

# WIPP MLU Shipment Preliminary Document

*Date:* 7/16/2020

*To:* Ronnie York, LANL MLU Team Lead

*From:* Amber Allardice, SNL RP Project Lead (TA-5)  
Edward Walton, SNL RP Sr. RCT (TA-5)

*Subject:* Pre-Shipment Start Documentation

The following SNL document contains required information as part of final preparation for the LANL MLU shipping team. The documents pertain to MLU shipment activities scheduled at Sandia National Laboratories (SNL) in TA-5, for the week of July 20<sup>th</sup> – 24<sup>th</sup>.

- EILOT (Escort In Lieu Of Training) for MLU team members and crane operators
- SNL-RP characterization surveys for the 11 SCA due for shipment

The EILOT document is listed first. The remaining pages are the radiation and contamination surveys completed on the 11 SCA containers that are being loaded and shipped to WIPP.

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



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Livermore, California 94551-0969

*date:* July 15, 2020

*to:* Rafe Campbell (1381), MS-1142

*from:* Michael Spoerner (1387), MS-1142

Amber Allardice (625), MS-1142

*subject:* Shielded Container Assembly Loading – Escort in Lieu of Training

The following personnel may use escort in lieu of training to enter and perform radiological work in Radiation Areas, Radioactive Material(s), and Controlled Areas located in the SPRF and AHCF during July 2020.

- Robert J. Semon, LANL
- Kelly A. Wohlwend, LANL
- Jacob R. Howard, LANL
- Ronald L. York, LANL
- James D. Branaman, LANL
- Carlos S. Quevedo, Crane Services
- Paul Raley, Crane Services

The radiological work to be performed is subject to the requirements in the following RTWD:

- SPRF-RTWD-018, Shielded Container Assembly Loading

The following Sandia personnel may provide escort to the personnel (listed above) to perform radiological work in the areas identified above:

- Bryan Green
- Mike Torneby
- Kevin MacRunnels
- Beth Hanson
- Richard Pratt
- Max Nager

Copy to:

MS-1142, Mitchell Callahan, 625  
MS-1142, Steve Kegeler, 625

# Radiological Survey Report

## Survey I-20180918-22

### General Information

Title: AHCF Campaign-19 WIPP SCA #SNL001401SC

Survey Date/Time: 9/18/2018 15:30

Lead Surveyor: Kemp, Justin

Location: 6597 High Bay

Work Order/Task #: 96752 80.01.02.01

TWD or RTWD #: AHCF-RTWD-025

Purpose: Characterization

Requestor Org: 01387

Status: Approved by: Bonadore, Steven, 10/11/2018

Ready for Review by: Kemp, Justin, 10/11/2018

### Additional Surveyors

#### Surveyor

Walton, Edward

### Instruments Used

| # | Instrument Model | Instrument Serial # | Inst Type | Probe Model | Probe Serial # | Probe Type | Calibration Date | Efficiency     |          |
|---|------------------|---------------------|-----------|-------------|----------------|------------|------------------|----------------|----------|
|   |                  |                     |           |             |                |            |                  | $\beta/\gamma$ | $\alpha$ |
| 1 | RO20             | 12405               | D         | N/A         | N/A            | D          | 2/10/2019        | N/A            | N/A      |
| 2 | RADEYE PX        | 10387               | D         | NRD         | 2210           | D          | 11/10/2018       | N/A            | N/A      |
| 3 | 3030             | 278114              | C         | 43-10-1     | 102768         | C          | 10/10/2018       | 0.21           | 0.31     |

### Instruments Used - Notes

| # | Notes |
|---|-------|
| 1 | N/A   |
| 2 | N/A   |
| 3 | N/A   |

## Radiological Survey Report

### Comments:

Survey for WIPPs required Shielded Container Assembly (SCA) Contact Dose Rate Survey Form (CCP-TP-81 Rev.2.). Contact dose rates taken on SCA were taken according to, and documented on CCP-TP-81 Rev.2.

Area posted as RA/RMA/ConA

30cm dose rate survey at highest on contact location and removable contamination surveys also performed.

Radionuclides of concern:

Activation Products: Co-60 principal;

Fission Products (beta-gamma) Sr-90, Cs-137 principal;

Fission Products (alpha) Pu-239, Am-241 principal;

Actinides: U-234, U-235, U-238 principal

Swipes taken on the SCA were counted on a Ludlum 3030 counter.

All swipes were less than removable contamination limits of 20 dpm/100cm<sup>2</sup> alpha, 200 dpm/100cm<sup>2</sup> beta/gamma

RO-20 with open window was used for beta/gamma dose readings, and RadeyePx w/ NRD probe used for neutron dose readings.

Highest total contact dose rate measurement was less than WIPPs acceptance limit of 200 mR/hr

Highest dose rate on SCA was 80 mR/hr on contact and 20 mR/hr @ 30cm.

3030 MDA calculation worksheet sheet is attachment-1.

Copy of WIPP survey document CCP-TP-81 Rev.2. is attachment-2.

# Radiological Survey Report

## Itemized Details - Items

| #  | Item Location/Description | Comments |
|----|---------------------------|----------|
| 1  | SCA Top                   |          |
| 2  | SCA Bottom                |          |
| 3  | SCA Q1#1                  |          |
| 4  | SCA Q1#2                  |          |
| 5  | SCA Q1#3                  |          |
| 6  | SCA Q2#1                  |          |
| 7  | SCA Q2#2                  |          |
| 8  | SCA Q2#3                  |          |
| 9  | SCA Q3#1                  |          |
| 10 | SCA Q3#2                  |          |
| 11 | SCA Q3#3                  |          |
| 12 | SCA Q4#1                  |          |
| 13 | SCA Q4#2                  |          |
| 14 | SCA Q4#3                  |          |

## Alpha Activity

Counting Data Attached:  Yes  No

Radionuclide: Pu-239

Eff. for Removable: Inst:3 Eff: 0.31

Default Bkg Value: 0

Eff. for Total: Inst:N/A Eff:

Default Bkg Units: cpm/100 cm<sup>2</sup>

| #  | Data | Data Units              | Bkg. | Bkg. Units              | T/R | Activity | Activity Units          |
|----|------|-------------------------|------|-------------------------|-----|----------|-------------------------|
| 1  | 0    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 2  | 0    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 3  | 0    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 7  | 1    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | 3.2      | dpm/100 cm <sup>2</sup> |
| 11 | 1    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | 3.2      | dpm/100 cm <sup>2</sup> |

## Beta-Gamma Activity

Counting Data Attached:  Yes  No

Radionuclide: Cs-137

Eff. for Removable: Inst:3 Eff: 0.21

Default Bkg Value: 62

Eff. for Total: Inst:N/A Eff:

Default Bkg Units: cpm/100 cm<sup>2</sup>

| #  | Data | Data Units              | Bkg. | Bkg. Units              | T/R | Activity | Activity Units          |
|----|------|-------------------------|------|-------------------------|-----|----------|-------------------------|
| 1  | 49   | cpm/100 cm <sup>2</sup> | 62   | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 2  | 59   | cpm/100 cm <sup>2</sup> | 62   | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 3  | 54   | cpm/100 cm <sup>2</sup> | 62   | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 7  | 64   | cpm/100 cm <sup>2</sup> | 62   | cpm/100 cm <sup>2</sup> | R   | 9.5      | dpm/100 cm <sup>2</sup> |
| 11 | 53   | cpm/100 cm <sup>2</sup> | 62   | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |

# Radiological Survey Report

## Radiation Survey

Background: <0.1

Background Units: mR/hr

Radiation Type: Beta/Gamma

| #  | Radiation Type | Reading | Units | Distance From Source | Comment                       |
|----|----------------|---------|-------|----------------------|-------------------------------|
| 1  | Beta/Gamma     | 20      | mR/hr | OC                   | Open Window                   |
| 2  | Beta/Gamma     | 44      | mR/hr | OC                   | Open Window                   |
| 3  | Beta/Gamma     | 31      | mR/hr | OC                   | Open Window                   |
| 4  | Beta/Gamma     | 25      | mR/hr | OC                   | Open Window                   |
| 5  | Beta/Gamma     | 40      | mR/hr | OC                   | Open Window                   |
| 6  | Beta/Gamma     | 10      | mR/hr | OC                   | Open Window                   |
| 7  | Beta/Gamma     | 22      | mR/hr | OC                   | Open Window                   |
| 8  | Beta/Gamma     | 38      | mR/hr | OC                   | Open Window                   |
| 9  | Beta/Gamma     | 12      | mR/hr | OC                   | Open Window                   |
| 10 | Beta/Gamma     | 24      | mR/hr | OC                   | Open Window                   |
| 11 | Beta/Gamma     | 80/20   | mR/hr | OC/30 cm             | Open Window (highest reading) |
| 12 | Beta/Gamma     | 10      | mR/hr | OC                   | Open Window                   |
| 13 | Beta/Gamma     | 27      | mR/hr | OC                   | Open Window                   |
| 14 | Beta/Gamma     | 70      | mR/hr | OC                   | Open Window                   |

## Additional Radiation Survey

Background: <0.1

Unit: mrem/hr

Radiation Type: Neutron

| #  | Radiation Type | Reading | Units   | Distance From Source | Comment |
|----|----------------|---------|---------|----------------------|---------|
| 1  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 2  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 3  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 4  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 5  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 6  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 7  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 8  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 9  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 10 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 11 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 12 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 13 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 14 | Neutron        | <0.1    | mrem/hr | OC                   |         |

# Radiological Survey Report

## Attachments

| Order | Filename                    | Description                      | Pages |
|-------|-----------------------------|----------------------------------|-------|
| 1     | MDA 3030 20180918.pdf       | 3030 MDA worksheet               | 1     |
| 2     | WIPP survey SNL001401SC.pdf | Copy of WIPP SCA survey document | 2     |

## LUDLUM 3030 MDA CALCULATION WORKSHEET

|   |  |
|---|--|
| Instrument #: <u>278114</u>               | Calibration Expires: <u>10/10/18</u> Location: Bldg. <u>6597</u> Room <u>highbay</u> |
| Probe Type: <u>43-10-1</u>                | Probe #: <u>102768</u>   |
| <b>CALCULATION BY:</b> <u>Justin Kemp</u> | <b>DATE:</b> <u>9-18-18</u>  |

|  |   |
|--|---|
| Expected Sample Radionuclide ( $\alpha$ ): <u>Pu-239</u>               | $\alpha$ Detector Efficiency for expected radionuclide (cpd): <u>0.31</u>                 |
| Expected Sample Radionuclide ( $\beta$ ): <u>Cs-137</u>                | $\beta$ Detector Efficiency for expected radionuclide (cpd): <u>0.21</u>                  |
| Background Count Time (min): <u>1</u>                                  | If background and sample count times are the same, use MDA calculation method 4.6.1.      |
| Sample Count Time (min): <u>1</u>                                      | 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. |   |
| $\alpha$ <u>0</u> cpm  | $\beta$ <u>62</u> cpm   |

|   |  |
|---|--|
| <b>Method 4.4.2:</b><br>Use when background and sample count times are the same.  | <b>Method 4.4.3:</b><br>Use when background and sample count times are different.  |
| $MDA = \frac{2.71 + 4.65\sqrt{(R_b * t_b)}}{t_b * E}$   | $MDA = \frac{2.71 + 3.29\sqrt{(R_b * t_s)\left(1 + \frac{t_s}{t_b}\right)}}{t_s * E}$  |
| Where:<br>MDA = Minimum Detectable Activity level in dpm<br>R <sub>b</sub> = Background count rate in counts per minute | t <sub>s</sub> = Sample count time in minutes<br>t <sub>b</sub> = Background count time in minutes<br>E = Detector efficiency ( $\alpha$ or $\beta$ ) in counts per disintegration (cpd) |

| <b>Instrument MDA<br/>Calculation Results</b>  | <b>Acceptable</b><br>Y <input checked="" type="checkbox"/> N <input type="checkbox"/> N/A <input type="checkbox"/><br>Y <input checked="" type="checkbox"/> N <input type="checkbox"/> N/A <input type="checkbox"/> | <b>MDA Acceptance Limits<sup>†</sup></b><br>(from Table 6-1, RPPM)         |                      |
|--|---|--|----------------------|
|  |   | <b>Nuclide</b>   | <b>dpm</b>           |
| $\alpha$ MDA: <u>9</u>   |   | Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129 | 20                   |
| $\beta$ MDA: <u>188</u>  |   | 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)<br>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)         |
| <sup>†</sup> Assumes swipe area is 100 cm <sup>2</sup>   |   |  |                      |
| <b>List Applicable Survey Number(s):</b>   | <u>M-20180918-2</u>   | <u>M-20180918-11</u>   | <u>I-20180918-22</u> |
| <b>REVIEWED BY:</b>  | <u>WIC Callahan</u>   | <b>DATE:</b>   | <u>9/18/18</u>       |
| Radiation Protection Line Support Project Leader (or Designee)   |   |  |                      |

Attachment 2 – Shielded Container Assembly Contact Dose Rate Survey (Continued)

**COPY**

R020 open window ARI <0.1 AR/hr

Page 2 of 2

| Shielded Container Assembly Contact Dose Rate Survey Form |                      |                   |                 |
|---|----------------------|-------------------|-----------------|
| Contact Dose Rate Measurement                             | Beta/Gamma (mrem/hr) | Neutron (mrem/hr) | Total Dose Rate |
| SCA Top (1) 0/49  | 20                   | <0.1              | 20              |
| SCA Bottom (5) 0/59                                       | 44                   | <0.1              | 44              |
| SCA Q1 #1 (2) 0/54  | 31                   | <0.1              | 31              |
| SCA Q1 #2   | 25                   | <0.1              | 25              |
| SCA Q1 #3   | 40                   | <0.1              | 40              |
| SCA Q2 #1   | 10                   | <0.1              | 10              |
| SCA Q2 #2 (3) 1/64  | 22                   | <0.1              | 22              |
| SCA Q2 #3   | 38                   | <0.1              | 38              |
| SCA Q3 #1   | 12                   | <0.1              | 12              |
| SCA Q3 #2   | 24                   | <0.1              | 24              |
| SCA Q3 #3 (4) 1/53  | 80* / 20'            | <0.1              | 80              |
| SCA Q4 #1   | 10'                  | <0.1              | 10              |
| SCA Q4 #2   | 27                   | <0.1              | 27              |
| SCA Q4 #3   | 70                   | <0.1              | 70              |

Verify the highest total contact dose rate measurement is ≤200 mrem/hr on the external surface of the SCA, and record as the contact dose rate of record: 80 mrem/hr.

I certify that the contact dose rate data recorded is correct.

L. L. WIC / 9-18-18

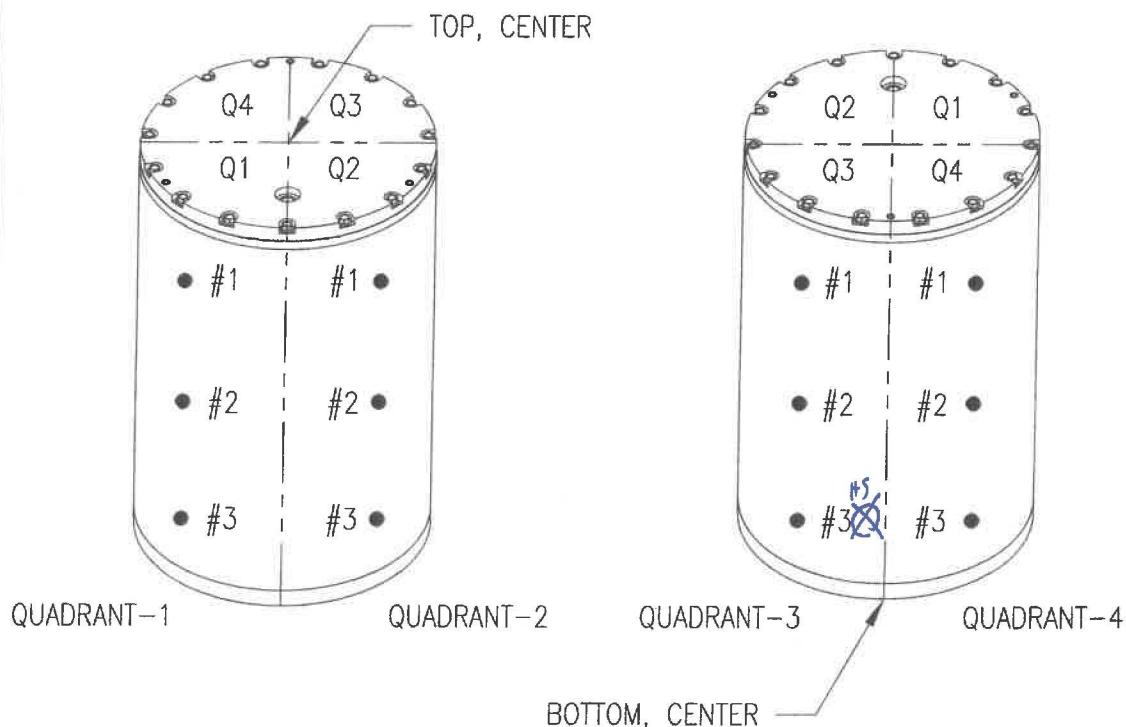
|   |      |
|---|------|
| Transportation Certification Official (or designee) | Date |
|---|------|

Attachment 2 – Shielded Container Assembly Contact Dose Rate Survey

**COPY**

Page 1 of 2

SCA CONTACT DOSE RATE SURVEY AREAS



# Radiological Survey Report

## Survey I-20180919-20

### General Information

Title: AHCF Campaign-19 WIPP SCA #SNL001402SC

Survey Date/Time: 9/19/2018 15:30

Lead Surveyor: Kemp, Justin

Location: 6597 High Bay

Work Order/Task #: 96752 80.01.02.01

TWD or RTWD #: AHCF-RTWD-025

Purpose: Characterization

Requestor Org: 01387

Status: Approved by: Bonadore, Steven, 10/11/2018

Ready for Review by: Kemp, Justin, 10/11/2018

### Additional Surveyors

#### Surveyor

Walton, Edward

### Instruments Used

| # | Instrument Model | Instrument Serial # | Inst Type | Probe Model | Probe Serial # | Probe Type | Calibration Date | Efficiency     |          |
|---|------------------|---------------------|-----------|-------------|----------------|------------|------------------|----------------|----------|
|   |                  |                     |           |             |                |            |                  | $\beta/\gamma$ | $\alpha$ |
| 1 | RO20             | 12405               | D         | N/A         | N/A            | D          | 2/10/2019        | N/A            | N/A      |
| 2 | RADEYE PX        | 10387               | D         | NRD         | 2210           | D          | 11/10/2018       | N/A            | N/A      |
| 3 | 3030             | 278114              | C         | 43-10-1     | 102768         | C          | 10/10/2018       | 0.21           | 0.31     |

### Instruments Used - Notes

| # | Notes |
|---|-------|
| 1 | N/A   |
| 2 | N/A   |
| 3 | N/A   |

## Radiological Survey Report

### Comments:

Survey for WIPPs required Shielded Container Assembly (SCA) Contact Dose Rate Survey Form (CCP-TP-81 Rev.2.). Contact dose rates taken on SCA were taken according to, and documented on CCP-TP-81 Rev.2.

Area posted as RA/RMA/ConA

30cm dose rate survey at highest on contact location and removable contamination surveys also performed.

Radionuclides of concern:

Activation Products: Co-60 principal;

Fission Products (beta-gamma) Sr-90, Cs-137 principal;

Fission Products (alpha) Pu-239, Am-241 principal;

Actinides: U-234, U-235, U-238 principal

Swipes taken on the SCA were counted on a Ludlum 3030 counter.

All swipes were less than removable contamination limits of 20 dpm/100cm<sup>2</sup> alpha, 200 dpm/100cm<sup>2</sup> beta/gamma

RO-20 with open window was used for beta/gamma dose readings, and RadeyePx w/ NRD probe used for neutron dose readings.

Highest total contact dose rate measurement was less than WIPPs acceptance limit of 200 mR/hr

Highest dose rate on SCA was 80 mR/hr on contact and 30 mR/hr @ 30cm.

3030 MDA calculation worksheet sheet is attachment-1.

Copy of WIPP survey document CCP-TP-81 Rev.2. is attachment-2.

