LLNL-TR-667001

Lawrence Livermore National Laboratory

Sampling Report for May-June, 2014 WIPP Samples

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Forensic Science Center
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Section 1

WIPP Panel 7 Sampling May-June, 2014

1. Summary of Sampling Activity

This report outlines the first attempted sampling of materials in the Panel 7 area that were exposed to the contents of the breached drum identified as Drum 68660. When Drum 68660 breached, the incident appeared to affect a very wide area in Panel 7, evidenced by the destruction of the outer containment of the MgO bags in various rows and columns. The first part of the sampling was to establish the extent of the effect by swiping various areas and monitoring the swipes for radioactivity. After these samples were taken, efforts were made to retrieve solid samples for analysis to determine the cause of the incident. Due to inadequate knowledge of how to sample under a rushed effort into unknown conditions, the sampling process was only partially successful. From the lessons learned, a future sampling (August 15, 2014) was implemented with new sampling devices and more focused location. An overview of the sampling process and controls is depicted in Figure 1.

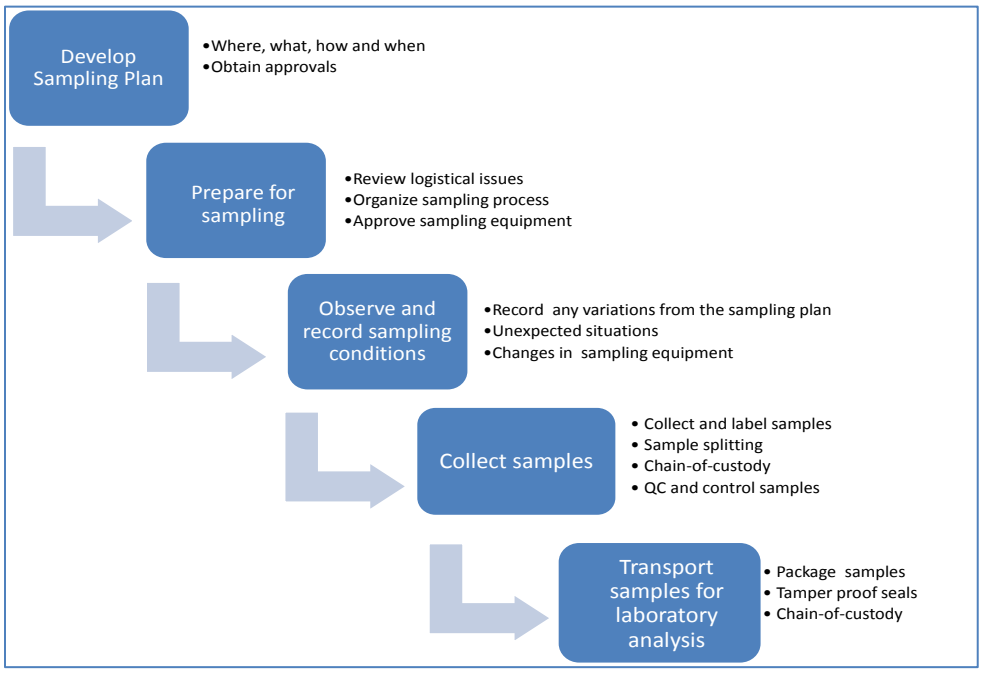


Figure 1. Sampling process flowchart

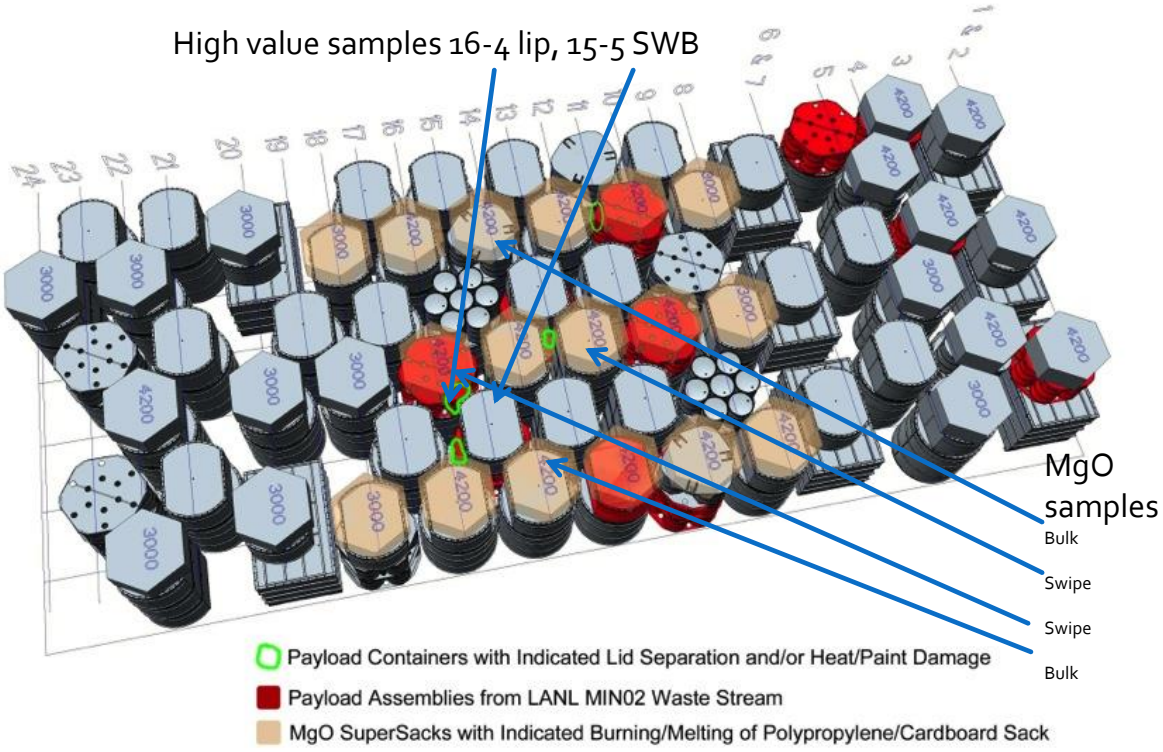


Figure 2. Location of Drum 68660 and surrounding areas

Figure 2 shows a three-dimensional illustration of the areas of damage and sampling locations. The target drum is in Row 16 and Column 4 of existing waste barrels — a location designated as "16-4". Note, throughout the remainder of this report, a "Row-Column" format convention will be used to describe locations in Panel 7; it is suggested that the reader refer to Figure 2 when determining these locations. Drum 68660 is indicated in red. Similar drums originating from Los Alamos National Laboratory (LANL, and specifically the LANL MIN02 Waste Stream) are also indicated in red. Breaches in any other drums (originating from LANL or elsewhere), at this time, have been not been verified. The target area for the sampling is the green highlighted area indicated with the "High value sample 16-4 lip". This is where the breach occurred. The drum 15-5 SWB (Standard Waste Box) is adjacent to the 68660 breached drum and appears to have residue from the breach. Note that 68660 had the MgO sack on top of it. These sacks weigh ca. 1.5 tons and are placed as whole, intact bags, with a polypropylene/cardboard containment. Not all the drums have these bags, however. 15-5 SWB did not have a MgO bag on it. The containers with the tan coloring indicate MgO sacks that no longer have the polypropylene/cardboard containment. Column 5 is the column with containers that have no MgO bags on them. The blue arrows in the figure indicate where the last of the series of samples were taken (vide infra).

