 cm2	R	***ND***	dpm/100 cm2
14	43	cpm/100 cm2	48	cpm/100 cm2	R	***ND***	dpm/100 cm2
15	33	cpm/100 cm2	48	cpm/100 cm2	R	***ND***	dpm/100 cm2
16	32	cpm/100 cm2	48	cpm/100 cm2	R	***ND***	dpm/100 cm2
17	31	cpm/100 cm2	48	cpm/100 cm2	R	***ND***	dpm/100 cm2
18	37	cpm/100 cm2	48	cpm/100 cm2	R	***ND***	dpm/100 cm2
23	43	cpm/100 cm2	45	cpm/100 cm2	R	***ND***	dpm/100 cm2
24	33	cpm/100 cm2	45	cpm/100 cm2	R	***ND***	dpm/100 cm2
25	38	cpm/100 cm2	45	cpm/100 cm2	R	***ND***	dpm/100 cm2

Alpha Activity

Counting Data Attached: ☐ Yes ☑ No
Eff. for Removable: **Inst:** 3 **Eff:** 0.31
Eff. for Total: **Inst:** N/A **Eff:** N/A

Radionuclide: Pu-239
Default Bkg Value: 0
Default Bkg Units: cpm/100cm2

#	Data	Data Units	Bkg.	Bkg. Units	T/R	Activity	Activity Units
1	0	cpm/100 cm2	0	cpm/100 cm2	R	***ND***	dpm/100 cm2
2	2	cpm/100 cm2	0	cpm/100 cm2	R	***6.5***	dpm/100 cm2
3	2	cpm/100 cm2	0	cpm/100 cm2	R	***6.5***	dpm/100 cm2
4	1	cpm/100 cm2	0	cpm/100 cm2	R	***3.2***	dpm/100 cm2
5	1	cpm/100 cm2	0	cpm/100 cm2	R	***3.2***	dpm/100 cm2
6	3	cpm/100 cm2	0	cpm/100 cm2	R	***9.7***	dpm/100 cm2
7	0	cpm/100 cm2	0	cpm/100 cm2	R	***ND***	dpm/100 cm2
8	2	cpm/100 cm2	0	cpm/100 cm2	R	***6.5***	dpm/100 cm2
9	0	cpm/100 cm2	0	cpm/100 cm2	R	***ND***	dpm/100 cm2
10	0	cpm/100 cm2	0	cpm/100 cm2	R	***ND***	dpm/100 cm2
11	0	cpm/100 cm2	0	cpm/100 cm2	R	***ND***	dpm/100 cm2
12	2	cpm/100 cm2	0	cpm/100 cm2	R	***6.5***	dpm/100 cm2
13	0	cpm/100 cm2	0	cpm/100 cm2	R	***ND***	dpm/100 cm2
14	0	cpm/100 cm2	0	cpm/100 cm2	R	***ND***	dpm/100 cm2
15	0	cpm/100 cm2	0	cpm/100 cm2	R	***ND***	dpm/100 cm2
16	0	cpm/100 cm2	0	cpm/100 cm2	R	***ND***	dpm/100 cm2
17	0	cpm/100 cm2	0	cpm/100 cm2	R	***ND***	dpm/100 cm2
18	0	cpm/100 cm2	0	cpm/100cm2	R	ND	dpm/100 cm2
23	0	cpm/100 cm2	0	cpm/100 cm2	R	***ND***	dpm/100 cm2
24	0	cpm/100 cm2	0	cpm/100 cm2	R	***ND***	dpm/100 cm2
25	0	cpm/100 cm2	0	cpm/100 cm2	R	***ND***	dpm/100 cm2

Radiation Survey

Background: <0.1
Background Units: mR/hr
Radiation Type: Gamma

#	Radiation Type	Reading	Units	Distance From Source	Comment
5	Gamma	<0.1	mR/hr	OC/1m/2m	Dose rate consistient at all distances measured.
10	Gamma	<0.1	mR/hr	OC/1m/2m	Dose rate consistient at all distances measured.
19	Gamma	<0.1	mR/hr	OC/1m/2m	Dose rate consistient at all distances measured.
20	Gamma	<0.1	mR/hr	OC/1m/2m	Dose rate consistient at all distances measured.
21	Gamma	<0.1	mR/hr	OC	Distances of 1m and 2m not accessible due to height of trailer/load.
22	Gamma	<0.1	mR/hr	OC/1m	Distance of 1m was on ground under trailer. 2m reading not accessible.
23	Gamma	<0.1	mR/hr	GA	Dose rates in occupied areas of the cab.