# Radiological Survey Report

## Itemized Details - Items

| #  | Item Location/Description | Comments |
|----|---------------------------|----------|
| 1  | SCA Top                   |          |
| 2  | SCA Bottom                |          |
| 3  | SCA Q1 #1                 |          |
| 4  | SCA Q1 #2                 |          |
| 5  | SCA Q1 #3                 |          |
| 6  | SCA Q2 #1                 |          |
| 7  | SCA Q2 #2                 |          |
| 8  | SCA Q2 #3                 |          |
| 9  | SCA Q3 #1                 |          |
| 10 | SCA Q3 #2                 |          |
| 11 | SCA Q3 #3                 |          |
| 12 | SCA Q4 #1                 |          |
| 13 | SCA Q4 #2                 |          |
| 14 | SCA Q4 #3                 |          |

## Alpha Activity

Counting Data Attached:  Yes  No

Radionuclide: Pu-239

Eff. for Removable: Inst:3 Eff: 0.31

Default Bkg Value: 0

Eff. for Total: Inst:N/A Eff:

Default Bkg Units: cpm/100 cm<sup>2</sup>

| #  | Data | Data Units              | Bkg. | Bkg. Units              | T/R | Activity | Activity Units          |
|----|------|-------------------------|------|-------------------------|-----|----------|-------------------------|
| 1  | 0    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 2  | 0    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 3  | 0    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 7  | 1    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | 3.2      | dpm/100 cm <sup>2</sup> |
| 11 | 1    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | 3.2      | dpm/100 cm <sup>2</sup> |

## Beta-Gamma Activity

Counting Data Attached:  Yes  No

Radionuclide: Cs-137

Eff. for Removable: Inst:3 Eff: 0.21

Default Bkg Value: 58

Eff. for Total: Inst:N/A Eff:

Default Bkg Units: cpm/100 cm<sup>2</sup>

| #  | Data | Data Units              | Bkg. | Bkg. Units              | T/R | Activity | Activity Units          |
|----|------|-------------------------|------|-------------------------|-----|----------|-------------------------|
| 1  | 51   | cpm/100 cm <sup>2</sup> | 58   | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 2  | 53   | cpm/100 cm <sup>2</sup> | 58   | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 3  | 47   | cpm/100 cm <sup>2</sup> | 58   | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 7  | 49   | cpm/100 cm <sup>2</sup> | 58   | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 11 | 55   | cpm/100 cm <sup>2</sup> | 58   | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |

# Radiological Survey Report

## Radiation Survey

Background: <0.1

Background Units: mR/hr

Radiation Type: Beta/Gamma

| #  | Radiation Type | Reading | Units | Distance From Source | Comment                       |
|----|----------------|---------|-------|----------------------|-------------------------------|
| 1  | Beta/Gamma     | 48      | mR/hr | OC                   | Open Window                   |
| 2  | Beta/Gamma     | 60      | mR/hr | OC                   | Open Window                   |
| 3  | Beta/Gamma     | 47      | mR/hr | OC                   | Open Window                   |
| 4  | Beta/Gamma     | 60      | mR/hr | OC                   | Open Window                   |
| 5  | Beta/Gamma     | 80      | mR/hr | OC                   | Open Window                   |
| 6  | Beta/Gamma     | 29      | mR/hr | OC                   | Open Window                   |
| 7  | Beta/Gamma     | 60      | mR/hr | OC                   | Open Window                   |
| 8  | Beta/Gamma     | 60      | mR/hr | OC                   | Open Window                   |
| 9  | Beta/Gamma     | 47      | mR/hr | OC                   | Open Window                   |
| 10 | Beta/Gamma     | 80/30   | mR/hr | OC/30 cm             | Open Window (highest reading) |
| 11 | Beta/Gamma     | 70      | mR/hr | OC                   | Open Window                   |
| 12 | Beta/Gamma     | 38      | mR/hr | OC                   | Open Window                   |
| 13 | Beta/Gamma     | 60      | mR/hr | OC                   | Open Window                   |
| 14 | Beta/Gamma     | 70      | mR/hr | OC                   | Open Window                   |

## Additional Radiation Survey

Background: <0.1

Unit: mrem/hr

Radiation Type: Neutron

| #  | Radiation Type | Reading | Units   | Distance From Source | Comment |
|----|----------------|---------|---------|----------------------|---------|
| 1  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 2  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 3  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 4  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 5  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 6  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 7  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 8  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 9  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 10 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 11 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 12 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 13 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 14 | Neutron        | <0.1    | mrem/hr | OC                   |         |

# Radiological Survey Report

## Attachments

| Order | Filename                    | Description                      | Pages |
|-------|-----------------------------|----------------------------------|-------|
| 1     | MDA 3030 20180919.pdf       | 3030 MDA worksheet               | 1     |
| 2     | WIPP survey SNL001402SC.pdf | Copy of WIPP SCA survey document | 2     |

## LUDLUM 3030 MDA CALCULATION WORKSHEET

|   |  |
|---|--|
| Instrument #: <u>278114</u>               | Calibration Expires: <u>10/10/18</u> Location: Bldg. <u>6597</u> Room <u>highbay</u> |
| Probe Type: <u>43-10-1</u>                | Probe #: <u>102768</u>   |
| <b>CALCULATION BY:</b> <u>Justin Kemp</u> | <b>DATE:</b> <u>9-19-18</u>  |

|   |   |
|---|---|
| Expected Sample Radionuclide ( $\alpha$ ): <u>Pu-239</u>  | $\alpha$ Detector Efficiency for expected radionuclide (cpd): <u>0.31</u>                 |
| Expected Sample Radionuclide ( $\beta$ ): <u>Cs-137</u>   | $\beta$ Detector Efficiency for expected radionuclide (cpd): <u>0.21</u>                  |
| Background Count Time (min): <u>1</u>   | If background and sample count times are the same, use MDA calculation method 4.6.1.      |
| Sample Count Time (min): <u>1</u>   | 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.<br>$\alpha$ <u>0</u> cpm $\beta$ <u>58</u> cpm |   |

|  |   |
|--|---|
| <b>Method 4.4.2:</b><br>Use when background and sample count times are the same.   | <b>Method 4.4.3:</b><br>Use when background and sample count times are different.     |
| $MDA = \frac{2.71 + 4.65\sqrt{(R_b * t_b)}}{t_b * E}$  | $MDA = \frac{2.71 + 3.29\sqrt{(R_b * t_s)\left(1 + \frac{t_s}{t_b}\right)}}{t_s * E}$ |
| Where:<br>$t_s$ = Sample count time in minutes<br>$t_b$ = Background count time in minutes<br>$R_b$ = Background count rate in counts per minute<br>$E$ = Detector efficiency ( $\alpha$ or $\beta$ ) in counts per disintegration (cpd) |   |

| <b>Instrument MDA<br/>Calculation Results</b>  | <b>Acceptable</b><br>Y <input checked="" type="checkbox"/> N <input type="checkbox"/> N/A <input type="checkbox"/> | <b>MDA Acceptance Limits<sup>†</sup></b><br>(from Table 6-1, RPPM)         |              |
|--|--|--|--------------|
|  |  | <b>Nuclide</b>   | <b>dpm</b>   |
| $\alpha$ MDA: <u>9</u>   |  | Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129 | 20           |
| $\beta$ MDA: <u>182</u>  |  | 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)<br>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) |
| <sup>†</sup> Assumes swipe area is 100 cm <sup>2</sup>   |  |  |              |
| List Applicable Survey Number(s): <u>M-20180919-4</u> <u>M-20180919-14</u> <u>I-20180919-20</u>  |  |  |              |
| <b>REVIEWED BY:</b> <u>MC Callahan</u>   | <b>DATE:</b> <u>9/19/18</u>  |  |              |
| Radiation Protection Line Support Project Leader (or Designee)   |  |  |              |

## Attachment 2 – Shielded Container Assembly Contact Dose Rate Survey (Continued)

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9-19-2018

Page 2 of 2

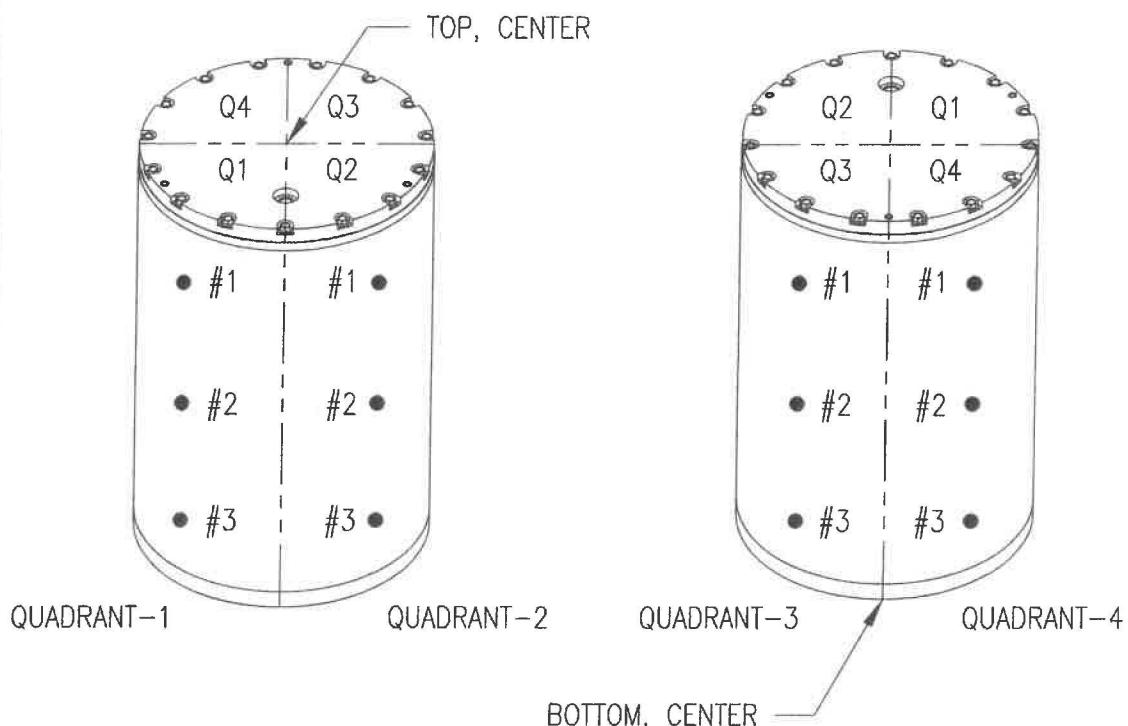
Snipers ⑮ 5 Between edge

Attachment 2 – Shielded Container Assembly Contact Dose Rate Survey

Page 1 of 2

**COPY**

SCA CONTACT DOSE RATE SURVEY AREAS



# Radiological Survey Report

## Survey I-20180920-4

### General Information

Title: AHCF Campaign-19 WIPP SCA #SNL001403SC

Survey Date/Time: 9/20/2018 15:00

Lead Surveyor: Kemp, Justin

Location: 6597 High Bay

Work Order/Task #: 96752 80.01.02.01

TWD or RTWD #: AHCF-RTWD-025

Purpose: Characterization

Requestor Org: 01387

Status: Approved by: Bonadore, Steven, 10/11/2018

Ready for Review by: Kemp, Justin, 10/11/2018

### Additional Surveyors

#### Surveyor

Walton, Edward

### Instruments Used

| # | Instrument Model | Instrument Serial # | Inst Type | Probe Model | Probe Serial # | Probe Type | Calibration Date | Efficiency     |          |
|---|------------------|---------------------|-----------|-------------|----------------|------------|------------------|----------------|----------|
|   |                  |                     |           |             |                |            |                  | $\beta/\gamma$ | $\alpha$ |
| 1 | RO20             | 12405               | D         | N/A         | N/A            | D          | 2/10/2019        | N/A            | N/A      |
| 2 | RADEYE PX        | 10387               | D         | NRD         | 2210           | D          | 11/10/2018       | N/A            | N/A      |
| 3 | 3030             | 278114              | C         | 43-10-1     | 102768         | C          | 10/10/2018       | 0.21           | 0.31     |

### Instruments Used - Notes

| # | Notes |
|---|-------|
| 1 | N/A   |
| 2 | N/A   |
| 3 | N/A   |

## Radiological Survey Report

### Comments:

Survey for WIPPs required Shielded Container Assembly (SCA) Contact Dose Rate Survey Form (CCP-TP-81 Rev.2.). Contact dose rates taken on SCA were taken according to, and documented on CCP-TP-81 Rev.2.

Area posted as RA/RMA/ConA

30cm dose rate survey at highest on contact location and removable contamination surveys also performed.

Radionuclides of concern:

Activation Products: Co-60 principal;

Fission Products (beta-gamma) Sr-90, Cs-137 principal;

Fission Products (alpha) Pu-239, Am-241 principal;

Actinides: U-234, U-235, U-238 principal

Swipes taken on the SCA were counted on a Ludlum 3030 counter.

All swipes were less than removable contamination limits of 20 dpm/100cm<sup>2</sup> alpha, 200 dpm/100cm<sup>2</sup> beta/gamma

RO-20 with open window was used for beta/gamma dose readings, and RadeyePx w/ NRD probe used for neutron dose readings.

Highest total contact dose rate measurement was less than WIPPs acceptance limit of 200 mR/hr

Highest dose rate on SCA was 150 mR/hr on contact and 40 mR/hr @ 30cm.

3030 MDA calculation worksheet sheet is attachment-1.

Copy of WIPP survey document CCP-TP-81 Rev.2. is attachment-2.

# Radiological Survey Report

## Itemized Details - Items

| #  | Item Location/Description | Comments |
|----|---------------------------|----------|
| 1  | SCA Top                   |          |
| 2  | SCA Bottom                |          |
| 3  | SCA Q1 #1                 |          |
| 4  | SCA Q1 #2                 |          |
| 5  | SCA Q1 #3                 |          |
| 6  | SCA Q2 #1                 |          |
| 7  | SCA Q2 #2                 |          |
| 8  | SCA Q2 #3                 |          |
| 9  | SCA Q3 #1                 |          |
| 10 | SCA Q3 #2                 |          |
| 11 | SCA Q3 #3                 |          |
| 12 | SCA Q4 #1                 |          |
| 13 | SCA Q4 #2                 |          |
| 14 | SCA Q4 #3                 |          |

## Alpha Activity

Counting Data Attached:  Yes  No

Radionuclide: Pu-239

Eff. for Removable: Inst:3 Eff: 0.31

Default Bkg Value: 0

Eff. for Total: Inst:N/A Eff:

Default Bkg Units: cpm/100 cm<sup>2</sup>

| #  | Data | Data Units              | Bkg. | Bkg. Units              | T/R | Activity | Activity Units          |
|----|------|-------------------------|------|-------------------------|-----|----------|-------------------------|
| 1  | 2    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | 6.5      | dpm/100 cm <sup>2</sup> |
| 2  | 0    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 3  | 0    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 7  | 2    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | 6.5      | dpm/100 cm <sup>2</sup> |
| 11 | 0    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |

## Beta-Gamma Activity

Counting Data Attached:  Yes  No

Radionuclide: Cs-137

Eff. for Removable: Inst:3 Eff: 0.21

Default Bkg Value: 49

Eff. for Total: Inst:N/A Eff:

Default Bkg Units: cpm/100 cm<sup>2</sup>

| #  | Data | Data Units              | Bkg. | Bkg. Units              | T/R | Activity | Activity Units          |
|----|------|-------------------------|------|-------------------------|-----|----------|-------------------------|
| 1  | 37   | cpm/100 cm <sup>2</sup> | 49   | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 2  | 50   | cpm/100 cm <sup>2</sup> | 49   | cpm/100 cm <sup>2</sup> | R   | 4.8      | dpm/100 cm <sup>2</sup> |
| 3  | 42   | cpm/100 cm <sup>2</sup> | 49   | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 7  | 52   | cpm/100 cm <sup>2</sup> | 49   | cpm/100 cm <sup>2</sup> | R   | 14.3     | dpm/100 cm <sup>2</sup> |
| 11 | 45   | cpm/100 cm <sup>2</sup> | 49   | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |

# Radiological Survey Report

## Radiation Survey

Background: <0.1

Background Units: mR/hr

Radiation Type: Beta/Gamma

| #  | Radiation Type | Reading | Units | Distance From Source | Comment                       |
|----|----------------|---------|-------|----------------------|-------------------------------|
| 1  | Beta/Gamma     | 21      | mR/hr | OC                   | Open window                   |
| 2  | Beta/Gamma     | 70      | mR/hr | OC                   | Open window                   |
| 3  | Beta/Gamma     | 16      | mR/hr | OC                   | Open window                   |
| 4  | Beta/Gamma     | 23      | mR/hr | OC                   | Open window                   |
| 5  | Beta/Gamma     | 60      | mR/hr | OC                   | Open window                   |
| 6  | Beta/Gamma     | 18      | mR/hr | OC                   | Open window                   |
| 7  | Beta/Gamma     | 50      | mR/hr | OC                   | Open window                   |
| 8  | Beta/Gamma     | 150/40  | mR/hr | OC                   | Open Window (highest reading) |
| 9  | Beta/Gamma     | 13      | mR/hr | OC                   | Open window                   |
| 10 | Beta/Gamma     | 36      | mR/hr | OC                   | Open window                   |
| 11 | Beta/Gamma     | 90      | mR/hr | OC                   | Open window                   |
| 12 | Beta/Gamma     | 15      | mR/hr | OC                   | Open window                   |
| 13 | Beta/Gamma     | 28      | mR/hr | OC                   | Open window                   |
| 14 | Beta/Gamma     | 44      | mR/hr | OC                   | Open window                   |

## Additional Radiation Survey

Background: <0.1

Unit: mrem/hr

Radiation Type: Neutron

| #  | Radiation Type | Reading | Units   | Distance From Source | Comment |
|----|----------------|---------|---------|----------------------|---------|
| 1  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 2  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 3  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 4  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 5  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 6  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 7  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 8  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 9  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 10 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 11 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 12 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 13 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 14 | Neutron        | <0.1    | mrem/hr | OC                   |         |

# Radiological Survey Report

## Attachments

| Order | Filename                    | Description                      | Pages |
|-------|-----------------------------|----------------------------------|-------|
| 1     | MDA 3030 20180920.pdf       | 3030 MDA worksheet               | 1     |
| 2     | WIPP survey SNL001403SC.pdf | Copy of WIPP SCA survey document | 2     |

## LUDLUM 3030 MDA CALCULATION WORKSHEET

|                                      |   |
|--------------------------------------|---|
| Instrument #: 278114                 | Calibration Expires: 10/10/18 Location: Bldg. 6597 Room highbay |
| Probe Type: 43-10-1                  | Probe #: 102768   |
| CALCULATION BY: <u>Edward Walton</u> | DATE: <u>9/20/18</u>  |

|  |   |
|--|---|
| Expected Sample Radionuclide ( $\alpha$ ): Pu-239                      | $\alpha$ Detector Efficiency for expected radionuclide (cpd): 0.31                        |
| Expected Sample Radionuclide ( $\beta$ ): Cs-137                       | $\beta$ Detector Efficiency for expected radionuclide (cpd): 0.21                         |
| 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. |   |
| $\alpha$ 0 cpm   | $\beta$ 49 cpm  |

|   |  |
|---|--|
| <b>Method 4.4.2:</b><br>Use when background and sample count times are the same.  | <b>Method 4.4.3:</b><br>Use when background and sample count times are different.  |
| $MDA = \frac{2.71 + 4.65\sqrt{(R_b * t_b)}}{t_b * E}$   | $MDA = \frac{2.71 + 3.29\sqrt{(R_b * t_s)\left(1 + \frac{t_s}{t_b}\right)}}{t_s * E}$  |
| Where:<br>MDA = Minimum Detectable Activity level in dpm<br>R <sub>b</sub> = Background count rate in counts per minute | t <sub>s</sub> = Sample count time in minutes<br>t <sub>b</sub> = Background count time in minutes<br>E = Detector efficiency ( $\alpha$ or $\beta$ ) in counts per disintegration (cpd) |

| Instrument MDA Calculation Results   | Acceptable  | MDA Acceptance Limits <sup>†</sup><br>(from Table 6-1, RPPM) |              |
|--|---|--|--------------|
|  |   | Nuclide  | dpm          |
| $\alpha$ MDA: 9  | Y <input checked="" type="checkbox"/> N <input type="checkbox"/> N/A <input type="checkbox"/> |  |              |
| $\beta$ MDA: 168   | Y <input checked="" type="checkbox"/> N <input type="checkbox"/> N/A <input type="checkbox"/> |  |              |
| 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)<br>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) |

<sup>†</sup> Assumes swipe area is 100 cm<sup>2</sup>

|                                   |              |                      |              |
|-----------------------------------|--------------|----------------------|--------------|
| List Applicable Survey Number(s): | M-20180920-3 | M-20180920-4         | I-20180920-4 |
| REVIEWED BY: <u>MC Callahan</u>   |              | DATE: <u>9/20/18</u> |              |