In early May, to further understand the breach that occurred, a sampling team entered the Panel 7 area to assess the extent of contamination. The extent was unknown and the sampling was a matter of urgency. The sampling strategy was the best available considering the time constraints. Peer review was also conducted to add to the validity of the methods.

A swipe (or, wipe) sampler was first used to attempt to collect both trace and bulk samples. The sampler itself had to securely fit on the end of a 50-foot boom and to have a sufficiently large, flat surface area to contact the sample and to hold various types of sample collection media. Two such configurations that met these needs were a foam paint brush and a Swiffer® holder; see Figure 3. These items could be modified to hold Rad Con disc smears (wipes), Velcro® pieces, and tape pieces (i.e. the adhesive on the backside of the Velcro® pieces), which could then be used to collect particulate samples; see Figure 4. Although it is not clear which item was chosen to perform the sampling, documents from the analysis indicate the Swiffer® brand as the item chosen to hold the media used for sample collection.

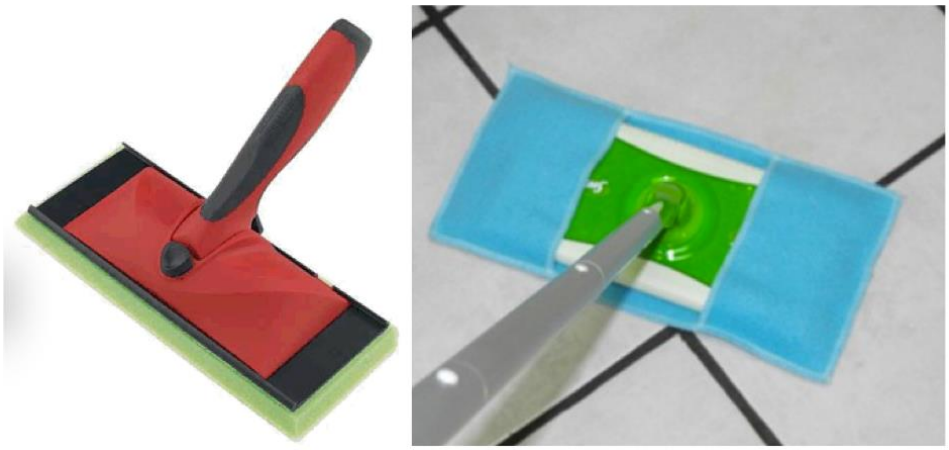


Figure 3. Origin of the multi-sampler (foam paint brush on the left, Swiffer® on the right)

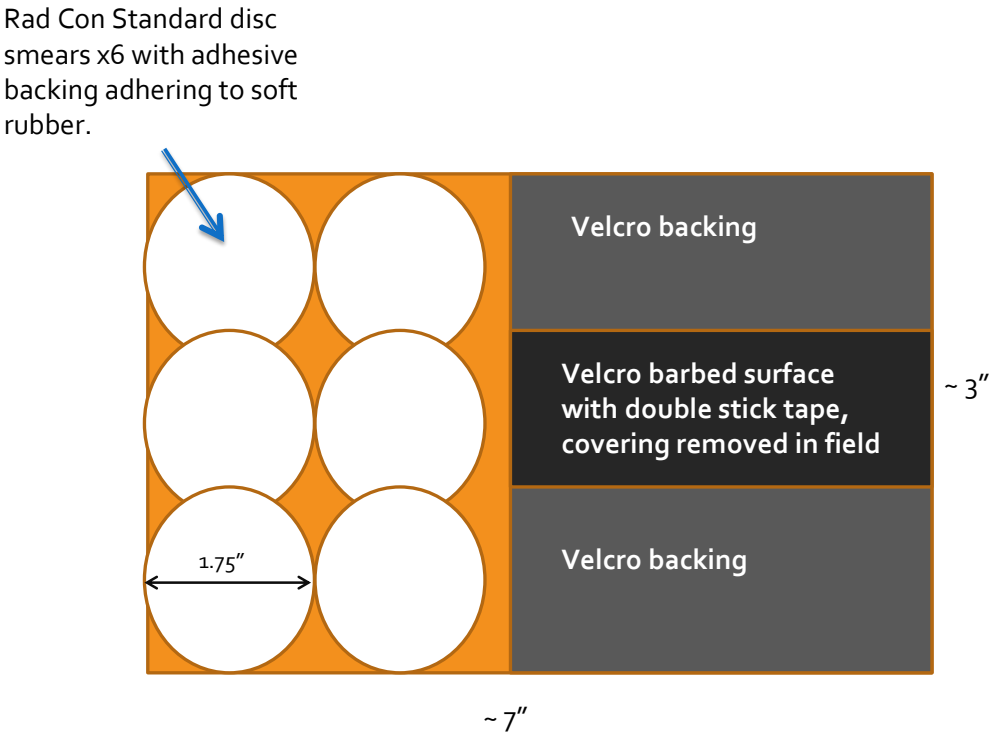


Figure 4. Multi sampler used in the May-June sampling.

As can be seen in Figure 4, all three methods of collection were incorporated onto the sampler: sticky tape (preferred for particulate, but not organics), disc smear (with adhesive on the back but not on sampling surface), and a Velcro® connector (the soft part was used to gather MgO and shown to collect about 5 g of MgO in mock runs). The Swiffer® multi-sampler was approximately 7" x 3", held six standard Rad Con smear discs (with adhesive backs adhering to soft rubber), two 1" x 3.5" bare Velcro strips, and one 1" x 3.5" Velcro patch with sticky tape, which was covered until deployment in the field. The sampler was designed to be used on a 50-foot, titanium/aluminum pole, to which a camera was also attached to help identify and document conditions; see Figure 5. The sampling team was fully suited and not allowed to enter directly near the breached materials.

Figure 5. Standard configuration of Swiffer® multi-sampler.

The left side of Figure 6 shows a Swiffer® multi-sampler after collection of a sample (refer to the conceptual drawing of Figure 4 to identify individual components). The right side of Figure 6 shows a sample collected on sticky tape; clearly, this is not sufficient sample to allow a wide-variety of analyses. After the sampler had been used, the entire sampling head (i.e. Swiffer® platform) was brought back to the operator, placed in plastic sample bags, and brought to the surface. Figure 7 shows the differences in the collection efficiencies of the components used in the multi-sampler, in which the middle section of the Velcro area appears to be the best collector (e.g. had the most white powder). Figure 7 also shows examples of some of the samples collected; the MgO on the left side of Figure 7 shows little contamination, although the MgO sack on 14-2 was ruptured, as were others in the area. The Swiffer® multi-sampler in the middle frame

shows that the MgO (sticky strip surround by black) was still fairly white. Some dark particles were still collected and examples of these are on the right, from 14-6.