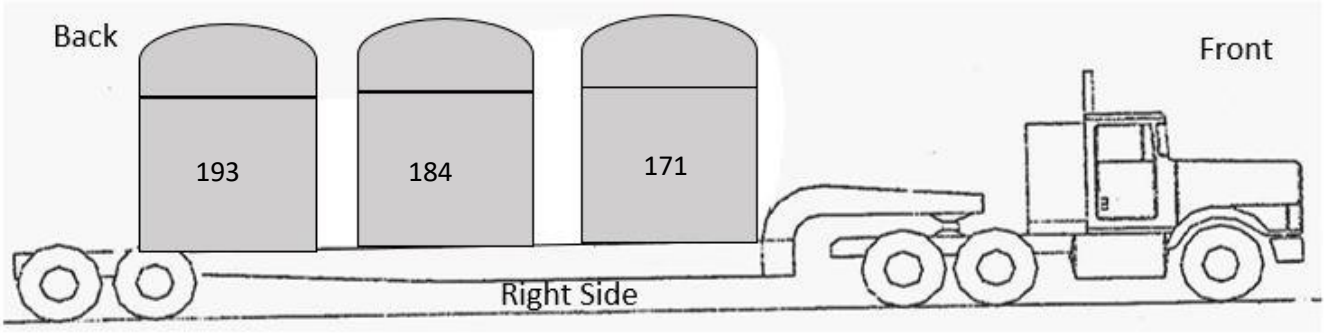
Additional Radiation Survey

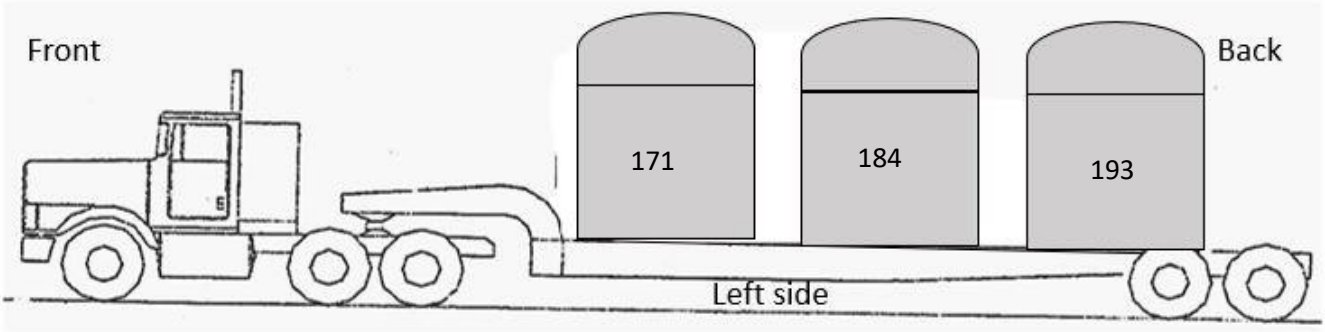
Background: <0.1
Unit: mrem/hr
Radiation Type: Neutron

#	Radiation Type	Reading	Units	Distance From Source	Comment
5	Neutron	<0.1	mrem/hr	OC/1m/2m	Dose rate consistient at all distances measured.
10	Neutron	<0.1	mrem/hr	OC/1m/2m	Dose rate consistient at all distances measured.
19	Neutron	<0.1	mrem/hr	OC/1m/2m	Dose rate consistient at all distances measured.
20	Neutron	<0.1	mrem/hr	OC/1m/2m	Dose rate consistient at all distances measured.
21	Neutron	<0.1	mrem/hr	OC	Distances of 1m and 2m not accessible due to height of trailer/load.
22	Neutron	<0.1	mrem/hr	OC/1m	Distance of 1m was on ground under trailer. 2m reading not accessible.
23	Neutron	<0.1	mrem/hr	GA	Dose rate survey in occupied areas of the cab.

Attachments

Order	Filename	Description	Pages
1	MLU Shipout Survey Diagram Trailer 329.pdf	MLU Shipout Survey Diagram	1
2	30-30 MDA MLU Shipout 20OCT21.pdf	30-30 MDA Sheet 20OCT21	1
3	30-30 MDA Sheet LANL Shipment I-20211019-13.pd	30-30 MDA Sheet 21OCT21	1





Notes: TRUPACT #193 is empty. Dose rates recorded on the front, back, left, right, top, and bottom are the highest detectable dose rates for that side/area. Dose rate survey performed in occupied areas of the cab.