Radiation Protection Line Support Project Leader (or Designee)

**Attachment 2 – Shielded Container Assembly Contact Dose Rate Survey (Continued)**

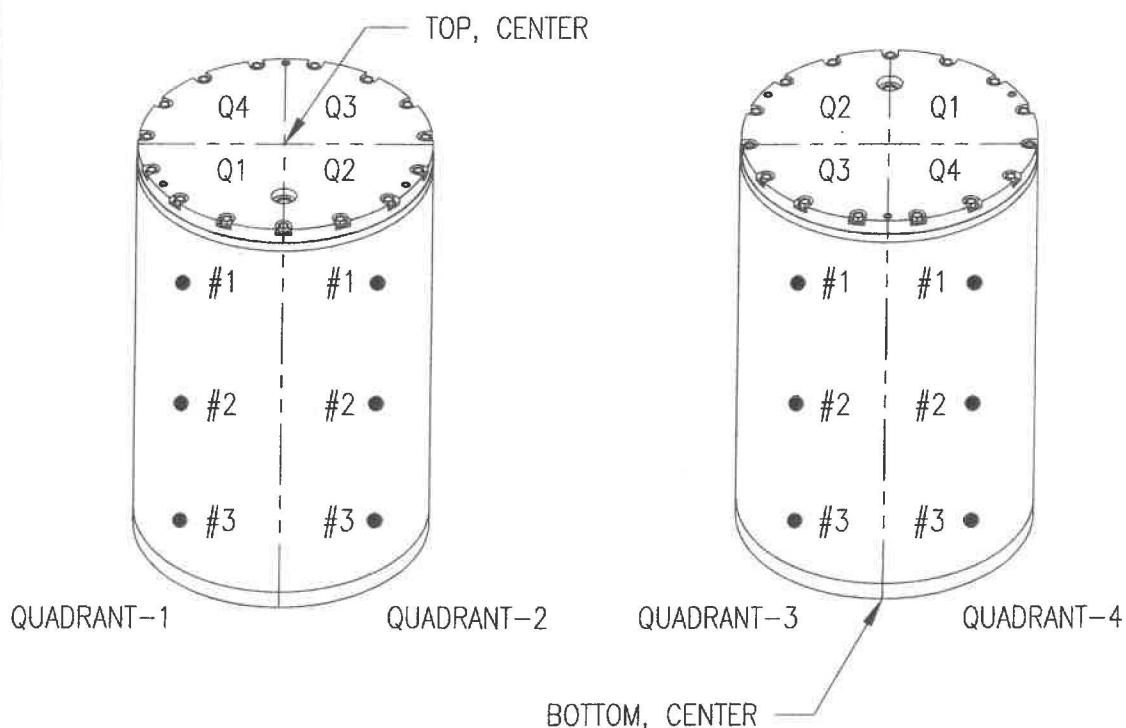
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Page 2 of 2

④ swipes

Attachment 2 – Shielded Container Assembly Contact Dose Rate Survey

**COPY**  
SCA CONTACT DOSE RATE SURVEY AREAS



# Radiological Survey Report

## Survey I-20180921-2

### General Information

Title: AHCF Campaign-19 WIPP SCA #SNL001509SC

Survey Date/Time: 9/21/2018 13:00

Lead Surveyor: Kemp, Justin

Location: 6597 High Bay

Work Order/Task #: 96752 80.01.02.01

TWD or RTWD #: AHCF-RTWD-025

Purpose: Characterization

Requestor Org: 01387

Status: Approved by: Bonadore, Steven, 10/11/2018

Ready for Review by: Kemp, Justin, 10/11/2018

### Instruments Used

| # | Instrument Model | Instrument Serial # | Inst Type | Probe Model | Probe Serial # | Probe Type | Calibration Date | Efficiency     |          |
|---|------------------|---------------------|-----------|-------------|----------------|------------|------------------|----------------|----------|
|   |                  |                     |           |             |                |            |                  | $\beta/\gamma$ | $\alpha$ |
| 1 | RO20             | 12405               | D         | N/A         | N/A            | D          | 2/10/2019        | N/A            | N/A      |
| 2 | RADEYE PX        | 10387               | D         | NRD         | 2210           | D          | 11/10/2018       | N/A            | N/A      |
| 3 | 3030             | 278114              | C         | 43-10-1     | 102768         | C          | 10/10/2018       | 0.21           | 0.31     |

### Instruments Used - Notes

| # | Notes |
|---|-------|
| 1 | N/A   |
| 2 | N/A   |
| 3 | N/A   |

## Radiological Survey Report

### Comments:

Survey for WIPPs required Shielded Container Assembly (SCA) Contact Dose Rate Survey Form (CCP-TP-81 Rev.2.). Contact dose rates taken on SCA were taken according to, and documented on CCP-TP-81 Rev.2.

Area posted as RA/RMA/ConA

30cm dose rate survey at highest on contact location and removable contamination surveys also performed.

Radionuclides of concern:

Activation Products: Co-60 principal;

Fission Products (beta-gamma) Sr-90, Cs-137 principal;

Fission Products (alpha) Pu-239, Am-241 principal;

Actinides: U-234, U-235, U-238 principal

Swipes taken on the SCA were counted on a Ludlum 3030 counter.

All swipes were less than removable contamination limits of 20 dpm/100cm<sup>2</sup> alpha, 200 dpm/100cm<sup>2</sup> beta/gamma

RO-20 with open window was used for beta/gamma dose readings, and RadeyePx w/ NRD probe used for neutron dose readings.

Highest total contact dose rate measurement was less than WIPPs acceptance limit of 200 mR/hr

Highest dose rate on SCA was 14 mR/hr on contact and 3.4 mR/hr @ 30cm.

3030 MDA calculation worksheet sheet is attachment-1.

Copy of WIPP survey document CCP-TP-81 Rev.2. is attachment-2.

# Radiological Survey Report

## Itemized Details - Items

| #  | Item Location/Description | Comments |
|----|---------------------------|----------|
| 1  | SCA Top                   |          |
| 2  | SCA Bottom                |          |
| 3  | SCA Q1 #1                 |          |
| 4  | SCA Q1 #2                 |          |
| 5  | SCA Q1 #3                 |          |
| 6  | SCA Q2 #1                 |          |
| 7  | SCA Q2 #2                 |          |
| 8  | SCA Q2 #3                 |          |
| 9  | SCA Q3 #1                 |          |
| 10 | SCA Q3 #2                 |          |
| 11 | SCA Q3 #3                 |          |
| 12 | SCA Q4 #1                 |          |
| 13 | SCA Q4 #2                 |          |
| 14 | SCA Q4 #3                 |          |

## Alpha Activity

Counting Data Attached:  Yes  No

Radionuclide: Pu-239

Eff. for Removable: Inst:3 Eff: 0.31

Default Bkg Value: 0

Eff. for Total: Inst:N/A Eff:

Default Bkg Units: cpm/100 cm<sup>2</sup>

| #  | Data | Data Units              | Bkg. | Bkg. Units              | T/R | Activity | Activity Units          |
|----|------|-------------------------|------|-------------------------|-----|----------|-------------------------|
| 1  | 0    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 2  | 0    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 3  | 1    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | 3.2      | dpm/100 cm <sup>2</sup> |
| 7  | 1    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | 3.2      | dpm/100 cm <sup>2</sup> |
| 11 | 0    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |

## Beta-Gamma Activity

Counting Data Attached:  Yes  No

Radionuclide: Cs-137

Eff. for Removable: Inst:3 Eff: 0.31

Default Bkg Value: 42

Eff. for Total: Inst:N/A Eff:

Default Bkg Units: cpm/100 cm<sup>2</sup>

| #  | Data | Data Units              | Bkg. | Bkg. Units              | T/R | Activity | Activity Units          |
|----|------|-------------------------|------|-------------------------|-----|----------|-------------------------|
| 1  | 48   | cpm/100 cm <sup>2</sup> | 42   | cpm/100 cm <sup>2</sup> | R   | 19.4     | dpm/100 cm <sup>2</sup> |
| 2  | 38   | cpm/100 cm <sup>2</sup> | 42   | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 3  | 38   | cpm/100 cm <sup>2</sup> | 42   | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 7  | 43   | cpm/100 cm <sup>2</sup> | 42   | cpm/100 cm <sup>2</sup> | R   | 3.2      | dpm/100 cm <sup>2</sup> |
| 11 | 45   | cpm/100 cm <sup>2</sup> | 42   | cpm/100 cm <sup>2</sup> | R   | 9.7      | dpm/100 cm <sup>2</sup> |

## Radiological Survey Report

### Radiation Survey

Background: <0.1

Background Units: mR/hr

Radiation Type: Beta/Gamma

| #  | Radiation Type | Reading | Units | Distance From Source | Comment                       |
|----|----------------|---------|-------|----------------------|-------------------------------|
| 1  | Beta/Gamma     | 3.1     | mR/hr | OC                   | Open window                   |
| 2  | Beta/Gamma     | 9       | mR/hr | OC                   | Open window                   |
| 3  | Beta/Gamma     | 2.0     | mR/hr | OC                   | Open window                   |
| 4  | Beta/Gamma     | 4.0     | mR/hr | OC                   | Open window                   |
| 5  | Beta/Gamma     | 4.1     | mR/hr | OC                   | Open window                   |
| 6  | Beta/Gamma     | 2.0     | mR/hr | OC                   | Open window                   |
| 7  | Beta/Gamma     | 12      | mR/hr | OC                   | Open window                   |
| 8  | Beta/Gamma     | 9       | mR/hr | OC                   | Open window                   |
| 9  | Beta/Gamma     | 2.2     | mR/hr | OC                   | Open window                   |
| 10 | Beta/Gamma     | 14/3.4  | mR/hr | OC/30 cm             | Open window (highest reading) |
| 11 | Beta/Gamma     | 10      | mR/hr | OC                   | Open window                   |
| 12 | Beta/Gamma     | 2.1     | mR/hr | OC                   | Open window                   |
| 13 | Beta/Gamma     | 4.6     | mR/hr | OC                   | Open window                   |
| 14 | Beta/Gamma     | 4.5     | mR/hr | OC                   | Open window                   |

### Additional Radiation Survey

Background: <0.1

Unit: mrem/hr

Radiation Type: Neutron

| #  | Radiation Type | Reading | Units   | Distance From Source | Comment |
|----|----------------|---------|---------|----------------------|---------|
| 1  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 2  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 3  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 4  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 5  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 6  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 7  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 8  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 9  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 10 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 11 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 12 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 13 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 14 | Neutron        | <0.1    | mrem/hr | OC                   |         |

# Radiological Survey Report

## Attachments

| Order | Filename                    | Description                      | Pages |
|-------|-----------------------------|----------------------------------|-------|
| 1     | MDA 3030 20180921.pdf       | 3030 MDA worksheet               | 1     |
| 2     | WIPP survey SNL001509SC.pdf | Copy of WIPP SCA survey document | 2     |

## LUDLUM 3030 MDA CALCULATION WORKSHEET

|  |  |
|--|--|
| Instrument #: <u>278114</u>            | Calibration Expires: <u>10/10/18</u> Location: Bldg. <u>6597</u> Room <u>highbay</u> |
| Probe Type: <u>43-10-1</u>             | Probe #: <u>102768</u>   |
| CALCULATION BY: <u>S. S. Siddleway</u> | DATE: <u>9/21/18</u>   |

|  |   |
|--|---|
| Expected Sample Radionuclide ( $\alpha$ ): <u>Pu-239</u>               | $\alpha$ Detector Efficiency for expected radionuclide (cpd): <u>0.31</u>                 |
| Expected Sample Radionuclide ( $\beta$ ): <u>Cs-137</u>                | $\beta$ Detector Efficiency for expected radionuclide (cpd): <u>0.21</u>                  |
| Background Count Time (min): <u>1</u>                                  | If background and sample count times are the same, use MDA calculation method 4.6.1.      |
| Sample Count Time (min): <u>1</u>                                      | 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. |   |
| $\alpha$ <u>D</u> cpm  | $\beta$ <u>42</u> cpm   |

|   |  |
|---|--|
| <b>Method 4.4.2:</b><br>Use when background and sample count times are the same.  | <b>Method 4.4.3:</b><br>Use when background and sample count times are different.  |
| $MDA = \frac{2.71 + 4.65 \sqrt{(R_b * t_b)}}{t_b * E}$  | $MDA = \frac{2.71 + 3.29 \sqrt{(R_b * t_s) \left(1 + \frac{t_s}{t_b}\right)}}{t_s * E}$  |
| Where:<br>MDA = Minimum Detectable Activity level in dpm<br>R <sub>b</sub> = Background count rate in counts per minute | t <sub>s</sub> = Sample count time in minutes<br>t <sub>b</sub> = Background count time in minutes<br>E = Detector efficiency ( $\alpha$ or $\beta$ ) in counts per disintegration (cpd) |

| Instrument MDA<br>Calculation Results                                     | Acceptable<br>Y <input checked="" type="checkbox"/> N <input type="checkbox"/> N/A <input type="checkbox"/> | MDA Acceptance Limits <sup>†</sup><br>(from Table 6-1, RPPM)   |              |
|---|---|--|--------------|
|   |   | Nuclide  | dpm          |
| $\alpha$ MDA: <u>9</u>  |   | Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129   | 20           |
| $\beta$ MDA: <u>157</u>   |   | 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)<br>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) |
| <sup>†</sup> Assumes swipe area is 100 cm <sup>2</sup>                    |   |  |              |
| List Applicable Survey Number(s): <u>M-20180921-1</u> <u>I-20180921-2</u> |   | <u>M-20180921-2</u>  |              |
| REVIEWED BY: <u>MIC Callahan</u>  | DATE: <u>9/21/18</u>  |  |              |
| Radiation Protection Line Support Project Leader (or Designee)            |   |  |              |

## Attachment 2 – Shielded Container Assembly Contact Dose Rate Survey (Continued)

**COPY** I-20130921-2

Page 2 of 2

13:00

| Shielded Container Assembly Contact Dose Rate Survey Form |                      |                   |                 |
|---|----------------------|-------------------|-----------------|
| Contact Dose Rate Measurement                             | Beta/Gamma (mrem/hr) | Neutron (mrem/hr) | Total Dose Rate |
| SCA Top (1) 0/48  | 3.1                  | < 0.1             | 3.1             |
| SCA Bottom (5) 0/38                                       | 9                    | < 0.1             | 9               |
| SCA Q1 #1 (2) 1/38  | 2.0                  | < 0.1             | 2.0             |
| SCA Q1 #2   | 4.0                  | < 0.1             | 4.0             |
| SCA Q1 #3   | 4.1                  | < 0.1             | 4.1             |
| SCA Q2 #1   | 2.2                  | < 0.1             | 2.2             |
| SCA Q2 #2 (3) 1/43  | 12* / 3.4'           | < 0.1             | 12              |
| SCA Q2 #3   | 9                    | < 0.1             | 9               |
| SCA Q3 #1   | 2.2                  | < 0.1             | 2.2             |
| SCA Q3 #2   | 14* / 3.4'           | < 0.1             | 14              |
| SCA Q3 #3 (4) 0/45  | 10                   | < 0.1             | 10              |
| SCA Q4 #1   | 2.1                  | < 0.1             | 2.1             |
| SCA Q4 #2   | 4.6                  | < 0.1             | 4.6             |
| SCA Q4 #3   | 4.5                  | < 0.1             | 4.5             |

Verify the highest total contact dose rate measurement is ≤200 mrem/hr on the external surface of the SCA, and record as the contact dose rate of record: \_\_\_\_\_ mrem/hr.

I certify that the contact dose rate data recorded is correct.

\_\_\_\_\_  
\_\_\_\_\_  
Transportation Certification Official (or designee)      Date

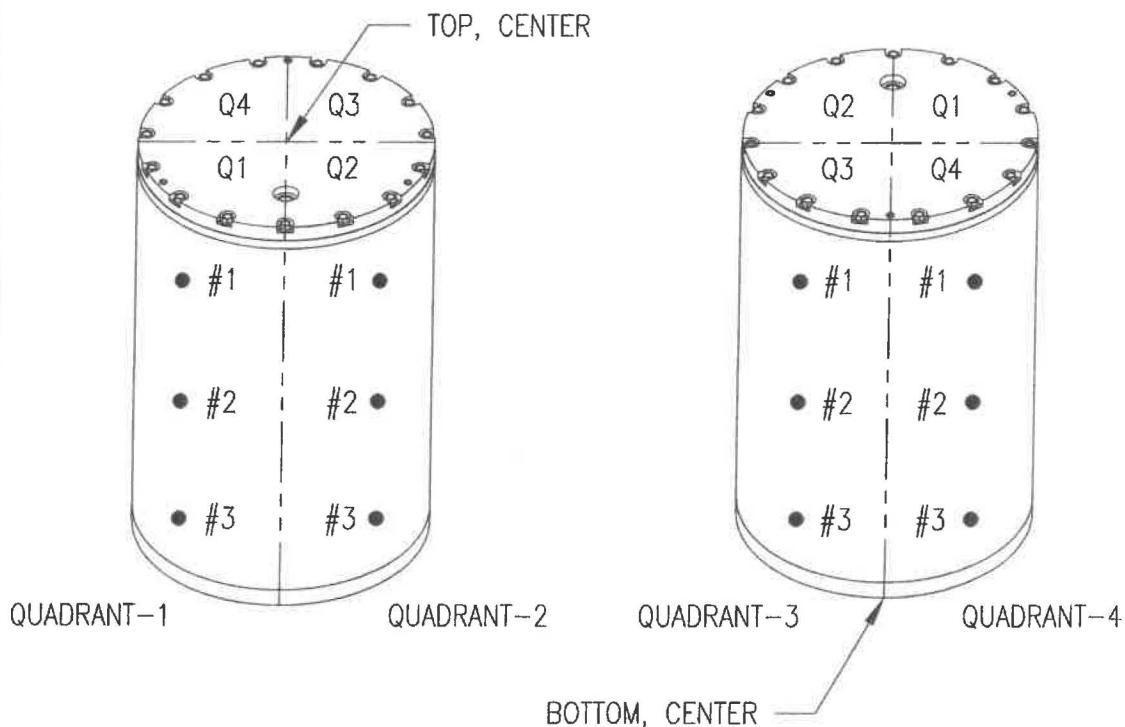
# Swipe

Attachment 2 – Shielded Container Assembly Contact Dose Rate Survey

**COPY**

Page 1 of 2

SCA CONTACT DOSE RATE SURVEY AREAS



# Radiological Survey Report

## Survey I-20180924-2

### General Information

Title: AHCF Campaign-19 WIPP SCA #SNL001602SC

Survey Date/Time: 9/24/2018 13:00

Lead Surveyor: Kemp, Justin

Location: 6597 High Bay

Work Order/Task #: 96752 80.01.02.01

TWD or RTWD #: AHCF-RTWD-025

Purpose: Characterization

Requestor Org: 01387

Status: Approved by: Bonadore, Steven, 10/12/2018

Ready for Review by: Kemp, Justin, 10/11/2018

### Additional Surveyors

#### Surveyor

Walton, Edward

### Instruments Used

| # | Instrument Model | Instrument Serial # | Inst Type | Probe Model | Probe Serial # | Probe Type | Calibration Date | Efficiency     |          |
|---|------------------|---------------------|-----------|-------------|----------------|------------|------------------|----------------|----------|
|   |                  |                     |           |             |                |            |                  | $\beta/\gamma$ | $\alpha$ |
| 1 | R020             | 12405               | D         | N/A         | N/A            | D          | 2/10/2019        | N/A            | N/A      |
| 2 | RADEYE PX        | 10387               | D         | NRD         | 2210           | D          | 11/10/2018       | N/A            | N/A      |
| 3 | 3030             | 278114              | C         | 43-10-1     | 102768         | C          | 10/10/2018       | 0.21           | 0.31     |

### Instruments Used - Notes

| # | Notes |
|---|-------|
| 1 | N/A   |
| 2 | N/A   |
| 3 | N/A   |

## Radiological Survey Report

### Comments:

Survey for WIPPs required Shielded Container Assembly (SCA) Contact Dose Rate Survey Form (CCP-TP-81 Rev.2.). Contact dose rates taken on SCA were taken according to, and documented on CCP-TP-81 Rev.2.

Area posted as RA/RMA/ConA

30cm dose rate survey at highest on contact location and removable contamination surveys also performed.