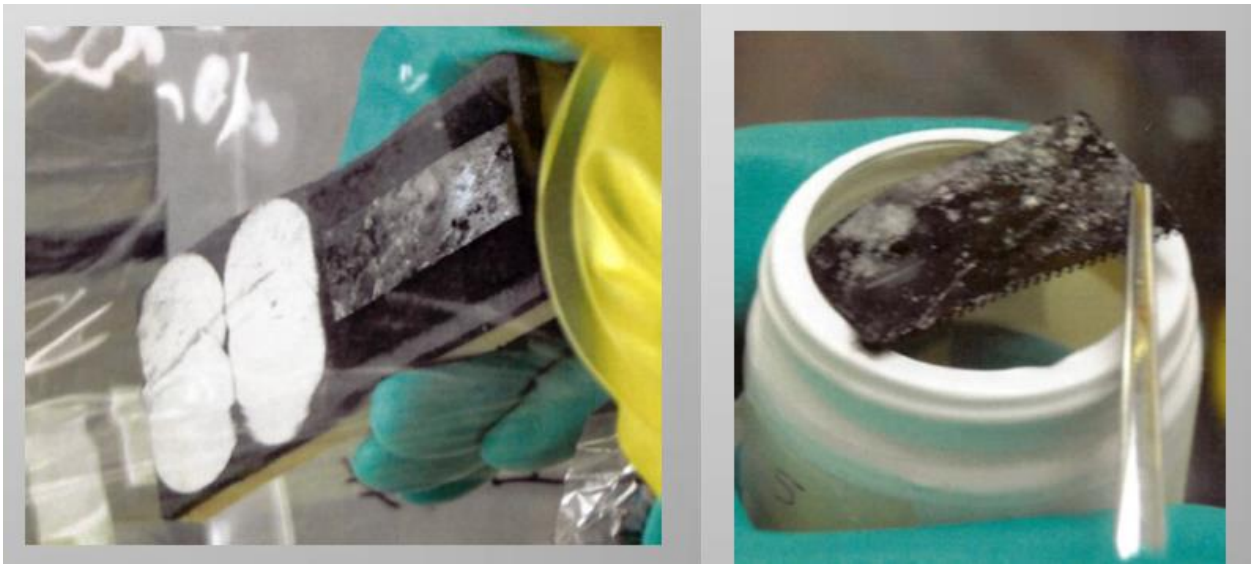


Figure 6. The Swiffer® multi-sampler (left) and close-up view of sticky tape (right).

Figure 7. MgO collected from 14-2 (left); Swiffer® multi-sampler after collection from 16-4 (middle); dark particles collected from 14-6 (right).

In addition to collecting samples with the Swiffer® multi-sampler, the Accident Investigation Board (AIB) suggested that bulk samples of magnesium oxide (MgO) be collected. Figure 8 shows a first-generation MgO bulk sampler. The sampler is made from standard PVC pipe with the end cut on the diagonal. The edge was purposely left sharp—cut, not machined. The sampler was configured at a 90° angle to the sampling boom so an angular motion could be used for the collection of the MgO samples. The sampler was positioned by moving the sampling boom into the bulk MgO powder. Then the operator rotated the sampling boom upwards to collect the sample down into the "T" part of the sampler. The sample was then brought back to the operator and put into vials for transport.

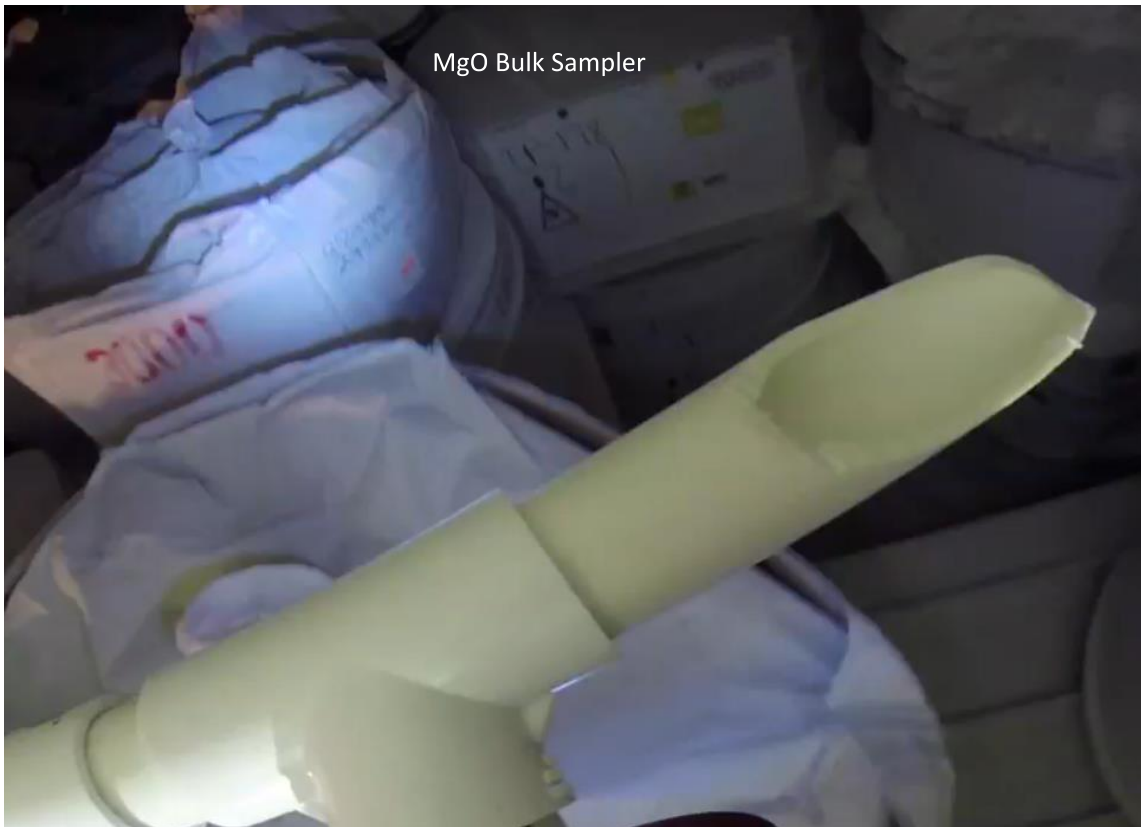


Figure 8. MgO bulk sampler for May-June 2014 Sampling.

In addition, many locations were sampled using Masslinn wipes. These wipes are pretreated with a solvent (by design of the manufacturer) such that they have a high efficiency for collecting particles. Wipe sampling is commonly performed because wipe samples are easy to collect and can be used to non-destructively sample many surfaces.

For the May–June sampling campaigns, sampling locations were recommended by Sandia National Laboratories. In addition to samples collected in the area of 16-4, many other locations were swiped with a Masslinn sampling cloth. Variance in the sampling plan was expected at this sampling time, because this was the first attempt at sampling an area that was not well understood/characterized and was not totally accessible to sampling. And, as there was no expectation of collecting homogenous or representative samples; for this reason, only qualitative (and not quantitative) data could be obtained.

After collection, swipes and such were placed in static-proof bags. However, the bags could not be sealed in the mine because the operators lacked the dexterity needed to seal the bags when wearing bulky, protective clothing. Upon transferring custody of the samples, J-seals were put on the outer bag.