LUDLUM 3030 MDA CALCULATION WORKSHEET

Instrument #: 276345 Calibration Expires: 12/10/21 Location: Bldg. 6593

Probe Type: 43-10-1 Probe #: 113586

CALCULATION BY: David Tafoya **DATE:** 10/20/21

Expected Sample Radionuclide (α):	Pu-239	α Detector Efficiency for expected radionuclide (cpd):	0.31 (Pu-239)
Expected Sample Radionuclide (β):	Cs-137	β Detector Efficiency for expected radionuclide (cpd):	0.21 (Cs-137)
Background Count Time (min):	1	If background and sample count times are the same, use MDA calculation method 4.6.1.	
Sample Count Time (min):	1	If background and sample count times are different then use MDA calculation method 4.6.2.	

Daily check background count rate shall be used for MDA determination.

α 0 cpm β 48 cpm

Method 4.4.2:
Use when background and sample count times are the same.

$$MDA = \frac{2.71 + 4.65\sqrt{(R_b * t_b)}}{t_b * E}$$

Method 4.4.3:
Use when background and sample count times are different.

$$MDA = \frac{2.71 + 3.29\sqrt{(R_b * t_s)\left(1 + \frac{t_s}{t_b}\right)}}{t_s * E}$$

Where:

MDA = Minimum Detectable Activity level in dpm

R_b = Background count rate in counts per minute

t_s = Sample count time in minutes

t_b = Background count time in minutes

E = Detector efficiency (α or β) in counts per disintegration (cpd)

Instrument MDA Calculation Results	Acceptable	MDA Acceptance Limits† (from Table 6-1, RPPM)	
		Nuclide	dpm
α MDA: 9	Y ☑ N ☐ N/A ☐	Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	20
β MDA: 167	Y ☑ N ☐ N/A ☐	Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	200
		Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above. Includes mixed fission products containing Sr-90.	1000
		U-natural, U-235, U-238 and associated decay products	1000 (alpha)

†Assumes swipe area is 100 cm²

List Applicable Survey Number(s): I-20211019-4 I-20211019-12 I-20211019-13

REVIEWED BY: [signature] **DATE:** 10/20/2021

Radiation Protection Line Support Project Leader (or Designee)

LUDLUM 3030 MDA CALCULATION WORKSHEET

Instrument #: 276345 Calibration Expires: 12/10/21 Location: Bldg. 6593

Probe Type: 43-10-1 Probe #: 113586

CALCULATION BY: David Tafoya **DATE:** 10/21/21

Expected Sample Radionuclide (α):	Pu-239	α Detector Efficiency for expected radionuclide (cpd):	0.31 (Pu-239)
Expected Sample Radionuclide (β):	Cs-137	β Detector Efficiency for expected radionuclide (cpd):	0.21 (Cs-137)
Background Count Time (min):	1	If background and sample count times are the same, use MDA calculation method 4.6.1.	
Sample Count Time (min):	1	If background and sample count times are different then use MDA calculation method 4.6.2.	

Daily check background count rate shall be used for MDA determination.

α 0 cpm β 45 cpm

Method 4.4.2:
Use when background and sample count times are the same.

$$MDA = \frac{2.71 + 4.65\sqrt{(R_b * t_b)}}{t_b * E}$$

Method 4.4.3:
Use when background and sample count times are different.

$$MDA = \frac{2.71 + 3.29\sqrt{(R_b * t_s)\left(1 + \frac{t_s}{t_b}\right)}}{t_s * E}$$

Where:

MDA = Minimum Detectable Activity level in dpm

R_b = Background count rate in counts per minute

t_s = Sample count time in minutes

t_b = Background count time in minutes

E = Detector efficiency (α or β) in counts per disintegration (cpd)

Instrument MDA Calculation Results	Acceptable	MDA Acceptance Limits† (from Table 6-1, RPPM)	
α MDA: 9	Y ☑ N ☐ N/A ☐	**Nuclide**	**dpm**
β MDA: 162	Y ☑ N ☐ N/A ☐		
		Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	20
		Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	200
		Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above. Includes mixed fission products containing Sr-90.	1000
		U-natural, U-235, U-238 and associated decay products	1000 (alpha)

†Assumes swipe area is 100 cm^2

List Applicable Survey Number(s): I-20211019-13

REVIEWED BY: [signature] **DATE:** 10/20/2021

Radiation Protection Line Support Project Leader (or Designee)