Radionuclides of concern:

Activation Products: Co-60 principal;

Fission Products (beta-gamma) Sr-90, Cs-137 principal;

Fission Products (alpha) Pu-239, Am-241 principal;

Actinides: U-234, U-235, U-238 principal

Swipes taken on the SCA were counted on a Ludlum 3030 counter.

All swipes were less than removable contamination limits of 20 dpm/100cm<sup>2</sup> alpha, 200 dpm/100cm<sup>2</sup> beta/gamma

RO-20 with open window was used for beta/gamma dose readings, and RadeyePx w/ NRD probe used for neutron dose readings.

Highest total contact dose rate measurement was less than WIPPs acceptance limit of 200 mR/hr

Highest dose rate on SCA was 100 mR/hr on contact and 33 mR/hr @ 30cm.

3030 MDA calculation worksheet sheet is attachment-1.

Copy of WIPP survey document CCP-TP-81 Rev.2. is attachment-2.

# Radiological Survey Report

## Itemized Details - Items

| #  | Item Location/Description | Comments |
|----|---------------------------|----------|
| 1  | SCA Top                   |          |
| 2  | SCA Bottom                |          |
| 3  | SCA Q1 #1                 |          |
| 4  | SCA Q1 #2                 |          |
| 5  | SCA Q1 #3                 |          |
| 6  | SCA Q2 #1                 |          |
| 7  | SCA Q2 #2                 |          |
| 8  | SCA Q2 #3                 |          |
| 9  | SCA Q3 #1                 |          |
| 10 | SCA Q3 #2                 |          |
| 11 | SCA Q3 #3                 |          |
| 12 | SCA Q4 #1                 |          |
| 13 | SCA Q4 #2                 |          |
| 14 | SCA Q4 #3                 |          |

## Alpha Activity

Counting Data Attached:  Yes  No

Radionuclide: Pu-239

Eff. for Removable: Inst:3 Eff: 0.31

Default Bkg Value: 0

Eff. for Total: Inst:N/A Eff:

Default Bkg Units: cpm/100 cm<sup>2</sup>

| #  | Data | Data Units              | Bkg. | Bkg. Units              | T/R | Activity   | Activity Units          |
|----|------|-------------------------|------|-------------------------|-----|------------|-------------------------|
| 1  | 1    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | <b>3.2</b> | dpm/100 cm <sup>2</sup> |
| 2  | 1    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | <b>3.2</b> | dpm/100 cm <sup>2</sup> |
| 3  | 2    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | <b>6.5</b> | dpm/100 cm <sup>2</sup> |
| 7  | 0    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | <b>ND</b>  | dpm/100 cm <sup>2</sup> |
| 11 | 0    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | <b>ND</b>  | dpm/100 cm <sup>2</sup> |

## Beta-Gamma Activity

Counting Data Attached:  Yes  No

Radionuclide: Cs-137

Eff. for Removable: Inst:3 Eff: 0.21

Default Bkg Value: 42

Eff. for Total: Inst:N/A Eff:

Default Bkg Units: cpm/100 cm<sup>2</sup>

| #  | Data | Data Units              | Bkg. | Bkg. Units              | T/R | Activity    | Activity Units          |
|----|------|-------------------------|------|-------------------------|-----|-------------|-------------------------|
| 1  | 58   | cpm/100 cm <sup>2</sup> | 42   | cpm/100 cm <sup>2</sup> | R   | <b>76.2</b> | dpm/100 cm <sup>2</sup> |
| 2  | 44   | cpm/100 cm <sup>2</sup> | 42   | cpm/100 cm <sup>2</sup> | R   | <b>9.5</b>  | dpm/100 cm <sup>2</sup> |
| 3  | 47   | cpm/100 cm <sup>2</sup> | 42   | cpm/100 cm <sup>2</sup> | R   | <b>23.8</b> | dpm/100 cm <sup>2</sup> |
| 7  | 40   | cpm/100 cm <sup>2</sup> | 42   | cpm/100 cm <sup>2</sup> | R   | <b>ND</b>   | dpm/100 cm <sup>2</sup> |
| 11 | 46   | cpm/100 cm <sup>2</sup> | 42   | cpm/100 cm <sup>2</sup> | R   | <b>19</b>   | dpm/100 cm <sup>2</sup> |

# Radiological Survey Report

## Radiation Survey

Background: <0.1

Background Units: mR/hr

Radiation Type: Beta/Gamma

| #  | Radiation Type | Reading | Units | Distance From Source | Comment                       |
|----|----------------|---------|-------|----------------------|-------------------------------|
| 1  | Beta/Gamma     | 37      | mR/hr | OC                   | Open window                   |
| 2  | Beta/Gamma     | 70      | mR/hr | OC                   | Open window                   |
| 3  | Beta/Gamma     | 90      | mR/hr | OC                   | Open window                   |
| 4  | Beta/Gamma     | 100/33  | mR/hr | OC/30 cm             | Open window (highest reading) |
| 5  | Beta/Gamma     | 36      | mR/hr | OC                   | Open window                   |
| 6  | Beta/Gamma     | 35      | mR/hr | OC                   | Open window                   |
| 7  | Beta/Gamma     | 34      | mR/hr | OC                   | Open window                   |
| 8  | Beta/Gamma     | 100/29  | mR/hr | OC/30 cm             | Open window                   |
| 9  | Beta/Gamma     | 32      | mR/hr | OC                   | Open window                   |
| 10 | Beta/Gamma     | 44      | mR/hr | OC                   | Open window                   |
| 11 | Beta/Gamma     | 60      | mR/hr | OC                   | Open window                   |
| 12 | Beta/Gamma     | 33      | mR/hr | OC                   | Open window                   |
| 13 | Beta/Gamma     | 46      | mR/hr | OC                   | Open window                   |
| 14 | Beta/Gamma     | 80      | mR/hr | OC                   | Open window                   |

## Additional Radiation Survey

Background: <0.1

Unit: mrem/hr

Radiation Type: Neutron

| #  | Radiation Type | Reading | Units   | Distance From Source | Comment |
|----|----------------|---------|---------|----------------------|---------|
| 1  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 2  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 3  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 4  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 5  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 6  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 7  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 8  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 9  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 10 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 11 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 12 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 13 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 14 | Neutron        | <0.1    | mrem/hr | OC                   |         |

# Radiological Survey Report

## Attachments

| Order | Filename                    | Description                      | Pages |
|-------|-----------------------------|----------------------------------|-------|
| 1     | MDA 3030 20180924.pdf       | 3030 MDA worksheet               | 1     |
| 2     | WIPP survey SNL001602SC.pdf | Copy of WIPP SCA survey document | 2     |

## LUDLUM 3030 MDA CALCULATION WORKSHEET

|                                      |  |
|--------------------------------------|--|
| Instrument #: <u>278114</u>          | Calibration Expires: <u>10/10/18</u> Location: Bldg. <u>6597</u> Room <u>highbay</u> |
| Probe Type: <u>43-10-1</u>           | Probe #: <u>102768</u>   |
| CALCULATION BY: <u>Edward Walton</u> | DATE: <u>9/24/18</u>   |

|  |   |
|--|---|
| Expected Sample Radionuclide ( $\alpha$ ): <u>Pu-239</u>               | $\alpha$ Detector Efficiency for expected radionuclide (cpd): <u>0.31</u>                 |
| Expected Sample Radionuclide ( $\beta$ ): <u>Cs-137</u>                | $\beta$ Detector Efficiency for expected radionuclide (cpd): <u>0.21</u>                  |
| Background Count Time (min): <u>1</u>                                  | If background and sample count times are the same, use MDA calculation method 4.6.1.      |
| Sample Count Time (min): <u>1</u>                                      | 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. |   |
| $\alpha$ <u>0</u> cpm  | $\beta$ <u>42</u> cpm   |

| Method 4.4.2:<br>Use when background and sample count times are the same. | Method 4.4.3:<br>Use when background and sample count times are different.              |
|---|---|
| $MDA = \frac{2.71 + 4.65 \sqrt{(R_b * t_b)}}{t_b * E}$                    | $MDA = \frac{2.71 + 3.29 \sqrt{(R_b * t_s) \left(1 + \frac{t_s}{t_b}\right)}}{t_s * E}$ |
| Where:  | $t_s$ = Sample count time in minutes  |
| $MDA$ = Minimum Detectable Activity level in dpm                          | $t_b$ = Background count time in minutes  |
| $R_b$ = Background count rate in counts per minute                        | $E$ = Detector efficiency ( $\alpha$ or $\beta$ ) in counts per disintegration (cpd)    |

| Instrument MDA<br>Calculation Results  | Acceptable  | MDA Acceptance Limits <sup>†</sup><br>(from Table 6-1, RPPM)               |              |
|--|---|--|--------------|
|  |   | Nuclide  | dpm          |
| $\alpha$ MDA: <u>9</u>   | Y <input checked="" type="checkbox"/> N <input type="checkbox"/> N/A <input type="checkbox"/> | Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129 | 20           |
| $\beta$ MDA: <u>157</u>  | Y <input checked="" type="checkbox"/> N <input type="checkbox"/> N/A <input type="checkbox"/> | 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)<br>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) |

<sup>†</sup> Assumes swipe area is 100 cm<sup>2</sup>

|                                   |                     |                     |                     |
|-----------------------------------|---------------------|---------------------|---------------------|
| List Applicable Survey Number(s): | <u>M-20180924-5</u> | <u>M-20180924-7</u> | <u>I-20180924-1</u> |
| REVIEWED BY:                      | <u>WA Callahan</u>  | DATE:               | <u>9/24/18</u>      |

Radiation Protection Line Support Project Leader (or Designee)

## Attachment 2 – Shielded Container Assembly Contact Dose Rate Survey (Continued)

**COPY**

Page 2 of 2

13:00

| Shielded Container Assembly Contact Dose Rate Survey Form |                      |                   |                 |
|---|----------------------|-------------------|-----------------|
| Measurement   | Beta/Gamma (mrem/hr) | Neutron (mrem/hr) | Total Dose Rate |
| SCA Top (1) 1/58  | 37                   | <0.1              | 37              |
| SCA Bottom (5) 1/44                                       | 70                   |                   | 70              |
| SCA Q1 #1 (2) 2/47  | 90                   |                   | 90              |
| SCA Q1 #2   | 100 / 33             |                   | 100             |
| SCA Q1 #3   | 36                   |                   | 36              |
| SCA Q2 #1   | 35                   |                   | 35              |
| SCA Q2 #2 (3) 0/40  | 34                   |                   | 34              |
| SCA Q2 #3   | 100 / 29             |                   | 100             |
| SCA Q3 #1   | 32                   |                   | 32              |
| SCA Q3 #2   | 44                   |                   | 44              |
| SCA Q3 #3 (4) 0/46  | 60                   |                   | 60              |
| SCA Q4 #1   | 33                   |                   | 33              |
| SCA Q4 #2   | 46                   |                   | 46              |
| SCA Q4 #3   | 80                   |                   | 80              |

Verify the highest total contact dose rate measurement is ≤200 mrem/hr on the external surface of the SCA, and record as the contact dose rate of record: 100 mrem/hr.

I certify that the contact dose rate data recorded is correct.

9-24-2018

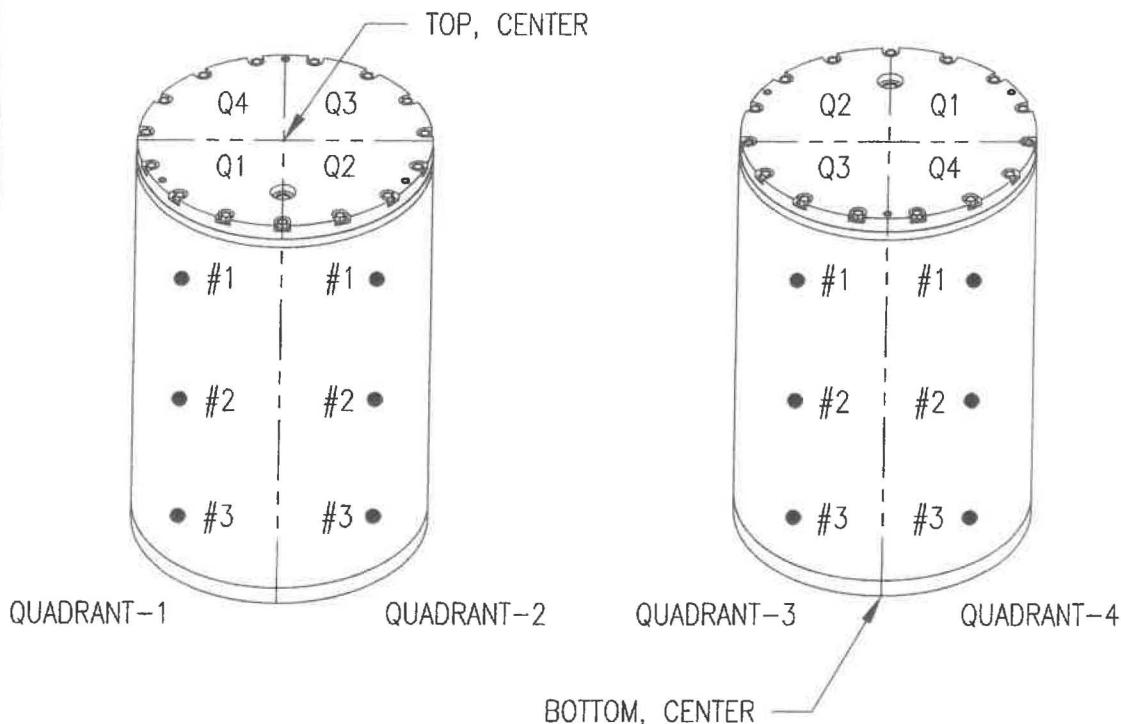
|   |      |
|---|------|
| Transportation Certification Official (or designee) | Date |
|---|------|

Attachment 2 – Shielded Container Assembly Contact Dose Rate Survey

**COPY**

Page 1 of 2

SCA CONTACT DOSE RATE SURVEY AREAS



# Radiological Survey Report

## Survey I-20180925-1

### General Information

Title: AHCF Campaign-19 WIPP SCA #SNL001705SC

Survey Date/Time: 9/25/2018 13:00

Lead Surveyor: Walton, Edward

Location: 6597 High Bay

Work Order/Task #: 96752 80.01.02.01

TWD or RTWD #: AHCF-RTWD-025

Purpose: Characterization

Requestor Org: 01387

Status: Approved by: Bonadore, Steven, 10/12/2018

Ready for Review by: Kemp, Justin, 10/11/2018

### Additional Surveyors

#### Surveyor

Kemp, Justin

### Instruments Used

| # | Instrument Model | Instrument Serial # | Inst Type | Probe Model | Probe Serial # | Probe Type | Calibration Date | Efficiency     |          |
|---|------------------|---------------------|-----------|-------------|----------------|------------|------------------|----------------|----------|
|   |                  |                     |           |             |                |            |                  | $\beta/\gamma$ | $\alpha$ |
| 1 | RO20             | 12405               | D         | N/A         | N/A            | D          | 2/10/2019        | N/A            | N/A      |
| 2 | RADEYEPX         | 10387               | D         | NRD         | 2210           | D          | 11/10/2018       | N/A            | N/A      |
| 3 | 3030             | 278114              | C         | 43-10-1     | 102768         | C          | 10/10/2018       | 0.21           | 0.31     |

### Instruments Used - Notes

| # | Notes |
|---|-------|
| 1 | N/A   |
| 2 | N/A   |
| 3 | N/A   |

## Radiological Survey Report

### Comments:

Survey for WIPPs required Shielded Container Assembly (SCA) Contact Dose Rate Survey Form (CCP-TP-81 Rev.2.). Contact dose rates taken on SCA were taken according to, and documented on CCP-TP-81 Rev.2.

Area posted as RA/RMA/ConA

30cm dose rate survey at highest on contact location and removable contamination surveys also performed.

Radionuclides of concern:

Activation Products: Co-60 principal;

Fission Products (beta-gamma) Sr-90, Cs-137 principal;

Fission Products (alpha) Pu-239, Am-241 principal;

Actinides: U-234, U-235, U-238 principal

Swipes taken on the SCA were counted on a Ludlum 3030 counter.

All swipes were less than removable contamination limits of 20 dpm/100cm<sup>2</sup> alpha, 200 dpm/100cm<sup>2</sup> beta/gamma

RO-20 with open window was used for beta/gamma dose readings, and RadeyePx w/ NRD probe used for neutron dose readings.

Highest total contact dose rate measurement was less than WIPPs acceptance limit of 200 mR/hr

Highest dose rate on SCA was 16 mR/hr on contact and 5.5 mR/hr @ 30cm.

3030 MDA calculation worksheet sheet is attachment-1.

Copy of WIPP survey document CCP-TP-81 Rev.2. is attachment-2.

# Radiological Survey Report

## Itemized Details - Items

| #  | Item Location/Description | Comments |
|----|---------------------------|----------|
| 1  | SCA Top                   |          |
| 2  | SCA Bottom                |          |
| 3  | SCA Q1 #1                 |          |
| 4  | SCA Q1 #2                 |          |
| 5  | SCA Q1 #3                 |          |
| 6  | SCA Q2 #1                 |          |
| 7  | SCA Q2 #2                 |          |
| 8  | SCA Q2 #3                 |          |
| 9  | SCA Q3 #1                 |          |
| 10 | SCA Q3 #2                 |          |
| 11 | SCA Q3 #3                 |          |
| 12 | SCA Q4 #1                 |          |
| 13 | SCA Q4 #2                 |          |
| 14 | SCA Q4 #3                 |          |

## Alpha Activity

Counting Data Attached:  Yes  No

Radionuclide: Pu-239

Eff. for Removable: Inst:3 Eff: 0.31

Default Bkg Value: 0

Eff. for Total: Inst:N/A Eff:

Default Bkg Units: cpm/100 cm<sup>2</sup>

| #  | Data | Data Units              | Bkg. | Bkg. Units              | T/R | Activity   | Activity Units          |
|----|------|-------------------------|------|-------------------------|-----|------------|-------------------------|
| 1  | 1    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | <b>3.2</b> | dpm/100 cm <sup>2</sup> |
| 2  | 0    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | <b>ND</b>  | dpm/100 cm <sup>2</sup> |
| 3  | 0    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | <b>ND</b>  | dpm/100 cm <sup>2</sup> |
| 7  | 2    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | <b>6.5</b> | dpm/100 cm <sup>2</sup> |
| 11 | 1    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | <b>3.2</b> | dpm/100 cm <sup>2</sup> |

## Beta-Gamma Activity

Counting Data Attached:  Yes  No

Radionuclide: Cs-137

Eff. for Removable: Inst:3 Eff: 0.21

Default Bkg Value: 48

Eff. for Total: Inst:N/A Eff:

Default Bkg Units: cpm/100 cm<sup>2</sup>

| #  | Data | Data Units              | Bkg. | Bkg. Units              | T/R | Activity    | Activity Units          |
|----|------|-------------------------|------|-------------------------|-----|-------------|-------------------------|
| 1  | 51   | cpm/100 cm <sup>2</sup> | 48   | cpm/100 cm <sup>2</sup> | R   | <b>14.3</b> | dpm/100 cm <sup>2</sup> |
| 2  | 38   | cpm/100 cm <sup>2</sup> | 48   | cpm/100 cm <sup>2</sup> | R   | <b>ND</b>   | dpm/100 cm <sup>2</sup> |
| 3  | 46   | cpm/100 cm <sup>2</sup> | 48   | cpm/100 cm <sup>2</sup> | R   | <b>ND</b>   | dpm/100 cm <sup>2</sup> |
| 7  | 37   | cpm/100 cm <sup>2</sup> | 48   | cpm/100 cm <sup>2</sup> | R   | <b>ND</b>   | dpm/100 cm <sup>2</sup> |
| 11 | 51   | cpm/100 cm <sup>2</sup> | 48   | cpm/100 cm <sup>2</sup> | R   | <b>14.3</b> | dpm/100 cm <sup>2</sup> |

# Radiological Survey Report

## Radiation Survey

Background: <0.1

Background Units: mR/hr

Radiation Type: Beta/Gamma

| #  | Radiation Type | Reading | Units | Distance From Source | Comment                       |
|----|----------------|---------|-------|----------------------|-------------------------------|
| 1  | Beta/Gamma     | 3.8     | mR/hr | OC                   | Open window                   |
| 2  | Beta/Gamma     | 1.7     | mR/hr | OC                   | Open window                   |
| 3  | Beta/Gamma     | 11/4    | mR/hr | OC/30 cm             | Open window                   |
| 4  | Beta/Gamma     | 16/5.5  | mR/hr | OC/30 cm             | Open window (Highest reading) |
| 5  | Beta/Gamma     | 3.5     | mR/hr | OC                   | Open window                   |
| 6  | Beta/Gamma     | 1.4     | mR/hr | OC                   | Open window                   |
| 7  | Beta/Gamma     | 2.1     | mR/hr | OC                   | Open window                   |
| 8  | Beta/Gamma     | 2.3     | mR/hr | OC                   | Open window                   |
| 9  | Beta/Gamma     | 1.6     | mR/hr | OC                   | Open window                   |
| 10 | Beta/Gamma     | 2.8     | mR/hr | OC                   | Open window                   |
| 11 | Beta/Gamma     | 3.5     | mR/hr | OC                   | Open window                   |
| 12 | Beta/Gamma     | 1.5     | mR/hr | OC                   | Open window                   |
| 13 | Beta/Gamma     | 2.1     | mR/hr | OC                   | Open window                   |
| 14 | Beta/Gamma     | 1.8     | mR/hr | OC                   | Open window                   |

## Additional Radiation Survey

Background: <0.1

Unit: mrem/hr

Radiation Type: Neutron

| #  | Radiation Type | Reading | Units   | Distance From Source | Comment |
|----|----------------|---------|---------|----------------------|---------|
| 1  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 2  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 3  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 4  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 5  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 6  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 7  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 8  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 9  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 10 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 11 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 12 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 13 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 14 | Neutron        | <0.1    | mrem/hr | OC                   |         |

# Radiological Survey Report

## Attachments

| Order | Filename                               | Description                | Pages |
|-------|--|----------------------------|-------|
| 1     | MDA sheet for AHCF 9-25-2018.pdf       | MDA sheet                  | 1     |
| 2     | AHCF WIPP SCA survey sheet 9-25-18.pdf | CCP-TP-81 Rev.2 sheet copy | 2     |

## LUDLUM 3030 MDA CALCULATION WORKSHEET

|                                      |  |
|--------------------------------------|--|
| Instrument #: <u>278114</u>          | Calibration Expires: <u>10/10/18</u> Location: Bldg. <u>6597</u> Room <u>highbay</u> |
| Probe Type: <u>43-10-1</u>           | Probe #: <u>102768</u>   |
| CALCULATION BY: <u>Edward Walton</u> | DATE: <u>9/25/18</u>   |

|  |   |
|--|---|
| Expected Sample Radionuclide ( $\alpha$ ): <u>Pu-239</u> | $\alpha$ Detector Efficiency for expected radionuclide (cpd): <u>0.31</u>                 |
| Expected Sample Radionuclide ( $\beta$ ): <u>Cs-137</u>  | $\beta$ Detector Efficiency for expected radionuclide (cpd): <u>0.21</u>                  |
| Background Count Time (min): <u>1</u>                    | If background and sample count times are the same, use MDA calculation method 4.6.1.      |
| Sample Count Time (min): <u>1</u>                        | 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.