Numerous samples were collected. The chain-of-custody (COC) reports are attached, with the results of radiography analyses. A list of samples, listed by COC number and the dates that the COCs were initiated (which do not necessarily correspond to the sample collection dates), are shown below:

1. COC 14-0160, date assigned 5/6/14, N. Domingues:
    - Sample #1—201455118 FAS filter paper
2. COC 14-0161, date assigned 5/7/14, J. Chavez:
    - Sample #1—various UG samples placed in bag
    - Sample #2—smears and wipes from Panel 7 Room 6
    - Blanks for Rudos air filters, FAS air filters, smears, and Masslinn swipe
3. COC 14-0168, date assigned 5/13/14, R. Groves (samples taken 5/10/14):
    - Sample #1—Panel 7, Room 7, waste face, Masslinn swipe
    - Sample #2—Panel 7, Room 7, waste face Masslinn swipe
    - Sample #3—Panel 7, Room 1, Masslinn swipe
    - Sample #4—Panel 7, Room 7 waste face table Masslinn swipe
    - Sample #5—Panel 7, Room 6 Masslinn swipe;
    - Sample #6—blank Masslinn swipe.
4. COC 14-0173, date assigned 5/16/14, R. Groves:
    - Sample #1—Table/chair Masslinn and disc smear
    - Sample #2—Pink pad waste face, Masslinn and disc smear
    - Sample #3—Slip sheet waste face, Masslinn swipe and disc smear
    - Sample #4—Room 1 exhaust drift, Masslinn swipe and disc smear
    - Sample #5—clean Masslinn swipe and disc smear.

5. COC 14-0175, date assigned 5/21/14, L. Turnbow:
    - Sample #1—pink mat waste face, Masslinn swipe
    - Sample #2—slip sheet, Masslinn swipe
    - Sample #3—Table and chair waste face, Masslinn swipe
    - Sample #4—Camera lens, Masslinn swipe
    - Sample #5—clean blank, Masslinn swipe.
6. COC 14-0179, date assigned 5/27/14, M. Carrathan:
    - Sample #1—East slipsheet, disc smear
    - Sample #2—West slipsheet, disc smear
    - Sample #3—Pigmat center, disc smear
    - Sample #4—Camera lens, towellete
    - Sample #5—Clean blank, disc smear.
7. COC 14-0182, date assigned 6/2/14, R. Groves:
    - Sample #1—Panel 7 16-4 MgO, sticky pad
    - Sample #4—Panel 7 14-4 MgO, sticky Pad
    - Sample #5—Panel 7 Row 14-6 MgO from PVC sampler
    - Sample #6—14-2 MgO from PVC sampler
8. COC 14-0183, date assigned 6/4/14, J. Bic####:
    - Sample #1—Clean blanks PVC, disc smears, sticky tape
    - Sample #2—15-5 SWB miscellaneous material
    - Sample #3—16-4, miscellaneous materials.

Most of the samples listed above are swipes and smears, collected for the purpose of checking for radioactive contamination. These samples are taken at various places throughout Panel 7. Sample collection numbers 7 and 8 are located in the vicinity of the breached drum and are indicated on Figure 2. Sample collection number 7 has swipes of a 14-4 and 16-4 (the breached drum) and bulk MgO samples from 14-2 and 14-6. The high-value samples are those collected from 16-4 (lip of the breached drum) and nearby 15-5 SWB.

2. Sample Integrity

Samples were collected and placed within certified clean containers or their equivalent. The containers were secured with tamper-evident seals and were accompanied by COC documentation. The samples were stored in a secured area to prevent tampering or loss.

3. Quality Control Samples

Quality control (QC) samples were employed to verify sampling integrity and to detect contamination should it occur due to containers, handling, and transportation. The following types of QC samples were incorporated into the overall process:

- Field blanks: Masslinn wipes, disc smears, and towelettes.
- MgO sampled from intact MgO containers in Panel 7.

4. Sample Transport and Storage

During sample transport and storage, the following procedures were followed to ensure that samples were not altered and were in a condition suitable for analysis at the laboratory. The following sample transport and storage procedures were followed:

1. Samples were taken by the boom operator and brought back to the staging area.
2. Samples were labeled, sealed and bagged individually and brought, labeled, from Panel 7 to surface laboratory. Static-proof bags were used, but were not sealed in the mine with tamper-evident tape because operators lacked sufficient dexterity to accomplish this while wearing PPE.
3. Samples were sealed by J-seal and were appropriately packaged to avoid breakage and cross-contamination.
4. Sample degradation was minimized through appropriate storage (e.g., samples were maintained at room temperature).
5. Sample containers were sealed with tamper-evident seals and accompanied by COC paperwork.
6. Samples were packed in insulated coolers for transport to the laboratories.

5. Summary of Samples Collected

Samples were taken in three groups: 1) Sample from 16-4 drum in Panel 7, 2) Samples from 15-5 SWB in Panel 7 and 3) Samples from unopened MgO in the front area of Panel 7. Table 1 lists the specific samples taken by their chain-of-custody ID number and description.

Table 1. Collected samples.

TAT Laboratory Samples		
No.	**COC ID**	**Description**
1	14-0161	Sample #1—V/G samples in Bag #1 Sample #2—smears and wipes, Panel 7 Room 6 in Bag #2 Blank Rudos Air Filter Blank Smear Media Blank Masslinn Cloth
2	14-0160	1-201455118-FAS Air Filter
3	14-0168	UG Masslinn swipe, waste face pink pillow UG Masslinn swipe, waste face UG Masslinn swipe, Panel 7 Room 1 UG Masslinn swipe, waste face table UG Masslinn swipe, Panel 7 Room 6 Blank clean Masslinn swipe
4	14-0173	Masslinn swipe/disc smear, table chair waste face Masslinn swipe/disc smear, pink pad waste face Masslinn wipe/disc smear, slip sheet waste face Masslinn swipe/disc smear, room 1 exhaust drift Masslinn swipe/disc smear, clean/blank
5	14-0175	Masslinn swipe, pink mat waste face Masslinn swipe, slip sheet Masslinn swipe, table chairs waste face Masslinn swipe, camera lens Masslinn swipe, clean blank
6	14-0179	Smear, east slip sheet Smear, west slip sheet Smear, pig mat center Towelette, camera lens Smear, clean blank
7	14-0182	Sticky pad, 16-4 MgO Sticky pad, 14-4 MgO PVC Sampler, 14-6 MgO PVC Sampler, 14-2 MgO
8	14-0183	Clean blanks—PVC, smears, sticky tape 15-5 SWB, miscellaneous material 16-4 Lip, miscellaneous material

6. Photographs of Sampling Activities

Videos were taken during most of the May-June sampling events. The videos are generally over 2 GB each. These are available through the WIPP facility. The files are the following:

1. 04-30-2014 ENTRY Video
2. 05-10-2014 Entry Video
3. 05-15-2014 Entry Video
4. 05-22-2014 Video Entry
5. 0001531R
6. 0031581R
7. GOPR0010
8. GOPR0051
9. GOPR0052
10. GP010009
11. GP010010
12. GP010051
13. GP020051
14. GP030051

The contents of the videos vary depending upon which area in Panel 7 that was being sampled. The general location and conditions of the waste container can be identified, as well as a survey perspective of the extent of damage caused by the incident.

7. Chain of Custody (COC)

Prior to this sampling activity, COC was set up for the influx of samples. Figures 9-17 show the official WIPP COCs, radiological screening, and screening locations for COC 14-0160, 14-0161, 14-0168, 14-0173, 14-0175, 14-0179, 14-0182, 14-0183, which covers the samples that were sent for analyses.

8. Sampling Authorization

Selected sampling of the materials in Panel 7 was authorized by TAT through an after-the-fact memo: R&D Directions, T6035-00069-03, Jun 11, 2014, John Young, 5-5641, 19420, WIPP special MgO samples. Below is a copy.