$\alpha$  0 cpm  $\beta$  48 cpm

| Method 4.4.2:<br>Use when background and sample count times are the same. | Method 4.4.3:<br>Use when background and sample count times are different.              |
|---|---|
| $MDA = \frac{2.71 + 4.65 \sqrt{(R_b * t_b)}}{t_b * E}$                    | $MDA = \frac{2.71 + 3.29 \sqrt{(R_b * t_s) \left(1 + \frac{t_s}{t_b}\right)}}{t_s * E}$ |
| Where:  | $t_s$ = Sample count time in minutes  |
| $MDA$ = Minimum Detectable Activity level in dpm                          | $t_b$ = Background count time in minutes  |
| $R_b$ = Background count rate in counts per minute                        | $E$ = Detector efficiency ( $\alpha$ or $\beta$ ) in counts per disintegration (cpd)    |

| Instrument MDA<br>Calculation Results  | Acceptable  | MDA Acceptance Limits <sup>†</sup><br>(from Table 6-1, RPPM) |              |
|--|---|--|--------------|
|  |   | Nuclide  | dpm          |
| $\alpha$ MDA: <u>9</u>   | Y <input checked="" type="checkbox"/> N <input type="checkbox"/> N/A <input type="checkbox"/> |  |              |
| $\beta$ MDA: <u>167</u>  | Y <input checked="" type="checkbox"/> N <input type="checkbox"/> N/A <input type="checkbox"/> |  |              |
| 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)<br>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) |

<sup>†</sup> Assumes swipe area is 100 cm<sup>2</sup>

|                                   |                     |                      |                     |
|-----------------------------------|---------------------|----------------------|---------------------|
| List Applicable Survey Number(s): | <u>M-20180925-3</u> | <u>M-20180925-1</u>  | <u>I-20180925-1</u> |
| REVIEWED BY: <u>MA Callahan</u>   |                     | DATE: <u>9/25/18</u> |                     |

Radiation Protection Line Support Project Leader (or Designee)

Attachment 2 – Shielded Container Assembly Contact Dose Rate Survey (Continued)

Page 2 of 2

| Shielded Container Assembly Contact Dose Rate Survey Form   |                      |                   |                 |
|---|----------------------|-------------------|-----------------|
| Shielded Container Assembly ID: <u>SNL 001706 SC</u>  |                      |                   |                 |
| Record highest contact dose rate measurements for beta/gamma and neutron. Sum the two values and record the total dose rates. |                      |                   |                 |
| Contact Dose Rate Measurement   | Beta/Gamma (mrem/hr) | Neutron (mrem/hr) | Total Dose Rate |
| SCA Top   | 3.8                  | <0.1              | 3.8             |
| SCA Bottom  | 1.7                  | <0.1              | 1.7             |
| SCA Q1 #1   | 11                   | <0.1              | 11              |
| SCA Q1 #2   | 16                   | <0.1              | 16              |
| SCA Q1 #3   | 3.5                  | <0.1              | 3.5             |
| SCA Q2 #1   | 1.4                  | <0.1              | 1.4             |
| SCA Q2 #2   | 2.1                  | <0.1              | 2.1             |
| SCA Q2 #3   | 2.3                  | <0.1              | 2.3             |
| SCA Q3 #1   | 1.6                  | <0.1              | 1.6             |
| SCA Q3 #2   | 2.8                  | <0.1              | 2.8             |
| SCA Q3 #3   | 3.5                  | <0.1              | 3.5             |
| SCA Q4 #1   | 1.5                  | <0.1              | 1.5             |
| SCA Q4 #2   | 2.1                  | <0.1              | 2.1             |
| SCA Q4 #3   | 1.8                  | <0.1              | 1.8             |

Verify the highest total contact dose rate measurement is ≤200 mrem/hr on the external surface of the SCA, and record as the contact dose rate of record: 16 mrem/hr.

I certify that the contact dose rate data recorded is correct.

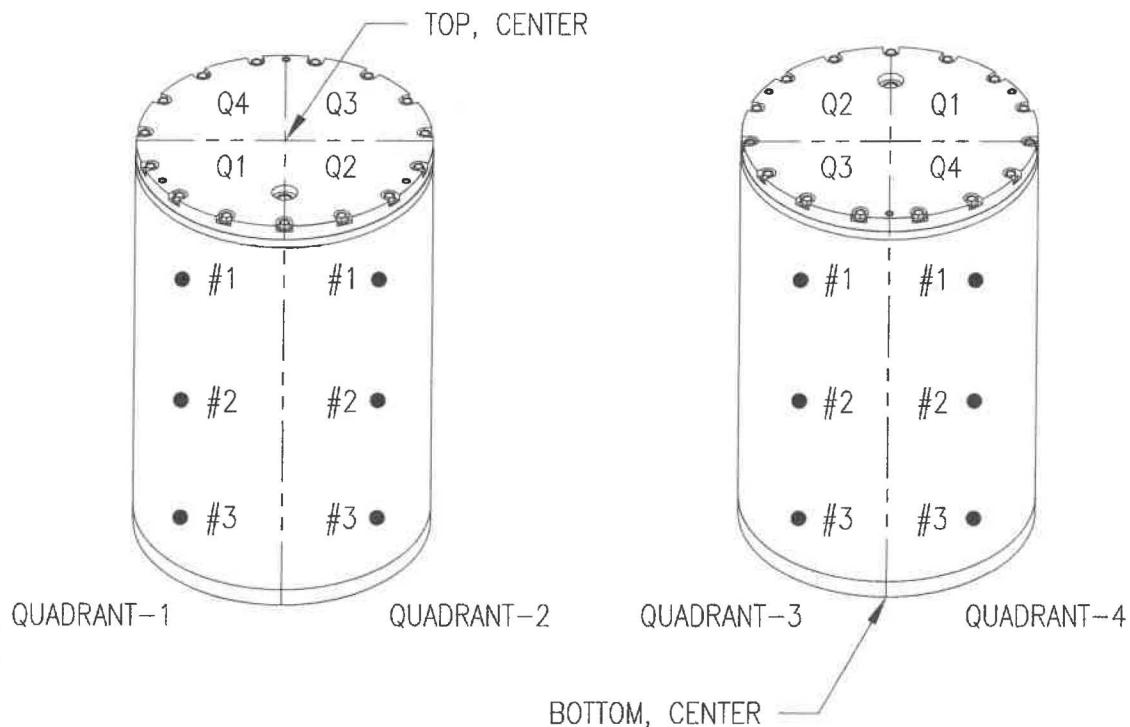
Thomas / 09-25-18

Transportation Certification Official (or designee) Date

Attachment 2 – Shielded Container Assembly Contact Dose Rate Survey

Page 1 of 2

## SCA CONTACT DOSE RATE SURVEY AREAS



# Radiological Survey Report

## Survey I-20180926-1

### General Information

Title: AHCF Campaign-19 WIPP SCA #SNL001708SC

Survey Date/Time: 9/26/2018 13:30

Lead Surveyor: Kemp, Justin

Location: 6597 High Bay

Work Order/Task #: 213283 80.01.05.01

TWD or RTWD #: AHCF-RTWD-025

Purpose: Characterization

Requestor Org: 01387

Status: Approved by: Bonadore, Steven, 10/12/2018

Ready for Review by: Kemp, Justin, 10/11/2018

### Additional Surveyors

#### Surveyor

Walton, Edward

### Instruments Used

| # | Instrument Model | Instrument Serial # | Inst Type | Probe Model | Probe Serial # | Probe Type | Calibration Date | Efficiency     |          |
|---|------------------|---------------------|-----------|-------------|----------------|------------|------------------|----------------|----------|
|   |                  |                     |           |             |                |            |                  | $\beta/\gamma$ | $\alpha$ |
| 1 | RO20             | 12405               | D         | N/A         | N/A            | D          | 2/10/2019        | N/A            | N/A      |
| 2 | RADEYE PX        | 10387               | D         | NRD         | 2210           | D          | 11/10/2018       | N/A            | N/A      |
| 3 | 3030             | 278114              | C         | 43-10-1     | 102768         | C          | 10/10/2018       | 0.21           | 0.31     |

### Instruments Used - Notes

| # | Notes |
|---|-------|
| 1 | N/A   |
| 2 | N/A   |
| 3 | N/A   |

## Radiological Survey Report

### Comments:

Survey for WIPPs required Shielded Container Assembly (SCA) Contact Dose Rate Survey Form (CCP-TP-81 Rev.2.). Contact dose rates taken on SCA were taken according to, and documented on CCP-TP-81 Rev.2.

Area posted as RA/RMA/ConA

30cm dose rate survey at highest on contact location and removable contamination surveys also performed.

Radionuclides of concern:

Activation Products: Co-60 principal;

Fission Products (beta-gamma) Sr-90, Cs-137 principal;

Fission Products (alpha) Pu-239, Am-241 principal;

Actinides: U-234, U-235, U-238 principal

Swipes taken on the SCA were counted on a Ludlum 3030 counter.

All swipes were less than removable contamination limits of 20 dpm/100cm<sup>2</sup> alpha, 200 dpm/100cm<sup>2</sup> beta/gamma

RO-20 with open window was used for beta/gamma dose readings, and RadeyePx w/ NRD probe used for neutron dose readings.

Highest total contact dose rate measurement was less than WIPPs acceptance limit of 200 mR/hr

Highest dose rate on SCA was 31 mR/hr on contact and 12 mR/hr @ 30cm.

3030 MDA calculation worksheet sheet is attachment-1.

Copy of WIPP survey document CCP-TP-81 Rev.2. is attachment-2.

# Radiological Survey Report

## Itemized Details - Items

| #  | Item Location/Description | Comments |
|----|---------------------------|----------|
| 1  | SCA Top                   |          |
| 2  | SCA Bottom                |          |
| 3  | SCA Q1 #1                 |          |
| 4  | SCA Q1 #2                 |          |
| 5  | SCA Q1 #3                 |          |
| 6  | SCA Q2 #1                 |          |
| 7  | SCA Q2 #2                 |          |
| 8  | SCA Q2 #3                 |          |
| 9  | SCA Q3 #1                 |          |
| 10 | SCA Q3 #2                 |          |
| 11 | SCA Q3 #3                 |          |
| 12 | SCA Q4 #1                 |          |
| 13 | SCA Q4 #2                 |          |
| 14 | SCA Q4 #3                 |          |

## Alpha Activity

Counting Data Attached:  Yes  No

Radionuclide: Pu-239

Eff. for Removable: Inst:3 Eff: 0.31

Default Bkg Value: 0

Eff. for Total: Inst:N/A Eff:

Default Bkg Units: cpm/100 cm<sup>2</sup>

| #  | Data | Data Units              | Bkg. | Bkg. Units              | T/R | Activity | Activity Units          |
|----|------|-------------------------|------|-------------------------|-----|----------|-------------------------|
| 1  | 0    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 2  | 0    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 3  | 0    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 7  | 0    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 11 | 2    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | 6.5      | dpm/100 cm <sup>2</sup> |

## Beta-Gamma Activity

Counting Data Attached:  Yes  No

Radionuclide: Cs-137

Eff. for Removable: Inst:3 Eff: 0.21

Default Bkg Value: 42

Eff. for Total: Inst:N/A Eff:

Default Bkg Units: cpm/100 cm<sup>2</sup>

| #  | Data | Data Units              | Bkg. | Bkg. Units              | T/R | Activity | Activity Units          |
|----|------|-------------------------|------|-------------------------|-----|----------|-------------------------|
| 1  | 33   | cpm/100 cm <sup>2</sup> | 42   | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 2  | 46   | cpm/100 cm <sup>2</sup> | 42   | cpm/100 cm <sup>2</sup> | R   | 19       | dpm/100 cm <sup>2</sup> |
| 3  | 41   | cpm/100 cm <sup>2</sup> | 42   | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 7  | 42   | cpm/100 cm <sup>2</sup> | 42   | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 11 | 45   | cpm/100 cm <sup>2</sup> | 42   | cpm/100 cm <sup>2</sup> | R   | 14.3     | dpm/100 cm <sup>2</sup> |

# Radiological Survey Report

## Radiation Survey

Background: <0.1

Background Units: mR/hr

Radiation Type: Beta/Gamma

| #  | Radiation Type | Reading | Units | Distance From Source | Comment                       |
|----|----------------|---------|-------|----------------------|-------------------------------|
| 1  | Beta/Gamma     | 5       | mR/hr | OC                   | Open window                   |
| 2  | Beta/Gamma     | 31/12   | mR/hr | OC/30 cm             | Open window (Highest reading) |
| 3  | Beta/Gamma     | 11      | mR/hr | OC                   | Open window                   |
| 4  | Beta/Gamma     | 10      | mR/hr | OC                   | Open window                   |
| 5  | Beta/Gamma     | 8       | mR/hr | OC                   | Open window                   |
| 6  | Beta/Gamma     | 7       | mR/hr | OC                   | Open window                   |
| 7  | Beta/Gamma     | 7       | mR/hr | OC                   | Open window                   |
| 8  | Beta/Gamma     | 16      | mR/hr | OC                   | Open window                   |
| 9  | Beta/Gamma     | 6       | mR/hr | OC                   | Open window                   |
| 10 | Beta/Gamma     | 9       | mR/hr | OC                   | Open window                   |
| 11 | Beta/Gamma     | 26/9    | mR/hr | OC/30 cm             | Open window                   |
| 12 | Beta/Gamma     | 7       | mR/hr | OC                   | Open window                   |
| 13 | Beta/Gamma     | 8       | mR/hr | OC                   | Open window                   |
| 14 | Beta/Gamma     | 11      | mR/hr | OC                   | Open window                   |

## Additional Radiation Survey

Background: <0.1

Unit: mrem/hr

Radiation Type: Neutron

| #  | Radiation Type | Reading | Units   | Distance From Source | Comment |
|----|----------------|---------|---------|----------------------|---------|
| 1  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 2  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 3  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 4  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 5  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 6  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 7  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 8  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 9  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 10 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 11 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 12 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 13 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 14 | Neutron        | <0.1    | mrem/hr | OC                   |         |

# Radiological Survey Report

## Attachments

| Order | Filename                    | Description                      | Pages |
|-------|-----------------------------|----------------------------------|-------|
| 1     | MDA 3030 20180926.pdf       | 3030 MDA worksheet               | 1     |
| 2     | WIPP survey SNL001708SC.pdf | Copy of WIPP SCA survey document | 2     |

## LUDLUM 3030 MDA CALCULATION WORKSHEET

|                             |  |
|-----------------------------|--|
| Instrument #: <u>278114</u> | Calibration Expires: <u>10/10/18</u> Location: Bldg. <u>6597</u> Room <u>highbay</u> |
| Probe Type: <u>43-10-1</u>  | Probe #: <u>102768</u>   |
| <b>CALCULATION BY:</b>      | <u>Justin Kew</u>  |
|                             | <b>DATE:</b> <u>9-26-2018</u>  |

|  |   |
|--|---|
| Expected Sample Radionuclide ( $\alpha$ ): <u>Pu-239</u>               | $\alpha$ Detector Efficiency for expected radionuclide (cpd): <u>0.31</u>                 |
| Expected Sample Radionuclide ( $\beta$ ): <u>Cs-137</u>                | $\beta$ Detector Efficiency for expected radionuclide (cpd): <u>0.21</u>                  |
| Background Count Time (min): <u>1</u>                                  | If background and sample count times are the same, use MDA calculation method 4.6.1.      |
| Sample Count Time (min): <u>1</u>                                      | 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. |   |
| $\alpha$ <u>0</u> cpm  | $\beta$ <u>42</u> cpm   |

|  |   |
|--|---|
| <b>Method 4.4.2:</b><br>Use when background and sample count times are the same. | <b>Method 4.4.3:</b><br>Use when background and sample count times are different.     |
| $MDA = \frac{2.71 + 4.65\sqrt{(R_b * t_b)}}{t_b * E}$                            | $MDA = \frac{2.71 + 3.29\sqrt{(R_b * t_s)\left(1 + \frac{t_s}{t_b}\right)}}{t_s * E}$ |
| Where:   | $t_s$ = Sample count time in minutes  |
| $MDA$ = Minimum Detectable Activity level in dpm                                 | $t_b$ = Background count time in minutes  |
| $R_b$ = Background count rate in counts per minute                               | $E$ = Detector efficiency ( $\alpha$ or $\beta$ ) in counts per disintegration (cpd)  |

| Instrument MDA Calculation Results  | Acceptable  | MDA Acceptance Limits <sup>†</sup><br>(from Table 6-1, RPPM)               |              |
|---|---|--|--------------|
|   |   | Nuclide  | dpm          |
| $\alpha$ MDA: <u>9</u>  | Y <input checked="" type="checkbox"/> N <input type="checkbox"/> N/A <input type="checkbox"/> | Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129 | 20           |
| $\beta$ MDA: <u>157</u>   | Y <input checked="" type="checkbox"/> N <input type="checkbox"/> N/A <input type="checkbox"/> | 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) |

<sup>†</sup> Assumes swipe area is 100 cm<sup>2</sup>

|                                   |                     |                     |                     |
|-----------------------------------|---------------------|---------------------|---------------------|
| List Applicable Survey Number(s): | <u>M-20180926-1</u> | <u>M-20180926-2</u> | <u>I-20180926-1</u> |
| REVIEWED BY:                      |                     | DATE:               | <u>9-26-18</u>      |

Radiation Protection Line Support Project Leader (or Designee)

Attachment 2 – Shielded Container Assembly Contact Dose Rate Survey (Continued)

**COPY**

Page 2 of 2

| Shielded Container Assembly Contact Dose Rate Survey Form |                      |                   |                 |
|---|----------------------|-------------------|-----------------|
| Contact Dose Rate Measurement                             | Beta/Gamma (mrem/hr) | Neutron (mrem/hr) | Total Dose Rate |
| SCA Top   | 5                    | <0.1              | 5               |
| SCA Bottom  | 31                   | <0.1              | 31              |
| SCA Q1 #1   | 11                   | <0.1              | 11              |
| SCA Q1 #2   | 10                   | <0.1              | 10              |
| SCA Q1 #3   | 8                    | <0.1              | 8               |
| SCA Q2 #1   | 7                    | <0.1              | 7               |
| SCA Q2 #2   | 7                    | <0.1              | 7               |
| SCA Q2 #3   | 16                   | <0.1              | 16              |
| SCA Q3 #1   | 6                    | <0.1              | 6               |
| SCA Q3 #2   | 9                    | <0.1              | 9               |
| SCA Q3 #3   | 26                   | <0.1              | 26              |
| SCA Q4 #1   | 7                    | <0.1              | 7               |
| SCA Q4 #2   | 8                    | <0.1              | 8               |
| SCA Q4 #3   | 11                   | <0.1              | 11              |

Verify the highest total contact dose rate measurement is ≤200 mrem/hr on the external surface of the SCA, and record as the contact dose rate of record: 31 mrem/hr.

I certify that the contact dose rate data recorded is correct.  
Phyllis 109-26-18

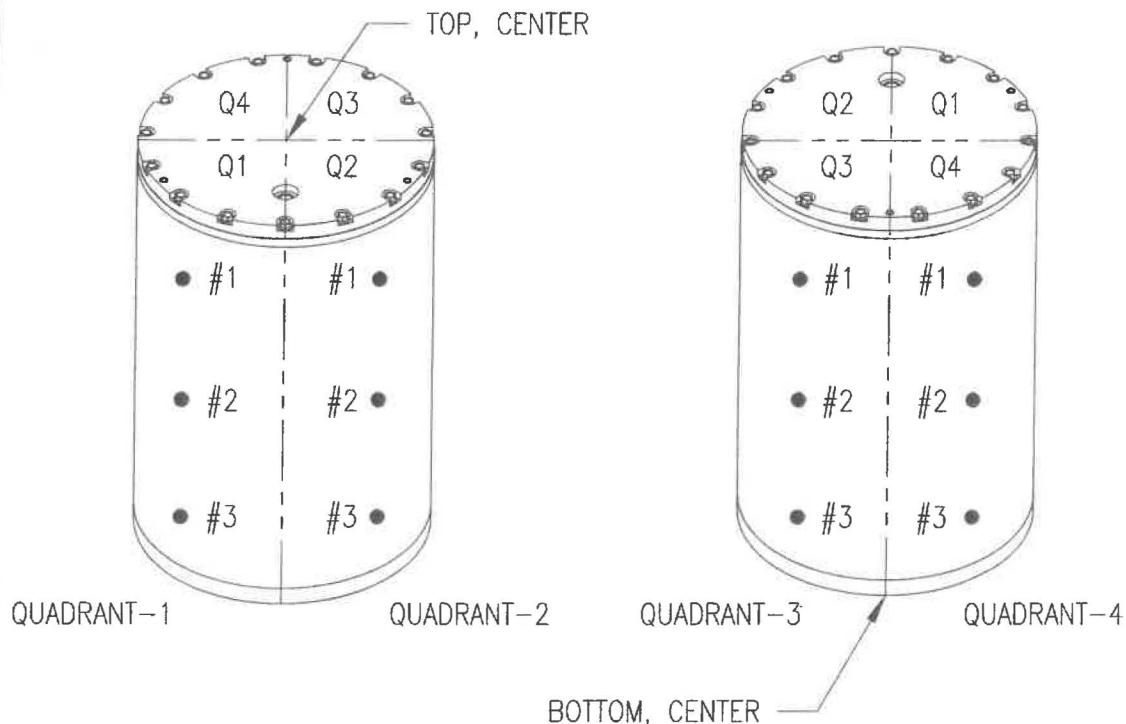
|   |      |
|---|------|
| Transportation Certification Official (or designee) | Date |
|---|------|

## Attachment 2 – Shielded Container Assembly Contact Dose Rate Survey

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Page 1 of 2

## SCA CONTACT DOSE RATE SURVEY AREAS



# Radiological Survey Report

## Survey I-20180927-1

### General Information

Title: AHCF Campaign-19 WIPP SCA #SNL001703SC

Survey Date/Time: 9/27/2018 13:45

Lead Surveyor: Walton, Edward

Location: 6597 High Bay

Work Order/Task #: 213283 80.01.05.01

TWD or RTWD #: AHCF-RTWD-025

Purpose: Characterization

Requestor Org: 01387

Status: Approved by: Bonadore, Steven, 10/16/2018

Ready for Review by: Walton, Edward, 10/15/2018

### Additional Surveyors

#### Surveyor

Kemp, Justin

### Instruments Used

| # | Instrument Model | Instrument Serial # | Inst Type | Probe Model | Probe Serial # | Probe Type | Calibration Date | Efficiency     |          |
|---|------------------|---------------------|-----------|-------------|----------------|------------|------------------|----------------|----------|
|   |                  |                     |           |             |                |            |                  | $\beta/\gamma$ | $\alpha$ |
| 1 | RO20             | 12405               | D         | N/A         | N/A            | D          | 2/10/2019        | N/A            | N/A      |
| 2 | RADEYE PX        | 10387               | D         | NRD         | 2210           | D          | 11/10/2018       | N/A            | N/A      |
| 3 | 3030             | 278114              | C         | 43-10-1     | 102768         | C          | 10/10/2018       | 0.21           | 0.31     |

### Instruments Used - Notes

| # | Notes |
|---|-------|
| 1 | N/A   |
| 2 | N/A   |
| 3 | N/A   |

## Radiological Survey Report

### Comments:

Survey for WIPP's required Shielded Container Assembly (SCA) on Contact Dose Rate Survey form CCP-TP-81 Rev.2. Contact dose rates taken on SCA in accordance to, and documented on, CCP-TP-81 Rev.2.

Area posted as RA/RMA/ConA

30cm dose rate survey at highest on contact location and removable contamination surveys also performed.

Radionuclides of concern:

Activation Products: Co-60 principal;

Fission Products (beta-gamma) Sr-90, Cs-137 principal;

Fission Products (alpha) Pu-239, Am-241 principal;

Actinides: U-234, U-235, U-238 principal

Swipes taken on the SCA were counted on a Ludlum 3030 counter.

All swipes were less than removable contamination limits of 20dpm/100cm<sup>2</sup> alpha, 200dpm/100cm<sup>2</sup> beta/gamma

RO-20 with open window was used for beta/gamma dose readings, and RadeyePx w/ NRD probe used for neutron dose readings.

Highest total contact dose rate measurement was less than WIPPs acceptance limit of 200mR/hr

Highest dose rate on SCA was 36mR/hr on-contact. A reading of 9mR/hr @30cm measured for radiological posting purposes only.

3030 MDA calculation worksheet sheet is attachment-1.

Copy of WIPP survey document CCP-TP-81 Rev.2. is attachment-2.

# Radiological Survey Report

## Itemized Details - Items

| #  | Item Location/Description | Comments |
|----|---------------------------|----------|
| 1  | SCA Top                   |          |
| 2  | SCA Bottom                |          |
| 3  | SCA Q1 #1                 |          |
| 4  | SCA Q1 #2                 |          |
| 5  | SCA Q1 #3                 |          |
| 6  | SCA Q2 #1                 |          |
| 7  | SCA Q2 #2                 |          |
| 8  | SCA Q2 #3                 |          |
| 9  | SCA Q3 #1                 |          |
| 10 | SCA Q3 #2                 |          |
| 11 | SCA Q3 #3                 |          |
| 12 | SCA Q4 #1                 |          |
| 13 | SCA Q4 #2                 |          |
| 14 | SCA Q4 #3                 |          |

## Alpha Activity

Counting Data Attached:  Yes  No

Radionuclide: Pu-239

Eff. for Removable: Inst:3 Eff: 0.31

Default Bkg Value: 0

Eff. for Total: Inst:N/A Eff:

Default Bkg Units: cpm/100 cm<sup>2</sup>

| #  | Data | Data Units              | Bkg. | Bkg. Units              | T/R | Activity | Activity Units          |
|----|------|-------------------------|------|-------------------------|-----|----------|-------------------------|
| 1  | 1    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | 3.2      | dpm/100 cm <sup>2</sup> |
| 2  | 1    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | 3.2      | dpm/100 cm <sup>2</sup> |
| 3  | 2    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | 6.5      | dpm/100 cm <sup>2</sup> |
| 7  | 0    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 11 | 0    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |

## Beta-Gamma Activity

Counting Data Attached:  Yes  No

Radionuclide: Cs-137

Eff. for Removable: Inst:3 Eff: 0.21

Default Bkg Value: 54

Eff. for Total: Inst:N/A Eff:

Default Bkg Units: cpm/100 cm<sup>2</sup>

| #  | Data | Data Units              | Bkg. | Bkg. Units              | T/R | Activity | Activity Units          |
|----|------|-------------------------|------|-------------------------|-----|----------|-------------------------|
| 1  | 41   | cpm/100 cm <sup>2</sup> | 54   | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 2  | 50   | cpm/100 cm <sup>2</sup> | 54   | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 3  | 53   | cpm/100 cm <sup>2</sup> | 54   | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 7  | 48   | cpm/100 cm <sup>2</sup> | 54   | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 11 | 39   | cpm/100 cm <sup>2</sup> | 54   | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |

# Radiological Survey Report

## Radiation Survey

Background: <0.1

Background Units: mR/hr

Radiation Type: Beta/Gamma

| #  | Radiation Type | Reading | Units | Distance From Source | Comment                       |
|----|----------------|---------|-------|----------------------|-------------------------------|
| 1  | Beta/Gamma     | 4.8     | mR/hr | OC                   | Open window                   |
| 2  | Beta/Gamma     | 10      | mR/hr | OC                   | Open window                   |
| 3  | Beta/Gamma     | 2.4     | mR/hr | OC                   | Open window                   |
| 4  | Beta/Gamma     | 6       | mR/hr | OC                   | Open window                   |
| 5  | Beta/Gamma     | 34      | mR/hr | OC                   | Open window                   |
| 6  | Beta/Gamma     | 2.7     | mR/hr | OC                   | Open window                   |
| 7  | Beta/Gamma     | 5       | mR/hr | OC                   | Open window                   |
| 8  | Beta/Gamma     | 36/9    | mR/hr | OC/30 cm             | Open window (Highest reading) |
| 9  | Beta/Gamma     | 4.7     | mR/hr | OC                   | Open window                   |
| 10 | Beta/Gamma     | 8       | mR/hr | OC                   | Open window                   |
| 11 | Beta/Gamma     | 9       | mR/hr | OC                   | Open window                   |
| 12 | Beta/Gamma     | 10      | mR/hr | OC                   | Open window                   |
| 13 | Beta/Gamma     | 12      | mR/hr | OC                   | Open window                   |
| 14 | Beta/Gamma     | 12      | mR/hr | OC                   | Open window                   |

## Additional Radiation Survey

Background: <0.1

Unit: mrem/hr

Radiation Type: Neutron

| #  | Radiation Type | Reading | Units   | Distance From Source | Comment |
|----|----------------|---------|---------|----------------------|---------|
| 1  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 2  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 3  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 4  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 5  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 6  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 7  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 8  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 9  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 10 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 11 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 12 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 13 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 14 | Neutron        | <0.1    | mrem/hr | OC                   |         |

# Radiological Survey Report

## Attachments

| Order | Filename                               | Description          | Pages |
|-------|--|----------------------|-------|
| 1     | MDA 3030 20180927.pdf                  | 3030 MDA worksheet   | 1     |
| 2     | AHCF WIPP SCA survey sheet 9-27-18.pdf | CCP-TP-81 Rev.2 form | 2     |

## LUDLUM 3030 MDA CALCULATION WORKSHEET

Instrument #: 278114 Calibration Expires: 10/10/18 Location: Bldg. 6597 Room highbay  
Probe Type: 43-10-1 Probe #: 102768  
CALCULATION BY: S. S. Johnson DATE: 9/22/18

Expected Sample Radionuclide ( $\alpha$ ): **Pu-239**       $\alpha$  Detector Efficiency for expected radionuclide (cpd): **0.31**

Expected Sample Radionuclide ( $\beta$ ): Cs-137       $\beta$  Detector Efficiency for expected radionuclide (cpd): 0.21

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.

$\alpha$  2 cpm  $\beta$  54 cpm

### Method 4.4.2:

Use when background and sample count times are the same.

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

Where:

MDA = Minimum Detectable Activity level in dpm

$R_b$  = Background count rate in counts per minute

### Method 4.4.3:

Use when background and sample count times are different.

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

$t_s$  = Sample count time in minutes

$t_b$  = Background count time in minutes

E = Detector efficiency ( $\alpha$  or  $\beta$ ) in counts per disintegration (cpd)

| Instrument MDA<br>Calculation Results | Acceptable  | MDA Acceptance Limits <sup>†</sup><br>(from Table 6-1, RPPM)   |              |
|---------------------------------------|---|--|--------------|
|                                       |   | Nuclide  | dpm          |
| α MDA : <u>9</u>                      | Y <input checked="" type="checkbox"/> N <input type="checkbox"/> N/A <input type="checkbox"/> |  |              |
| β MDA: <u>176</u>                     | Y <input checked="" type="checkbox"/> N <input type="checkbox"/> N/A <input type="checkbox"/> |  |              |
|                                       |   | 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)<br>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) |

Attachment 2 – Shielded Container Assembly Contact Dose Rate Survey (Continued)

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Page 2 of 2

| Shielded Container Assembly Contact Dose Rate Survey Form |                      |                   |                 |
|---|----------------------|-------------------|-----------------|
| Contact Dose Rate Measurement                             | Beta/Gamma (mrem/hr) | Neutron (mrem/hr) | Total Dose Rate |
| SCA Top   | 4.8                  | <0.1              | 4.8             |
| SCA Bottom  | 10                   | <0.1              | 10              |
| SCA Q1 #1   | 2.4                  | <0.1              | 2.4             |
| SCA Q1 #2   | 6                    | <0.1              | 6               |
| SCA Q1 #3   | 34                   | <0.1              | 34              |
| SCA Q2 #1   | 2.7                  | <0.1              | 2.7             |
| SCA Q2 #2   | 5.0                  | <0.1              | 5.0             |
| SCA Q2 #3   | 36                   | <0.1              | 36              |
| SCA Q3 #1   | 4.7                  | <0.1              | 4.7             |
| SCA Q3 #2   | 8                    | <0.1              | 8               |
| SCA Q3 #3   | 9                    | <0.1              | 9               |
| SCA Q4 #1   | 10                   | <0.1              | 10              |
| SCA Q4 #2   | 12                   | <0.1              | 12              |
| SCA Q4 #3   | 12                   | <0.1              | 12              |

Verify the highest total contact dose rate measurement is ≤200 mrem/hr on the external surface of the SCA, and record as the contact dose rate of record: 36 mrem/hr.

I certify that the contact dose rate data recorded is correct.

Thomas / 09-27-18

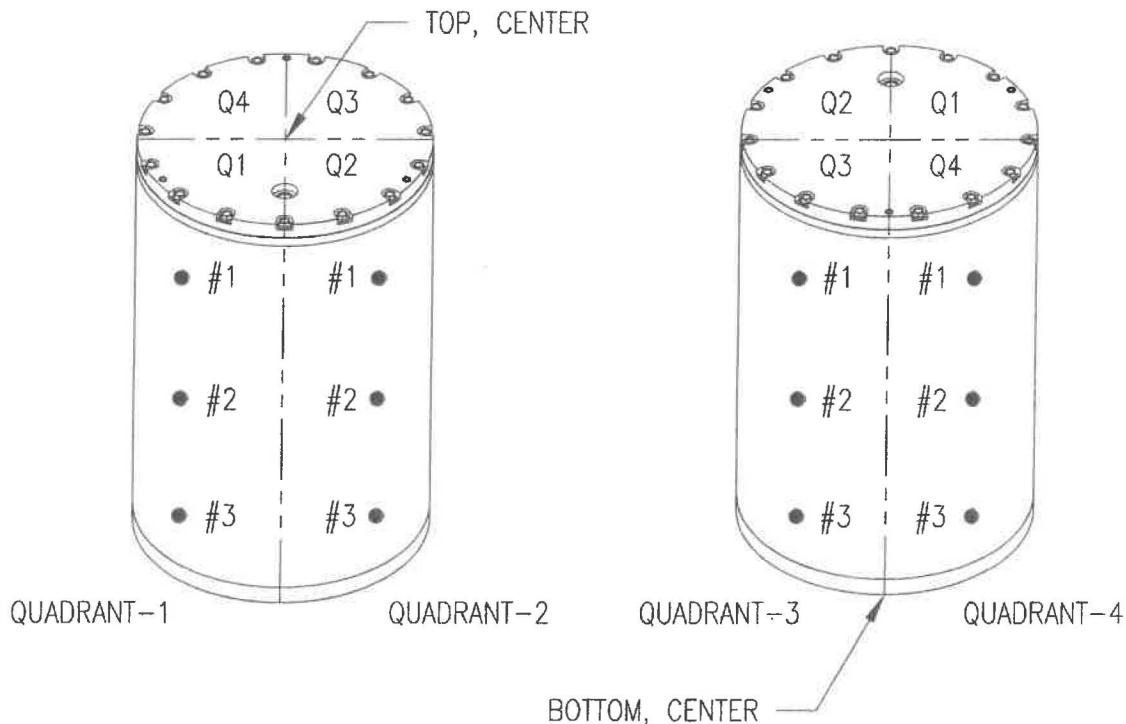
|   |      |
|---|------|
| Transportation Certification Official (or designee) | Date |
|---|------|

Attachment 2 – Shielded Container Assembly Contact Dose Rate Survey

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Page 1 of 2

SCA CONTACT DOSE RATE SURVEY AREAS



# Radiological Survey Report

## Survey I-20181001-2

### General Information

Title: AHCF Campaign-19 WIPP SCA #SNL001711SC

Survey Date/Time: 10/1/2018 13:00

Lead Surveyor: Kemp, Justin

Location: 6597 High Bay

Work Order/Task #: 213283 80.01.05.01

TWD or RTWD #: AHCF-RTWD-025

Purpose: Characterization

Requestor Org: 01387

Status: Approved by: Bonadore, Steven, 10/12/2018

Ready for Review by: Kemp, Justin, 10/11/2018

### Instruments Used

| # | Instrument Model | Instrument Serial # | Inst Type | Probe Model | Probe Serial # | Probe Type | Calibration Date | Efficiency     |          |
|---|------------------|---------------------|-----------|-------------|----------------|------------|------------------|----------------|----------|
|   |                  |                     |           |             |                |            |                  | $\beta/\gamma$ | $\alpha$ |
| 1 | RO20             | 12405               | D         | N/A         | N/A            | D          | 2/10/2019        | N/A            | N/A      |
| 2 | RADEYE PX        | 10387               | D         | NRD         | 2210           | D          | 11/10/2018       | N/A            | N/A      |
| 3 | 3030             | 278114              | C         | 43-10-1     | 102768         | C          | 10/10/2018       | 0.21           | 0.31     |

### Instruments Used - Notes

| # | Notes |
|---|-------|
| 1 | N/A   |
| 2 | N/A   |
| 3 | N/A   |

## Radiological Survey Report

### Comments:

Survey for WIPPs required Shielded Container Assembly (SCA) Contact Dose Rate Survey Form (CCP-TP-81 Rev.2.). Contact dose rates taken on SCA were taken according to, and documented on CCP-TP-81 Rev.2.

Area posted as RA/RMA/ConA

30cm dose rate survey at highest on contact location and removable contamination surveys also performed.

Radionuclides of concern:

Activation Products: Co-60 principal;

Fission Products (beta-gamma) Sr-90, Cs-137 principal;

Fission Products (alpha) Pu-239, Am-241 principal;

Actinides: U-234, U-235, U-238 principal

Swipes taken on the SCA were counted on a Ludlum 3030 counter.

All swipes were less than removable contamination limits of 20 dpm/100cm<sup>2</sup> alpha, 200 dpm/100cm<sup>2</sup> beta/gamma

RO-20 with open window was used for beta/gamma dose readings, and RadeyePx w/ NRD probe used for neutron dose readings.

Highest total contact dose rate measurement was less than WIPPs acceptance limit of 200 mR/hr

Highest dose rate on SCA was 150 mR/hr on contact and 60 mR/hr @ 30cm.

3030 MDA calculation worksheet sheet is attachment-1.

Copy of WIPP survey document CCP-TP-81 Rev.2. is attachment-2.