R&D Directions T6035-00069-03
Jun 11, 2014
John Young, 5-5641, 19420

WIPP special MgO samples

- **COC 14-0182**
  - #1 R-16 C-4 MgO Sticky pad (six disc smears, 1 pc tape and velcro backing)
  - #4 R-14 C-4 MgO Sticky pad
  - #5 R-16 C-6 MgO PVC bulk sampler
  - #6 R-16 C-2 MgO PVC bulk sampler

All samples are "pink dot" because they originate from offsite and are prohibited from the High Activity Drain. Return all liquid and solid residues.

Custody of the samples shall be controlled and protected. Samples shall remain in locked, restricted access storage areas.

Initial gamma scans will be done on each of the four packages, without opening. Geometry will be estimated to give a rough order of the activity contained within. Unceratinty measurements should reflect this lack of geometry control.

********** **Special Hold Point – Prior to destructive analysis, written approval (email ok) will be obtained from AIB, TAT, NWP and CBFO.**
****

Filter disk samples (#1 and #4) will be pulled off the sticky pad sampler for analysis
One (each) disk smear will be removed, for

1- XRD
2- XRF (may be shared with XRD)
3- SEM-w/x-ray
4- Hot water dissolution, followed by TOC and Ion Chromatography
5- GCMS (SVOA)
6- Archive for future need

Alternatively, if sufficient bulk sample is available on the velcro (or in the static proof bag), or if the sticky tape is a preferred sample, communicate this to me and I will get approval to remove part of it.

Bulk samples (#5 and #6) will be aliquoted from the PVC pipe or from the static proof bags for analysis

One (each) subsample of approximately 1 gram, will be weighed and removed (in B-131), for

1- XRD
2- XRF (may be shared with XRD)
3- SEM-w\x-ray
4- Hot water dissolution, followed by TOC and Ion Chromatography
5- GCMS (SVOA)
6- GCMS (VOA)
7- TGA-MS
8- Archive for future need

Dissolution chemist will provide oversight and give special directions if less than 10 grams of each bulk sample is recovered from the shipping bag/pipe.

NQA-1 quality standards, including current, full documentation of standards, Measurement and Testing Equipment (M&TE) and Measurement Systems and Equipment (MS&E) shall be used for this project. Additionally, guidance provided in the Technical Assistance Team Quality Standards document shall be used.

Speedchart is 06QBWPPTST

Appendix A: Chain of Custody Documentation

WIPP Shipments
WIPP COC/FED EX Tracking

#	Date Sent from WIPP/Date Received by SRS	WIPP Chain of Custody (COC) #	FED EX Tracking #	Customer Sample id from WIPP COC	Sample Type	SRNL/AD Travel copy #	SRNL/AD LIMS#
1	5-7-14/5-8-14	14-0161	798780165119	see details	Filter papers, smears and masselin	see details	see details
1	5-7-14/5-8-14	14-0160	798780165119	1-201455118-FAS	Filter paper	see details	see details
2	5-13-14/5-15-14	14-0168	798839837731	Bag 1-Waste Face Pink; Bag 2-Waste Face; Bag3-Panel 7 Room 1; Bag 4-Waste Face Table; Bag-5 Panel 7 Room 6	Masselin	65795	300311199-203
3	5-20-14/5-22-14	14-0173	770035524321	#1 Table-Chair Waste Face; #2 Pink Pad Waste Face; #3 Slip Sheet Waste Face; #4 Room 1 Exhause Drift	Smears and Masselin	65834	300311437-440
4	5-21-14/5-22-14	14-0175	770049803339	#1 Pink Mat Waste Face; #2 Slip sheet; #3 Table-Chairs Waste Face; #4 Camera Lens	Masselin	65852	300311515-518
5	5-27-14/5-29-14	14-0179	770099409499	#1 East Slip sheet; #2 West Slip sheet; #3 Pig Mat Center; #4 Camera Lens;	Smears and Towelette	65874	300311593-596
6	6-2-14/6-5-14	14-0182	770167511308	#1 R-16 C-4 MGO; #4 R-14 C-4 MGO; #5 R-14 C-6 MGO; #6 R-14 C-2 MGO;	MgO	65905	300311792-795
7	6-4-14/6-5-14	14-0183	770196860881 (shipped from WIPP to SRS arrived 6/5/14); 770238590452 (shipped from SRS 6/10/14 to PNNL)	#1 Clean blanks; #2 R-15 C-5 SWB; #3 R-16 C-4 Lip;	sticky pads	n/a	n/a

Figure 9. Summary of Chain-of-Custody for May- June 2014 Sampling

(1)

Attachment 4 – Request for Analysis/Chain-of-Custody Record

Sampling program: ☑ Radiological Control ☐ SEC **COC Number**: 14-0160 **Page** 1 **of** 1

SAMPLE IDENTIFICATION NUMBER	SAMPLE TYPE	SAMPLE VOL. FT.^{3}	ANALYSIS TYPE	SPECIAL INSTRUCTIONS
Sample # 1-201455118	Air filter	N/A	Per attached sample plan	Per attached sample plan
		N		
		A		

TURNAROUND TIME REQUIRED: NORMAL ✓ RUSH: _____

		Printed Name	Signature	Date/Time			Printed Name	Signature	Date/Time
1.	Relinquished by:	N Dominguez		5-6-14 1555	1.	Received by:	Jim Saterfiel		5-6-14/1553
2.	Relinquished by:	Jim Saterfiel		5-7-14/0744	2.	Received by:	J. Chavez		5-7-14/0745
3.	Relinquished by:	J. Chavez		5-7-14/1000	3.	Received by:	John Young		5/8/14 & 1507

Figure 10. Copy of COC 14-0160

(2)

Attachment 4 – Request for Analysis/Chain-of-Custody Record

Sampling program: ☐ Radiological Control ☐ SEC **COC Number**: 14-0161 **Page** 1 **of** 1

SAMPLE IDENTIFICATION NUMBER	SAMPLE TYPE	SAMPLE VOL. FT.^{3}	ANALYSIS TYPE	SPECIAL INSTRUCTIONS
Sample #1	Various U/G Samples in Bag #1	N/A	Per Rad Eng.	Per attached Sample Plan
Sample #2	Smears and wipes from Panel 7 Room 6 in Bag #2			
Blank Rados Filter	Air Filter			
Blank FAS Filter	Air Filter			
Blank Smear Media	Smear Media			
Blank Muslin Cloth	Muslin Cloth			
		N/A		

TURNAROUND TIME REQUIRED: NORMAL _____ RUSH: _____

		Printed Name	Signature	Date/Time
1.	Relinquished by:	J. Chavez	[signature]	5-7-14/1000
2.	Relinquished by:			
3.	Relinquished by;			

		Printed Name	Signature	Date/Time
1.	Received by:	Leigh Brown	LW Brown	5/8/14 1530
2.	Received by:			
3.	Received by:			

Figure 11a. Copy of COC 14-0161

Removable Radiological Survey Count Results (Ludlum 3030)