# Radiological Survey Report

## Itemized Details - Items

| #  | Item Location/Description | Comments |
|----|---------------------------|----------|
| 1  | SCA Top                   |          |
| 2  | SCA Bottom                |          |
| 3  | SCA Q1 #1                 |          |
| 4  | SCA Q1 #2                 |          |
| 5  | SCA Q1 #3                 |          |
| 6  | SCA Q2 #1                 |          |
| 7  | SCA Q2 #2                 |          |
| 8  | SCA Q2 #3                 |          |
| 9  | SCA Q3 #1                 |          |
| 10 | SCA Q3 #2                 |          |
| 11 | SCA Q3 #3                 |          |
| 12 | SCA Q4 #1                 |          |
| 13 | SCA Q4 #2                 |          |
| 14 | SCA Q4 #3                 |          |

## Alpha Activity

Counting Data Attached:  Yes  No

Radionuclide: Pu-239

Eff. for Removable: Inst:3 Eff: 0.31

Default Bkg Value: 0

Eff. for Total: Inst:N/A Eff:

Default Bkg Units: cpm/100 cm<sup>2</sup>

| #  | Data | Data Units              | Bkg. | Bkg. Units              | T/R | Activity | Activity Units          |
|----|------|-------------------------|------|-------------------------|-----|----------|-------------------------|
| 1  | 1    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | 3.2      | dpm/100 cm <sup>2</sup> |
| 2  | 1    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | 3.2      | dpm/100 cm <sup>2</sup> |
| 3  | 1    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | 3.2      | dpm/100 cm <sup>2</sup> |
| 7  | 1    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | 3.2      | dpm/100 cm <sup>2</sup> |
| 11 | 1    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | 3.2      | dpm/100 cm <sup>2</sup> |

## Beta-Gamma Activity

Counting Data Attached:  Yes  No

Radionuclide: Cs-137

Eff. for Removable: Inst:3 Eff: 0.21

Default Bkg Value: 49

Eff. for Total: Inst:N/A Eff:

Default Bkg Units: cpm/100 cm<sup>2</sup>

| #  | Data | Data Units              | Bkg. | Bkg. Units              | T/R | Activity | Activity Units          |
|----|------|-------------------------|------|-------------------------|-----|----------|-------------------------|
| 1  | 49   | cpm/100 cm <sup>2</sup> | 49   | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 2  | 44   | cpm/100 cm <sup>2</sup> | 49   | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 3  | 53   | cpm/100 cm <sup>2</sup> | 49   | cpm/100 cm <sup>2</sup> | R   | 19       | dpm/100 cm <sup>2</sup> |
| 7  | 48   | cpm/100 cm <sup>2</sup> | 49   | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 11 | 45   | cpm/100 cm <sup>2</sup> | 49   | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |

# Radiological Survey Report

## Radiation Survey

Background: <0.1

Background Units: mR/hr

Radiation Type: Beta/Gamma

| #  | Radiation Type | Reading | Units | Distance From Source | Comment                       |
|----|----------------|---------|-------|----------------------|-------------------------------|
| 1  | Beta/Gamma     | 16      | mR/hr | OC                   | Open window                   |
| 2  | Beta/Gamma     | 150/60  | mR/hr | OC/30 cm             | Open window (Highest reading) |
| 3  | Beta/Gamma     | 10      | mR/hr | OC                   | Open window                   |
| 4  | Beta/Gamma     | 21      | mR/hr | OC                   | Open window                   |
| 5  | Beta/Gamma     | 70      | mR/hr | OC                   | Open window                   |
| 6  | Beta/Gamma     | 7       | mR/hr | OC                   | Open window                   |
| 7  | Beta/Gamma     | 24      | mR/hr | OC                   | Open window                   |
| 8  | Beta/Gamma     | 65      | mR/hr | OC                   | Open window                   |
| 9  | Beta/Gamma     | 9       | mR/hr | OC                   | Open window                   |
| 10 | Beta/Gamma     | 15      | mR/hr | OC                   | Open window                   |
| 11 | Beta/Gamma     | 60      | mR/hr | OC                   | Open window                   |
| 12 | Beta/Gamma     | 8       | mR/hr | OC                   | Open window                   |
| 13 | Beta/Gamma     | 29      | mR/hr | OC                   | Open window                   |
| 14 | Beta/Gamma     | 145     | mR/hr | OC                   | Open window                   |

## Additional Radiation Survey

Background: <0.1

Unit: mrem/hr

Radiation Type: Neutron

| #  | Radiation Type | Reading | Units   | Distance From Source | Comment |
|----|----------------|---------|---------|----------------------|---------|
| 1  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 2  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 3  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 4  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 5  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 6  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 7  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 8  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 9  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 10 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 11 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 12 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 13 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 14 | Neutron        | <0.1    | mrem/hr | OC                   |         |

# Radiological Survey Report

## Attachments

| Order | Filename                    | Description                      | Pages |
|-------|-----------------------------|----------------------------------|-------|
| 1     | MDA 3030 20181001.pdf       | 3030 MDA worksheet               | 1     |
| 2     | WIPP survey SNL001711SC.pdf | Copy of WIPP SCA survey document | 2     |

## LUDLUM 3030 MDA CALCULATION WORKSHEET

|   |  |
|---|--|
| Instrument #: <u>278114</u>               | Calibration Expires: <u>10/10/18</u> Location: Bldg. <u>6597</u> Room <u>highbay</u> |
| Probe Type: <u>43-10-1</u>                | Probe #: <u>102768</u>   |
| <b>CALCULATION BY:</b> <u>Justin Kemp</u> | <b>DATE:</b> <u>10-01-2018</u>   |

|   |   |
|---|---|
| Expected Sample Radionuclide ( $\alpha$ ): <u>Pu-239</u>  | $\alpha$ Detector Efficiency for expected radionuclide (cpd): <u>0.31</u>                 |
| Expected Sample Radionuclide ( $\beta$ ): <u>Cs-137</u>   | $\beta$ Detector Efficiency for expected radionuclide (cpd): <u>0.21</u>                  |
| Background Count Time (min): <u>1</u>   | If background and sample count times are the same, use MDA calculation method 4.6.1.      |
| Sample Count Time (min): <u>1</u>   | 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.<br>$\alpha$ <u>0</u> cpm $\beta$ <u>49</u> cpm |   |

|  |  |
|--|--|
| <b>Method 4.4.2:</b><br>Use when background and sample count times are the same.                                 | <b>Method 4.4.3:</b><br>Use when background and sample count times are different.  |
| $MDA = \frac{2.71 + 4.65\sqrt{(R_b * t_b)}}{t_b * E}$  | $MDA = \frac{2.71 + 3.29\sqrt{(R_b * t_s)\left(1 + \frac{t_s}{t_b}\right)}}{t_s * E}$  |
| Where:<br>$MDA$ = Minimum Detectable Activity level in dpm<br>$R_b$ = Background count rate in counts per minute | $t_s$ = Sample count time in minutes<br>$t_b$ = Background count time in minutes<br>$E$ = Detector efficiency ( $\alpha$ or $\beta$ ) in counts per disintegration (cpd) |

| Instrument MDA Calculation Results  | Acceptable  | MDA Acceptance Limits <sup>†</sup><br>(from Table 6-1, RPPM)               |              |
|---|---|--|--------------|
|   |   | Nuclide  | dpm          |
| $\alpha$ MDA: <u>9</u>  | <input checked="" type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> N/A | Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129 | 20           |
| $\beta$ MDA: <u>168</u>   | <input checked="" type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> 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) |

<sup>†</sup> Assumes swipe area is 100 cm<sup>2</sup>

|                                   |                     |                     |                     |
|-----------------------------------|---------------------|---------------------|---------------------|
| List Applicable Survey Number(s): | <u>M-20181001-1</u> | <u>M-20181001-2</u> | <u>I-20181001-2</u> |
| REVIEWED BY:                      | <u>MC Callahan</u>  | DATE:               | <u>10/1/18</u>      |

Radiation Protection Line Support Project Leader (or Designee)

Attachment 2 – Shielded Container Assembly Contact Dose Rate Survey (Continued)

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Page 2 of 2

**Shielded Container Assembly Contact Dose Rate Survey Form**

Shielded Container Assembly ID: SNL 001711 SC

Record highest contact dose rate measurements for beta/gamma and neutron. Sum the two values and record the total dose rates.

| Contact Dose Rate Measurement | Beta/Gamma (mrem/hr) | Neutron (mrem/hr) | Total Dose Rate |
|-------------------------------|----------------------|-------------------|-----------------|
| SCA Top                       | 16                   | <0.1              | 16              |
| SCA Bottom                    | 150                  | <0.1              | 150             |
| SCA Q1 #1                     | 10                   | <0.1              | 10              |
| SCA Q1 #2                     | 21                   | <0.1              | 21              |
| SCA Q1 #3                     | 70                   | <0.1              | 70              |
| SCA Q2 #1                     | 7                    | <0.1              | 7               |
| SCA Q2 #2                     | 24                   | <0.1              | 24              |
| SCA Q2 #3                     | 65                   | <0.1              | 65              |
| SCA Q3 #1                     | 9                    | <0.1              | 9               |
| SCA Q3 #2                     | 15                   | <0.1              | 15              |
| SCA Q3 #3                     | 60                   | <0.1              | 60              |
| SCA Q4 #1                     | 8                    | <0.1              | 8               |
| SCA Q4 #2                     | 29                   | <0.1              | 29              |
| SCA Q4 #3                     | 145                  | <0.1              | 145             |

Verify the highest total contact dose rate measurement is ≤200 mrem/hr on the external surface of the SCA, and record as the contact dose rate of record: 150 mrem/hr.

I certify that the contact dose rate data recorded is correct.

Thomas

/ 10-01-18

Transportation Certification Official (or designee)

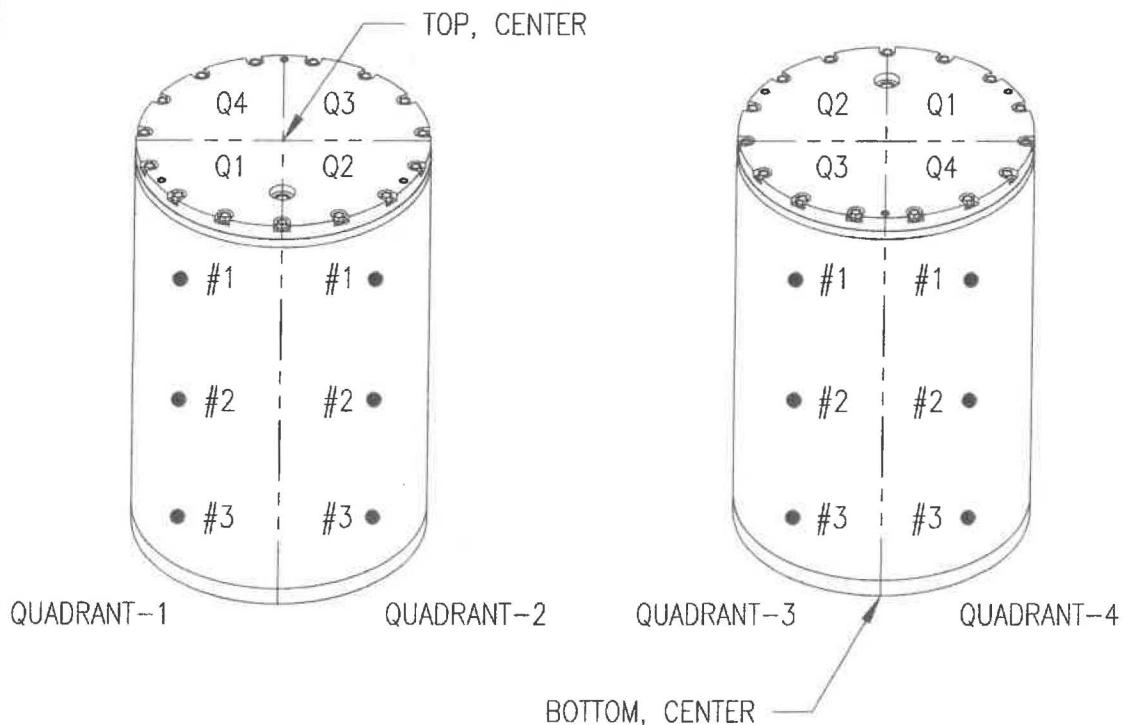
Date

Attachment 2 – Shielded Container Assembly Contact Dose Rate Survey

**COPY**

Page 1 of 2

## SCA CONTACT DOSE RATE SURVEY AREAS



# Radiological Survey Report

## Survey I-20181002-1

### General Information

Title: AHCF Campaign-19 WIPP SCA #SNL001704SC

Survey Date/Time: 10/2/2018 13:00

Lead Surveyor: Kemp, Justin

Location: 6597 High Bay

Work Order/Task #: 213283 80.01.05.01

TWD or RTWD #: AHCF-RTWD-025

Purpose: Characterization

Requestor Org: 01387

Status: Approved by: Bonadore, Steven, 10/12/2018

Ready for Review by: Kemp, Justin, 10/11/2018

### Instruments Used

| # | Instrument Model | Instrument Serial # | Inst Type | Probe Model | Probe Serial # | Probe Type | Calibration Date | Efficiency     |          |
|---|------------------|---------------------|-----------|-------------|----------------|------------|------------------|----------------|----------|
|   |                  |                     |           |             |                |            |                  | $\beta/\gamma$ | $\alpha$ |
| 1 | RO20             | 12405               | D         | N/A         | N/A            | D          | 2/10/2019        | N/A            | N/A      |
| 2 | RADEYE PX        | 10387               | D         | NRD         | 2210           | D          | 11/10/2018       | N/A            | N/A      |
| 3 | 3030             | 278114              | C         | 43-10-1     | 102768         | C          | 10/10/2018       | 0.21           | 0.31     |

### Instruments Used - Notes

| # | Notes |
|---|-------|
| 1 | N/A   |
| 2 | N/A   |
| 3 | N/A   |

## Radiological Survey Report

### Comments:

Survey for WIPPs required Shielded Container Assembly (SCA) Contact Dose Rate Survey Form (CCP-TP-81 Rev.2.). Contact dose rates taken on SCA were taken according to, and documented on CCP-TP-81 Rev.2.

Area posted as RA/RMA/ConA

30cm dose rate survey at highest on contact location and removable contamination surveys also performed.

Radionuclides of concern:

Activation Products: Co-60 principal;

Fission Products (beta-gamma) Sr-90, Cs-137 principal;

Fission Products (alpha) Pu-239, Am-241 principal;

Actinides: U-234, U-235, U-238 principal

Swipes taken on the SCA were counted on a Ludlum 3030 counter.

All swipes were less than removable contamination limits of 20 dpm/100cm<sup>2</sup> alpha, 200 dpm/100cm<sup>2</sup> beta/gamma

RO-20 with open window was used for beta/gamma dose readings, and RadeyePx w/ NRD probe used for neutron dose readings.

Highest total contact dose rate measurement was less than WIPPs acceptance limit of 200 mR/hr

Highest dose rate on SCA was 7 mR/hr on contact and 2.3 mR/hr @ 30cm.

3030 MDA calculation worksheet sheet is attachment-1.

Copy of WIPP survey document CCP-TP-81 Rev.2. is attachment-2.

# Radiological Survey Report

## Itemized Details - Items

| #  | Item Location/Description | Comments |
|----|---------------------------|----------|
| 1  | SCA Top                   |          |
| 2  | SCA Bottom                |          |
| 3  | SCA Q1#1                  |          |
| 4  | SCA Q1#2                  |          |
| 5  | SCA Q1#3                  |          |
| 6  | SCA Q2#1                  |          |
| 7  | SCA Q2#2                  |          |
| 8  | SCA Q2#3                  |          |
| 9  | SCA Q3#1                  |          |
| 10 | SCA Q3#2                  |          |
| 11 | SCA Q3#3                  |          |
| 12 | SCA Q4#1                  |          |
| 13 | SCA Q4#2                  |          |
| 14 | SCA Q4#3                  |          |

## Alpha Activity

Counting Data Attached:  Yes  No

Radionuclide: Pu-239

Eff. for Removable: Inst:3 Eff: 0.31

Default Bkg Value: 0

Eff. for Total: Inst:N/A Eff:

Default Bkg Units: cpm/100 cm<sup>2</sup>

| #  | Data | Data Units              | Bkg. | Bkg. Units              | T/R | Activity | Activity Units          |
|----|------|-------------------------|------|-------------------------|-----|----------|-------------------------|
| 1  | 0    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 2  | 0    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 3  | 1    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | 3.2      | dpm/100 cm <sup>2</sup> |
| 7  | 0    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 11 | 1    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | 3.2      | dpm/100 cm <sup>2</sup> |

## Beta-Gamma Activity

Counting Data Attached:  Yes  No

Radionuclide: Cs-137

Eff. for Removable: Inst:3 Eff: 0.21

Default Bkg Value: 64

Eff. for Total: Inst:N/A Eff:

Default Bkg Units: cpm/100 cm<sup>2</sup>

| #  | Data | Data Units              | Bkg. | Bkg. Units              | T/R | Activity | Activity Units          |
|----|------|-------------------------|------|-------------------------|-----|----------|-------------------------|
| 1  | 61   | cpm/100 cm <sup>2</sup> | 64   | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 2  | 51   | cpm/100 cm <sup>2</sup> | 64   | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 3  | 42   | cpm/100 cm <sup>2</sup> | 64   | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 7  | 58   | cpm/100 cm <sup>2</sup> | 64   | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |
| 11 | 57   | cpm/100 cm <sup>2</sup> | 64   | cpm/100 cm <sup>2</sup> | R   | ND       | dpm/100 cm <sup>2</sup> |

# Radiological Survey Report

## Radiation Survey

Background: <0.1

Background Units: mR/hr

Radiation Type: Beta/Gamma

| #  | Radiation Type | Reading | Units | Distance From Source | Comment                       |
|----|----------------|---------|-------|----------------------|-------------------------------|
| 1  | Beta/Gamma     | 4.0     | mR/hr | OC                   | Open Window                   |
| 2  | Beta/Gamma     | 1.6     | mR/hr | OC                   | Open Window                   |
| 3  | Beta/Gamma     | 6       | mR/hr | OC                   | Open Window                   |
| 4  | Beta/Gamma     | 7       | mR/hr | OC                   | Open Window                   |
| 5  | Beta/Gamma     | 2.3     | mR/hr | OC                   | Open Window                   |
| 6  | Beta/Gamma     | 7       | mR/hr | OC                   | Open Window                   |
| 7  | Beta/Gamma     | 7/2.3   | mR/hr | OC/30 cm             | Open Window (highest reading) |
| 8  | Beta/Gamma     | 2.6     | mR/hr | OC                   | Open Window                   |
| 9  | Beta/Gamma     | 3.6     | mR/hr | OC                   | Open Window                   |
| 10 | Beta/Gamma     | 3.5     | mR/hr | OC                   | Open Window                   |
| 11 | Beta/Gamma     | 1.2     | mR/hr | OC                   | Open Window                   |
| 12 | Beta/Gamma     | 4.4     | mR/hr | OC                   | Open Window                   |
| 13 | Beta/Gamma     | 4.5     | mR/hr | OC                   | Open Window                   |
| 14 | Beta/Gamma     | 2.5     | mR/hr | OC                   | Open Window                   |

## Additional Radiation Survey

Background: <0.1

Unit: mrem/hr

Radiation Type: Neutron

| #  | Radiation Type | Reading | Units   | Distance From Source | Comment |
|----|----------------|---------|---------|----------------------|---------|
| 1  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 2  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 3  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 4  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 5  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 6  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 7  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 8  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 9  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 10 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 11 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 12 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 13 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 14 | Neutron        | <0.1    | mrem/hr | OC                   |         |

# Radiological Survey Report

## Attachments

| Order | Filename                    | Description                      | Pages |
|-------|-----------------------------|----------------------------------|-------|
| 1     | MDA 3030 20181002.pdf       | 3030 MDA worksheet               | 1     |
| 2     | WIPP survey SNL001704SC.pdf | Copy of WIPP SCA survey document | 2     |