Batch # 050614 ~~140505~~ AF
5-6-14

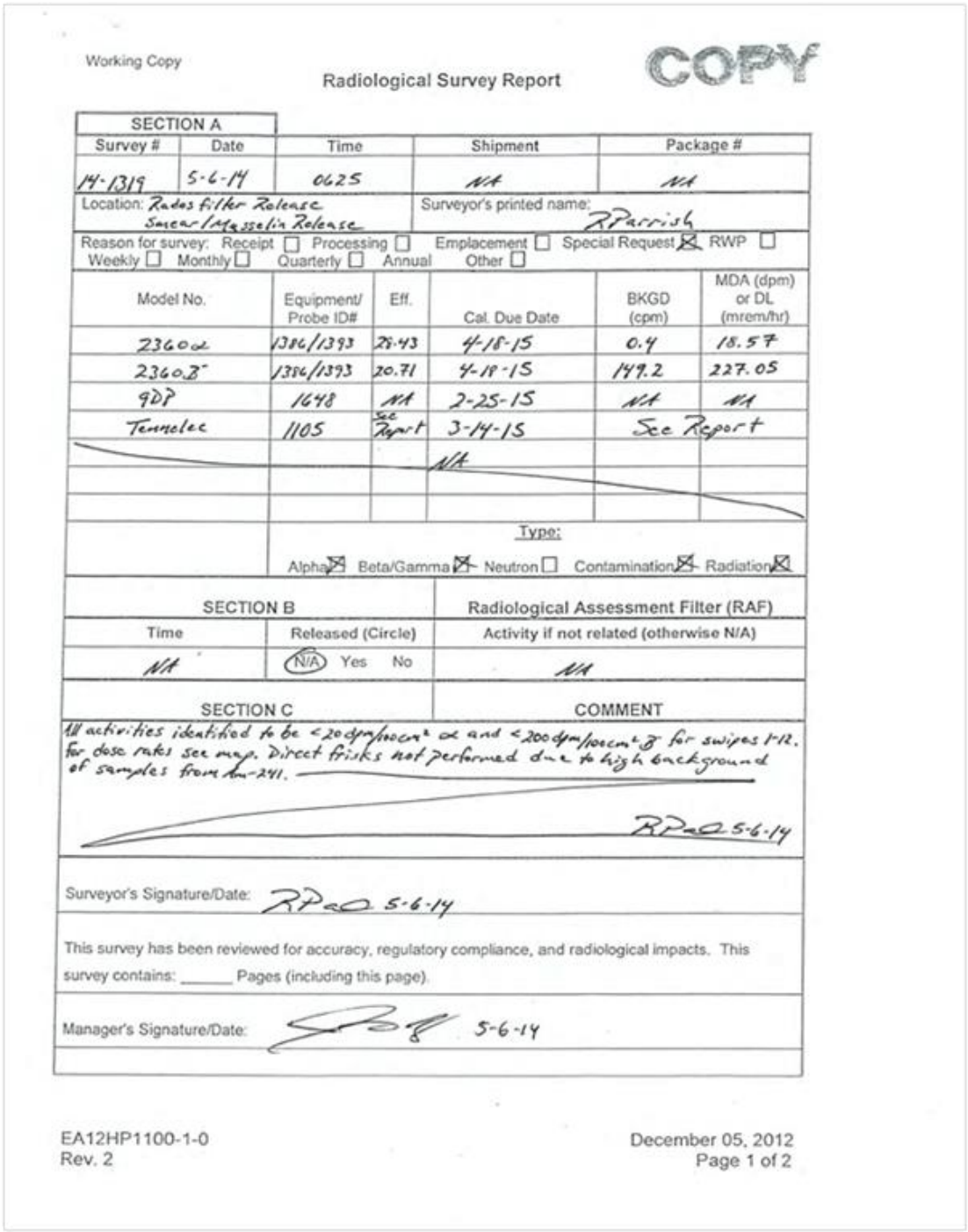
Count time Min	Date Counted	Alpha DL (DPM)	Beta/Gamma DL (DPM)	Instrument Model / Serial
1	5-6-14	4	60	Ludlum 3030 / 257633

Swipe #	Swipe Location	Alpha (DPM/swipe)	Beta/Gamma (DPM/swipe)	Comments
1	Front of 2nd bag in	0	0	NA
2	Back of 2nd bag in	0	19	
3	Back of outer bag	0	9	
4	front of outer bag	2	24	
5	outside of jar	2	29	
		CW	5-6-14	

Comments: Filter being Returned to Radcon after α count

Performed By: Craig Colletti Date: 5-6-14

Figure 11b. Copy of COC 14-0161 radiological screening



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Radiological Survey Report

SECTION A

Survey #	Date	Time	Shipment	Package #
14-1319	5-6-14	0625	NA	NA

Location: Rados filter Release
Smear/Masselin Release

Surveyor's printed name: RParrish

Reason for survey: Receipt ☐ Processing ☐ Emplacement ☐ Special Request ☒ RWP ☐
Weekly ☐ Monthly ☐ Quarterly ☐ Annual ☐ Other ☐

Model No.	Equipment/ Probe ID#	Eff.	Cal. Due Date	BKGD (cpm)	MDA (dpm) or DL (mrem/hr)
2360α	1386/1393	25.43	4-18-15	0.4	18.57
2360β	1386/1393	20.71	4-18-15	149.2	227.05
9DP	1648	NA	2-25-15	NA	NA
Tennelec	1105	See Report	3-14-15	See Report	
			NA		

Type:
Alpha ☒ Beta/Gamma ☒ Neutron ☐ Contamination ☒ Radiation ☒

SECTION B — **Radiological Assessment Filter (RAF)**

Time	Released (Circle)	Activity if not related (otherwise N/A)
NA	(N/A) Yes No	NA

SECTION C — **COMMENT**

All activities identified to be <20 dpm/100cm² α and <200 dpm/100cm² β for swipes 1-12. For dose rates see map. Direct frisks not performed due to high background of samples from Am-241.

RPar 5-6-14

Surveyor's Signature/Date: RPar 5-6-14

This survey has been reviewed for accuracy, regulatory compliance, and radiological impacts. This survey contains: _____ Pages (including this page).

Manager's Signature/Date: [signature] 5-6-14

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Figure 11c. Copy of COC 14-0161 radiological screening