## LUDLUM 3030 MDA CALCULATION WORKSHEET

|                                    |  |
|------------------------------------|--|
| Instrument #: <u>278114</u>        | Calibration Expires: <u>10/10/18</u> Location: Bldg. <u>6597</u> Room <u>highbay</u> |
| Probe Type: <u>43-10-1</u>         | Probe #: <u>102768</u>   |
| CALCULATION BY: <u>Justin Kemp</u> | DATE: <u>10-2-18</u>   |

|   |   |
|---|---|
| Expected Sample Radionuclide ( $\alpha$ ): <u>Pu-239</u>  | $\alpha$ Detector Efficiency for expected radionuclide (cpd): <u>0.31</u>                 |
| Expected Sample Radionuclide ( $\beta$ ): <u>Cs-137</u>   | $\beta$ Detector Efficiency for expected radionuclide (cpd): <u>0.21</u>                  |
| Background Count Time (min): <u>1</u>   | If background and sample count times are the same, use MDA calculation method 4.6.1.      |
| Sample Count Time (min): <u>1</u>   | 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.<br>$\alpha$ <u>0</u> cpm $\beta$ <u>64</u> cpm |   |

| Method 4.4.2:<br>Use when background and sample count times are the same. | Method 4.4.3:<br>Use when background and sample count times are different.            |
|---|---|
| $MDA = \frac{2.71 + 4.65\sqrt{(R_b * t_b)}}{t_b * E}$                     | $MDA = \frac{2.71 + 3.29\sqrt{(R_b * t_s)\left(1 + \frac{t_s}{t_b}\right)}}{t_s * E}$ |
| Where:  | $t_s$ = Sample count time in minutes  |
| $MDA$ = Minimum Detectable Activity level in dpm                          | $t_b$ = Background count time in minutes  |
| $R_b$ = Background count rate in counts per minute                        | $E$ = Detector efficiency ( $\alpha$ or $\beta$ ) in counts per disintegration (cpd)  |

| Instrument MDA<br>Calculation Results  | Acceptable  | MDA Acceptance Limits <sup>†</sup><br>(from Table 6-1, RPPM) |                      |
|--|---|--|----------------------|
|  |   | Nuclide  | dpm                  |
| $\alpha$ MDA: <u>9</u>   | Y <input checked="" type="checkbox"/> N <input type="checkbox"/> N/A <input type="checkbox"/> |  |                      |
| $\beta$ MDA: <u>191</u>  | Y <input checked="" type="checkbox"/> N <input type="checkbox"/> N/A <input type="checkbox"/> |  |                      |
| 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)<br>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)         |
| <sup>†</sup> Assumes swipe area is 100 cm <sup>2</sup>   |   |  |                      |
| List Applicable Survey Number(s):  | <u>M-20181002-1</u>   | <u>M-20181002-4</u>  | <u>I-20181002-1</u>  |
| REVIEWED BY:   |   |  | DATE: <u>10-2-18</u> |
| Radiation Protection Line Support Project Leader (or Designee)   |   |  |                      |

Attachment 2 – Shielded Container Assembly Contact Dose Rate Survey (Continued)

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Page 2 of 2

| Shielded Container Assembly Contact Dose Rate Survey Form |                      |                   |                 |
|---|----------------------|-------------------|-----------------|
| Contact Dose Rate Measurement                             | Beta/Gamma (mrem/hr) | Neutron (mrem/hr) | Total Dose Rate |
| SCA Top   | 4.0                  | <0.1              | 4.0             |
| SCA Bottom  | 1.6                  | <0.1              | 1.6             |
| SCA Q1 #1   | 6                    | <0.1              | 6               |
| SCA Q1 #2   | 7                    | <0.1              | 7               |
| SCA Q1 #3   | 2.3                  | <0.1              | 2.3             |
| SCA Q2 #1   | 7                    | <0.1              | 7               |
| SCA Q2 #2   | 7                    | <0.1              | 7               |
| SCA Q2 #3   | 2.6                  | <0.1              | 2.6             |
| SCA Q3 #1   | 3.6                  | <0.1              | 3.6             |
| SCA Q3 #2   | 3.5                  | <0.1              | 3.5             |
| SCA Q3 #3   | 1.2                  | <0.1              | 1.2             |
| SCA Q4 #1   | 4.4                  | <0.1              | 4.4             |
| SCA Q4 #2   | 4.5                  | <0.1              | 4.5             |
| SCA Q4 #3   | 2.5                  | <0.1              | 2.5             |

Verify the highest total contact dose rate measurement is ≤200 mrem/hr on the external surface of the SCA, and record as the contact dose rate of record: 7 mrem/hr.

I certify that the contact dose rate data recorded is correct.  
Thomas / 10-02-18

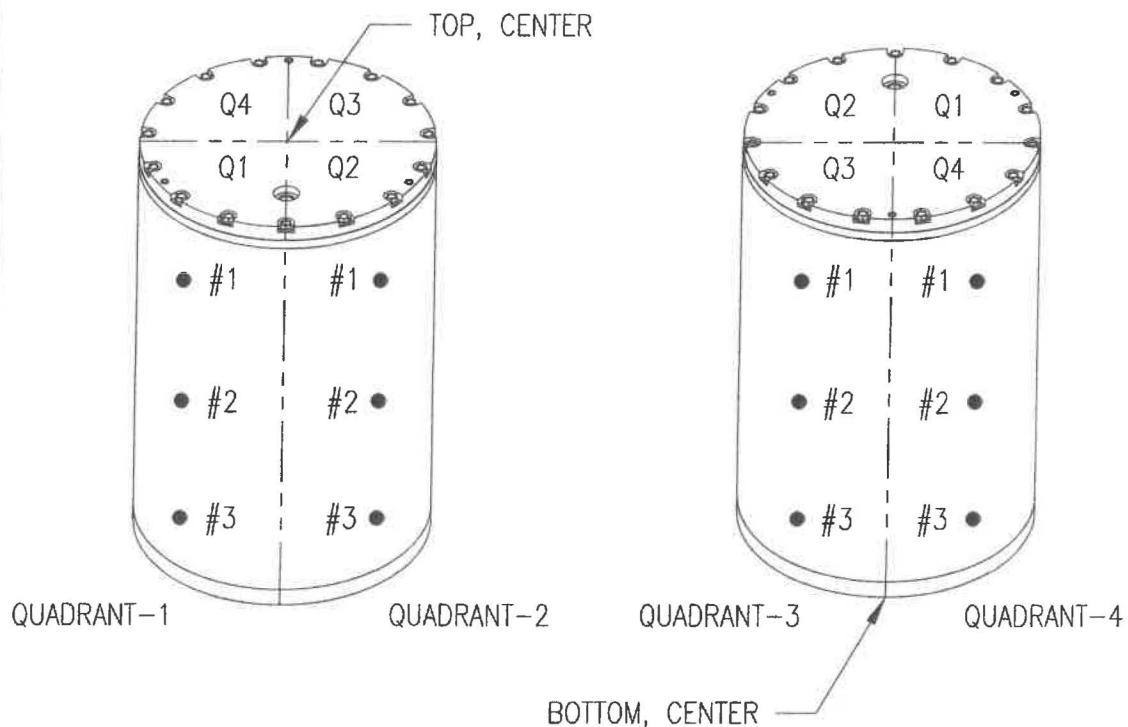
|   |      |
|---|------|
| Transportation Certification Official (or designee) | Date |
|---|------|

Attachment 2 – Shielded Container Assembly Contact Dose Rate Survey

**COPY**

Page 1 of 2

SCA CONTACT DOSE RATE SURVEY AREAS



# Radiological Survey Report

## Survey I-20181003-2

### General Information

Title: AHCF Campaign-19 WIPP SCA #SNL001702SC

Survey Date/Time: 10/3/2018 13:00

Lead Surveyor: Kemp, Justin

Location: 6597 High Bay

Work Order/Task #: 213283 80.01.05.01

TWD or RTWD #: AHCF-RTWD-025

Purpose: Characterization

Requestor Org: 01387

Status: Approved by: Bonadore, Steven, 10/12/2018

Ready for Review by: Kemp, Justin, 10/11/2018

### Additional Surveyors

#### Surveyor

Walton, Edward

### Instruments Used

| # | Instrument Model | Instrument Serial # | Inst Type | Probe Model | Probe Serial # | Probe Type | Calibration Date | Efficiency     |          |
|---|------------------|---------------------|-----------|-------------|----------------|------------|------------------|----------------|----------|
|   |                  |                     |           |             |                |            |                  | $\beta/\gamma$ | $\alpha$ |
| 1 | R020             | 12405               | D         | N/A         | N/A            | D          | 2/10/2019        | N/A            | N/A      |
| 2 | RADEYE PX        | 10387               | D         | NRD         | 2210           | D          | 11/10/2018       | N/A            | N/A      |
| 3 | 3030             | 278114              | C         | 43-10-1     | 102768         | C          | 10/10/2018       | 0.21           | 0.31     |

### Instruments Used - Notes

| # | Notes |
|---|-------|
| 1 | N/A   |
| 2 | N/A   |
| 3 | N/A   |

## Radiological Survey Report

### Comments:

Survey for WIPPs required Shielded Container Assembly (SCA) Contact Dose Rate Survey Form (CCP-TP-81 Rev.2.). Contact dose rates taken on SCA were taken according to, and documented on CCP-TP-81 Rev.2.

Area posted as RA/RMA/ConA

30cm dose rate survey at highest on contact location and removable contamination surveys also performed.

Radionuclides of concern:

Activation Products: Co-60 principal;

Fission Products (beta-gamma) Sr-90, Cs-137 principal;

Fission Products (alpha) Pu-239, Am-241 principal;

Actinides: U-234, U-235, U-238 principal

Swipes taken on the SCA were counted on a Ludlum 3030 counter.

All swipes were less than removable contamination limits of 20 dpm/100cm<sup>2</sup> alpha, 200 dpm/100cm<sup>2</sup> beta/gamma

RO-20 with open window was used for beta/gamma dose readings, and RadeyePx w/ NRD probe used for neutron dose readings.

Highest total contact dose rate measurement was less than WIPPs acceptance limit of 200 mR/hr

Highest dose rate on SCA was 18 mR/hr on contact and 6 mR/hr @ 30cm.

3030 MDA calculation worksheet sheet is attachment-1.

Copy of WIPP survey document CCP-TP-81 Rev.2. is attachment-2.

# Radiological Survey Report

## Itemized Details - Items

| #  | Item Location/Description | Comments |
|----|---------------------------|----------|
| 1  | SCA Top                   |          |
| 2  | SCA Bottom                |          |
| 3  | SCA Q1 #1                 |          |
| 4  | SCA Q1 #2                 |          |
| 5  | SCA Q1 #3                 |          |
| 6  | SCA Q2 #1                 |          |
| 7  | SCA Q2 #2                 |          |
| 8  | SCA Q2 #3                 |          |
| 9  | SCA Q3 #1                 |          |
| 10 | SCA Q3 #2                 |          |
| 11 | SCA Q3 #3                 |          |
| 12 | SCA Q4 #1                 |          |
| 13 | SCA Q4 #2                 |          |
| 14 | SCA Q4 #3                 |          |

## Alpha Activity

Counting Data Attached:  Yes  No

Radionuclide: Pu-239

Eff. for Removable: Inst:3 Eff: 0.31

Default Bkg Value: 0

Eff. for Total: Inst:N/A Eff:

Default Bkg Units: cpm/100 cm<sup>2</sup>

| #  | Data | Data Units              | Bkg. | Bkg. Units              | T/R | Activity   | Activity Units          |
|----|------|-------------------------|------|-------------------------|-----|------------|-------------------------|
| 1  | 1    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | <b>3.2</b> | dpm/100 cm <sup>2</sup> |
| 2  | 1    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | <b>3.2</b> | dpm/100 cm <sup>2</sup> |
| 3  | 0    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | <b>ND</b>  | dpm/100 cm <sup>2</sup> |
| 7  | 0    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | <b>ND</b>  | dpm/100 cm <sup>2</sup> |
| 11 | 1    | cpm/100 cm <sup>2</sup> | 0    | cpm/100 cm <sup>2</sup> | R   | <b>3.2</b> | dpm/100 cm <sup>2</sup> |

## Beta-Gamma Activity

Counting Data Attached:  Yes  No

Radionuclide: Cs-137

Eff. for Removable: Inst:3 Eff: 0.21

Default Bkg Value: 48

Eff. for Total: Inst:N/A Eff:

Default Bkg Units: cpm/100 cm<sup>2</sup>

| #  | Data | Data Units              | Bkg. | Bkg. Units              | T/R | Activity    | Activity Units          |
|----|------|-------------------------|------|-------------------------|-----|-------------|-------------------------|
| 1  | 46   | cpm/100 cm <sup>2</sup> | 48   | cpm/100 cm <sup>2</sup> | R   | <b>ND</b>   | dpm/100 cm <sup>2</sup> |
| 2  | 51   | cpm/100 cm <sup>2</sup> | 48   | cpm/100 cm <sup>2</sup> | R   | <b>14.3</b> | dpm/100 cm <sup>2</sup> |
| 3  | 43   | cpm/100 cm <sup>2</sup> | 48   | cpm/100 cm <sup>2</sup> | R   | <b>ND</b>   | dpm/100 cm <sup>2</sup> |
| 7  | 46   | cpm/100 cm <sup>2</sup> | 48   | cpm/100 cm <sup>2</sup> | R   | <b>ND</b>   | dpm/100 cm <sup>2</sup> |
| 11 | 38   | cpm/100 cm <sup>2</sup> | 48   | cpm/100 cm <sup>2</sup> | R   | <b>ND</b>   | dpm/100 cm <sup>2</sup> |

# Radiological Survey Report

## Radiation Survey

Background: <0.1

Background Units: mR/hr

Radiation Type: Beta/Gamma

| #  | Radiation Type | Reading | Units | Distance From Source | Comment                       |
|----|----------------|---------|-------|----------------------|-------------------------------|
| 1  | Beta/Gamma     | 3       | mR/hr | OC                   | Open window                   |
| 2  | Beta/Gamma     | 18/6    | mR/hr | OC/30 cm             | Open window (Highest reading) |
| 3  | Beta/Gamma     | 4       | mR/hr | OC                   | Open window                   |
| 4  | Beta/Gamma     | 3       | mR/hr | OC                   | Open window                   |
| 5  | Beta/Gamma     | 10/4.2  | mR/hr | OC/30 cm             | Open window                   |
| 6  | Beta/Gamma     | 3.5     | mR/hr | OC                   | Open window                   |
| 7  | Beta/Gamma     | 4       | mR/hr | OC                   | Open window                   |
| 8  | Beta/Gamma     | 8       | mR/hr | OC                   | Open window                   |
| 9  | Beta/Gamma     | 3       | mR/hr | OC                   | Open window                   |
| 10 | Beta/Gamma     | 3.5     | mR/hr | OC                   | Open window                   |
| 11 | Beta/Gamma     | 6       | mR/hr | OC                   | Open window                   |
| 12 | Beta/Gamma     | 3       | mR/hr | OC                   | Open window                   |
| 13 | Beta/Gamma     | 4       | mR/hr | OC                   | Open window                   |
| 14 | Beta/Gamma     | 6       | mR/hr | OC                   | Open window                   |

## Additional Radiation Survey

Background: <0.1

Unit: mrem/hr

Radiation Type: Neutron

| #  | Radiation Type | Reading | Units   | Distance From Source | Comment |
|----|----------------|---------|---------|----------------------|---------|
| 1  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 2  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 3  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 4  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 5  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 6  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 7  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 8  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 9  | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 10 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 11 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 12 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 13 | Neutron        | <0.1    | mrem/hr | OC                   |         |
| 14 | Neutron        | <0.1    | mrem/hr | OC                   |         |

# Radiological Survey Report

## Attachments

| Order | Filename                    | Description                      | Pages |
|-------|-----------------------------|----------------------------------|-------|
| 1     | MDA 3030 20181003.pdf       | 3030 MDA worksheet               | 1     |
| 2     | WIPP survey SNL001702SC.pdf | Copy of WIPP SCA survey document | 2     |

## LUDLUM 3030 MDA CALCULATION WORKSHEET

|                                    |  |
|------------------------------------|--|
| Instrument #: <u>278114</u>        | Calibration Expires: <u>10/10/18</u> Location: Bldg. <u>6597</u> Room <u>highbay</u> |
| Probe Type: <u>43-10-1</u>         | Probe #: <u>102768</u>   |
| CALCULATION BY: <u>Justin Keno</u> | DATE: <u>10-3-2018</u>   |

|  |   |
|--|---|
| Expected Sample Radionuclide ( $\alpha$ ): <u>Pu-239</u> | $\alpha$ Detector Efficiency for expected radionuclide (cpd): <u>0.31</u>                 |
| Expected Sample Radionuclide ( $\beta$ ): <u>Cs-137</u>  | $\beta$ Detector Efficiency for expected radionuclide (cpd): <u>0.21</u>                  |
| Background Count Time (min): <u>1</u>                    | If background and sample count times are the same, use MDA calculation method 4.6.1.      |
| Sample Count Time (min): <u>1</u>                        | If background and sample count times are different then use MDA calculation method 4.6.2. |

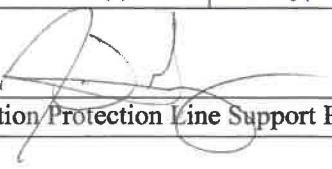
Daily check background count rate shall be used for MDA determination.

$\alpha$  0 cpm       $\beta$  48 cpm

| Method 4.4.2:<br>Use when background and sample count times are the same. | Method 4.4.3:<br>Use when background and sample count times are different.            |
|---|---|
| $MDA = \frac{2.71 + 4.65\sqrt{(R_b * t_b)}}{t_b * E}$                     | $MDA = \frac{2.71 + 3.29\sqrt{(R_b * t_s)}\left(1 + \frac{t_s}{t_b}\right)}{t_s * E}$ |
| Where:  | $t_s$ = Sample count time in minutes  |
| $MDA$ = Minimum Detectable Activity level in dpm                          | $t_b$ = Background count time in minutes  |
| $R_b$ = Background count rate in counts per minute                        | $E$ = Detector efficiency ( $\alpha$ or $\beta$ ) in counts per disintegration (cpd)  |

| Instrument MDA<br>Calculation Results  | Acceptable  | MDA Acceptance Limits <sup>†</sup><br>(from Table 6-1, RPPM) |              |
|--|---|--|--------------|
|  |   | Nuclide  | dpm          |
| $\alpha$ MDA: <u>9</u>   | Y <input checked="" type="checkbox"/> N <input type="checkbox"/> N/A <input type="checkbox"/> |  |              |
| $\beta$ MDA: <u>167</u>  | Y <input checked="" type="checkbox"/> N <input type="checkbox"/> N/A <input type="checkbox"/> |  |              |
| 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)<br>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) |

<sup>†</sup> Assumes swipe area is 100 cm<sup>2</sup>

|  |   |                     |                     |
|--|---|---------------------|---------------------|
| List Applicable Survey Number(s):                              | <u>M-2018/003-1</u>   | <u>M-2018/003-2</u> | <u>I-2018/003-2</u> |
| REVIEWED BY:   |  |                     |                     |
| Radiation Protection Line Support Project Leader (or Designee) | DATE: <u>10-3-18</u>  |                     |                     |

Attachment 2 – Shielded Container Assembly Contact Dose Rate Survey (Continued)

**COPY**

Page 2 of 2

| Shielded Container Assembly Contact Dose Rate Survey Form |                      |                   |                 |
|---|----------------------|-------------------|-----------------|
| Contact Dose Rate Measurement                             | Beta/Gamma (mrem/hr) | Neutron (mrem/hr) | Total Dose Rate |
| SCA Top   | 3                    | <0.1              | 3               |
| SCA Bottom  | 18                   | <0.1              | 18              |
| SCA Q1 #1   | 4                    | <0.1              | 4               |
| SCA Q1 #2   | 3                    | <0.1              | 3               |
| SCA Q1 #3   | 10                   | <0.1              | 10              |
| SCA Q2 #1   | 3.5                  | <0.1              | 3.5             |
| SCA Q2 #2   | 4                    | <0.1              | 4               |
| SCA Q2 #3   | 8                    | <0.1              | 8               |
| SCA Q3 #1   | 3                    | <0.1              | 3               |
| SCA Q3 #2   | 3.5                  | <0.1              | 3.5             |
| SCA Q3 #3   | 6                    | <0.1              | 6               |
| SCA Q4 #1   | 3                    | <0.1              | 3               |
| SCA Q4 #2   | 4                    | <0.1              | 4               |
| SCA Q4 #3   | 6                    | <0.1              | 6               |

Verify the highest total contact dose rate measurement is ≤200 mrem/hr on the external surface of the SCA, and record as the contact dose rate of record: 18 mrem/hr.

I certify that the contact dose rate data recorded is correct.

Thomas 10-03-18

Transportation Certification Official (or designee) Date

Attachment 2 – Shielded Container Assembly Contact Dose Rate Survey

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## SCA CONTACT DOSE RATE SURVEY AREAS