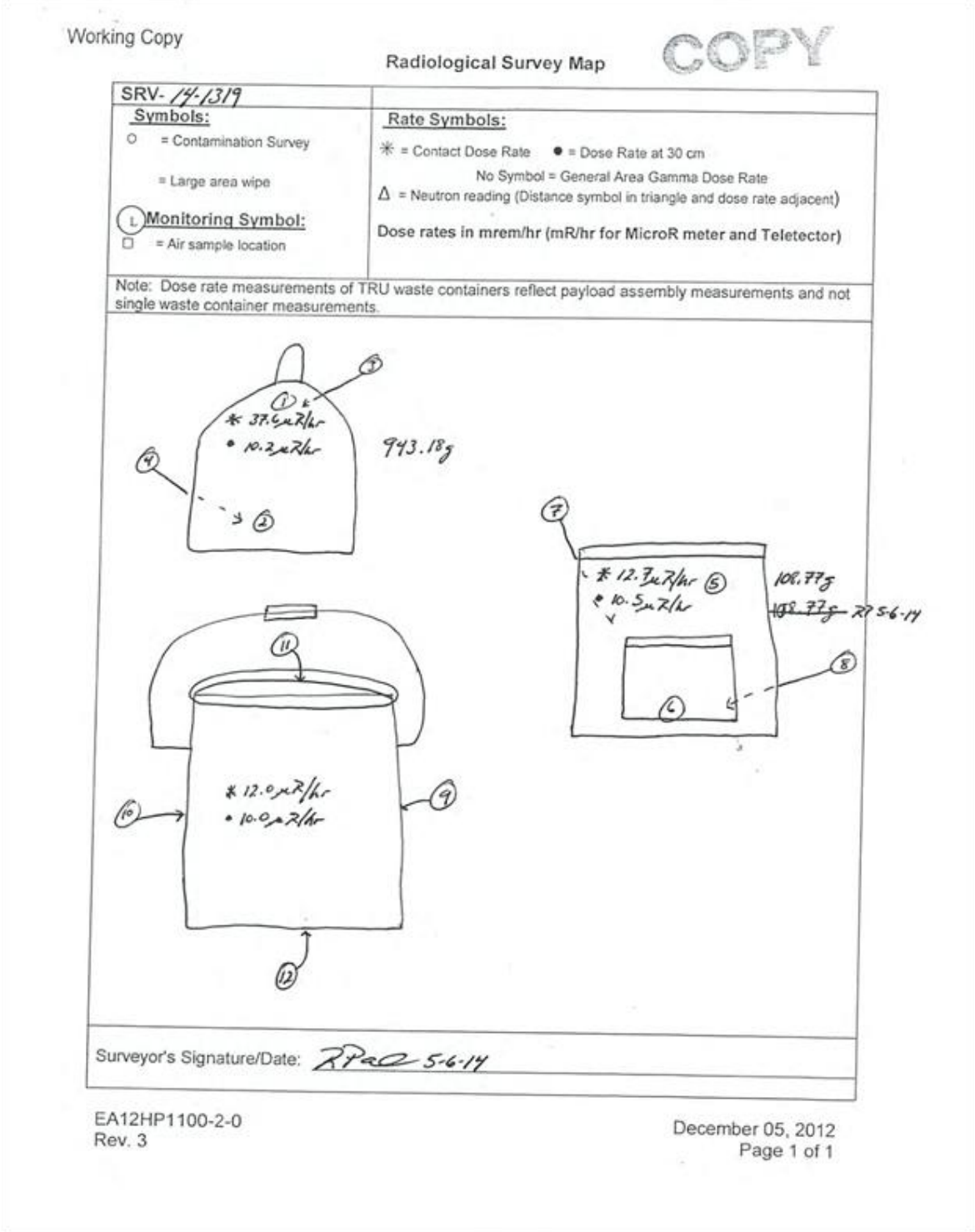
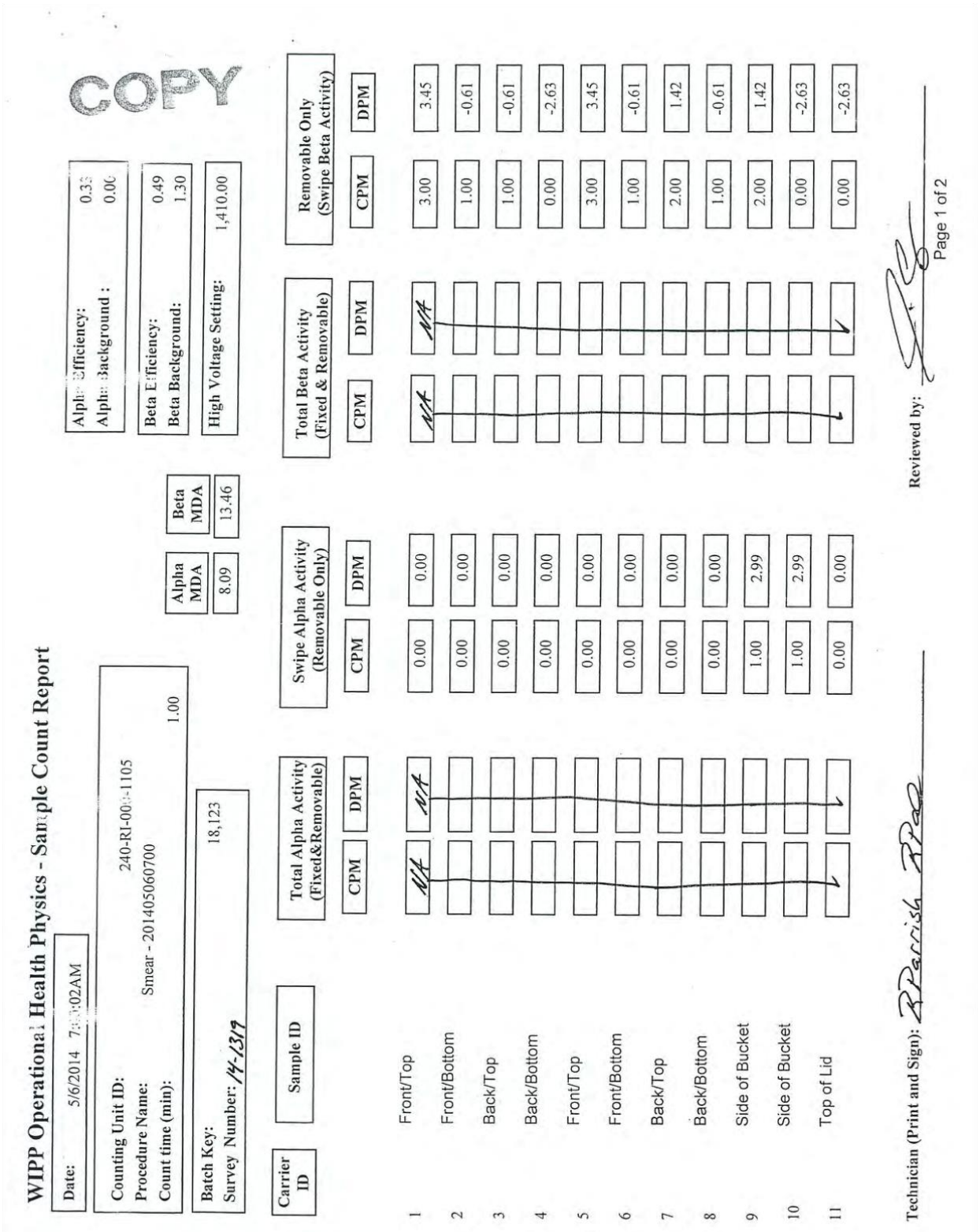


Figure 11d. Copy of COC 14-0161 radiological screening, sample locations



WIPP Operational Health Physics - Sample Count Report

Date: 5/6/2014 7:[illegible]:02AM

Counting Unit ID: 240-RI-00[illegible]-1105
Procedure Name: Smear - 201405060700
Count time (min): 1.00

Batch Key:
Survey Number: 14-1319 — 18,123

Alpha Efficiency: 0.3[illegible]
Alpha Background: 0.0[illegible]

Beta Efficiency: 0.49
Beta Background: 1.30

High Voltage Setting: 1,410.00

Alpha MDA	Beta MDA
8.09	13.46

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	Carrier ID	Sample ID	Total Alpha Activity (Fixed&Removable)		Swipe Alpha Activity (Removable Only)		Total Beta Activity (Fixed & Removable)		Removable Only (Swipe Beta Activity)	
			CPM	DPM	CPM	DPM	CPM	DPM	CPM	DPM
1		Front/Top	N/A	N/A	0.00	0.00	N/A	N/A	3.00	3.45
2		Front/Bottom			0.00	0.00			1.00	-0.61
3		Back/Top			0.00	0.00			1.00	-0.61
4		Back/Bottom			0.00	0.00			0.00	-2.63
5		Front/Top			0.00	0.00			3.00	3.45
6		Front/Bottom			0.00	0.00			1.00	-0.61
7		Back/Top			0.00	0.00			2.00	1.42
8		Back/Bottom			0.00	0.00			1.00	-0.61
9		Side of Bucket			1.00	2.99			2.00	1.42
10		Side of Bucket			1.00	2.99			0.00	-2.63
11		Top of Lid			0.00	0.00			0.00	-2.63

Technician (Print and Sign): RParrish RPar

Reviewed by:

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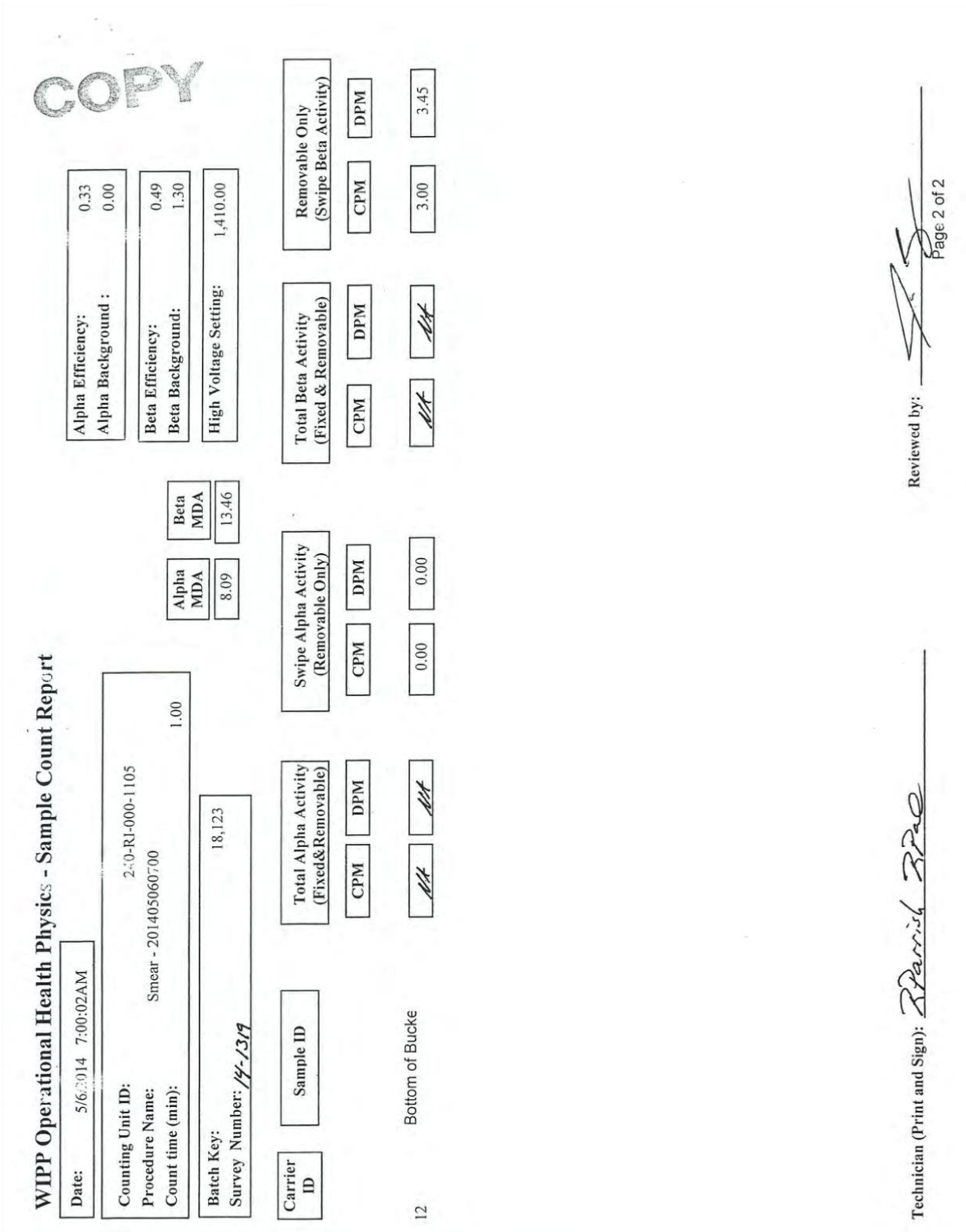
Figure 11e. Copy of COC 14-0161 radiological screening



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WIPP Operational Health Physics - Sample Count Report

Date: 5/6/2014 7:00:02AM

Counting Unit ID: 240-RI-000-1105
Procedure Name: Smear - 201405060700
Count time (min): 1.00

Batch Key: 18,123
Survey Number: 14-1319

Alpha MDA	Beta MDA
8.09	13.46

Alpha Efficiency: 0.33
Alpha Background : 0.00

Beta Efficiency: 0.49
Beta Background: 1.30

High Voltage Setting: 1,410.00

Carrier ID	Sample ID	Total Alpha Activity (Fixed&Removable)		Swipe Alpha Activity (Removable Only)		Total Beta Activity (Fixed & Removable)		Removable Only (Swipe Beta Activity)	
		CPM	DPM	CPM	DPM	CPM	DPM	CPM	DPM
12	Bottom of Bucke	NA	NA	0.00	0.00	NA	NA	3.00	3.45

Technician (Print and Sign): RParrish RPae

Reviewed by: [signature]

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Figure 11f. Copy of COC 14-0161 radiological screening

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Attachment 4 – Request for Analysis/Chain-of-Custody Record

Sampling program: ☑ Radiological Control ☐ SEC **COC Number**: 14-0168 **Page** 1 **of** 1

	SAMPLE IDENTIFICATION NUMBER	SAMPLE TYPE	SAMPLE VOL. FT.^{3}	ANALYSIS TYPE	SPECIAL INSTRUCTIONS
#1	UG 5/10/14 waste Face pink pillow	Masslinn	n/A	Gamma Spec	N/A
#2	UG 5/10/14 waste Face	Masslinn	n/A	Gamma Spec	
#3	UG 5/10/14 Panel 7 Room 1	Masslinn	n/A	Gamma Spec	
#4	UG 5/10/14 waste Face Table	Masslinn	n/A	Gamma Spec	
#5	UG 5/10/14 Panel 7 Room 6	Masslinn	n/A	Gamma Spec	
#6	blank/clean masslinn	Masslinn	n/A	Gamma Spec	
			N/A		

TURNAROUND TIME REQUIRED: NORMAL _____ RUSH: ✓

1. Relinquished by: R Graves [signature] 5-13-14/0830 — Printed Name / Signature / Date/Time
2. Relinquished by: _____ — Printed Name / Signature / Date/Time
3. Relinquished by; _____ — Printed Name / Signature / Date/Time

1. Received by: Leigh Brown Leigh Brown 5-15-14/1530 — Printed Name / Signature / Date/Time
2. Received by: _____ — Printed Name / Signature / Date/Time
3. Received by: _____ — Printed Name / Signature / Date/Time

Figure 12a. Copy of COC 14-0168

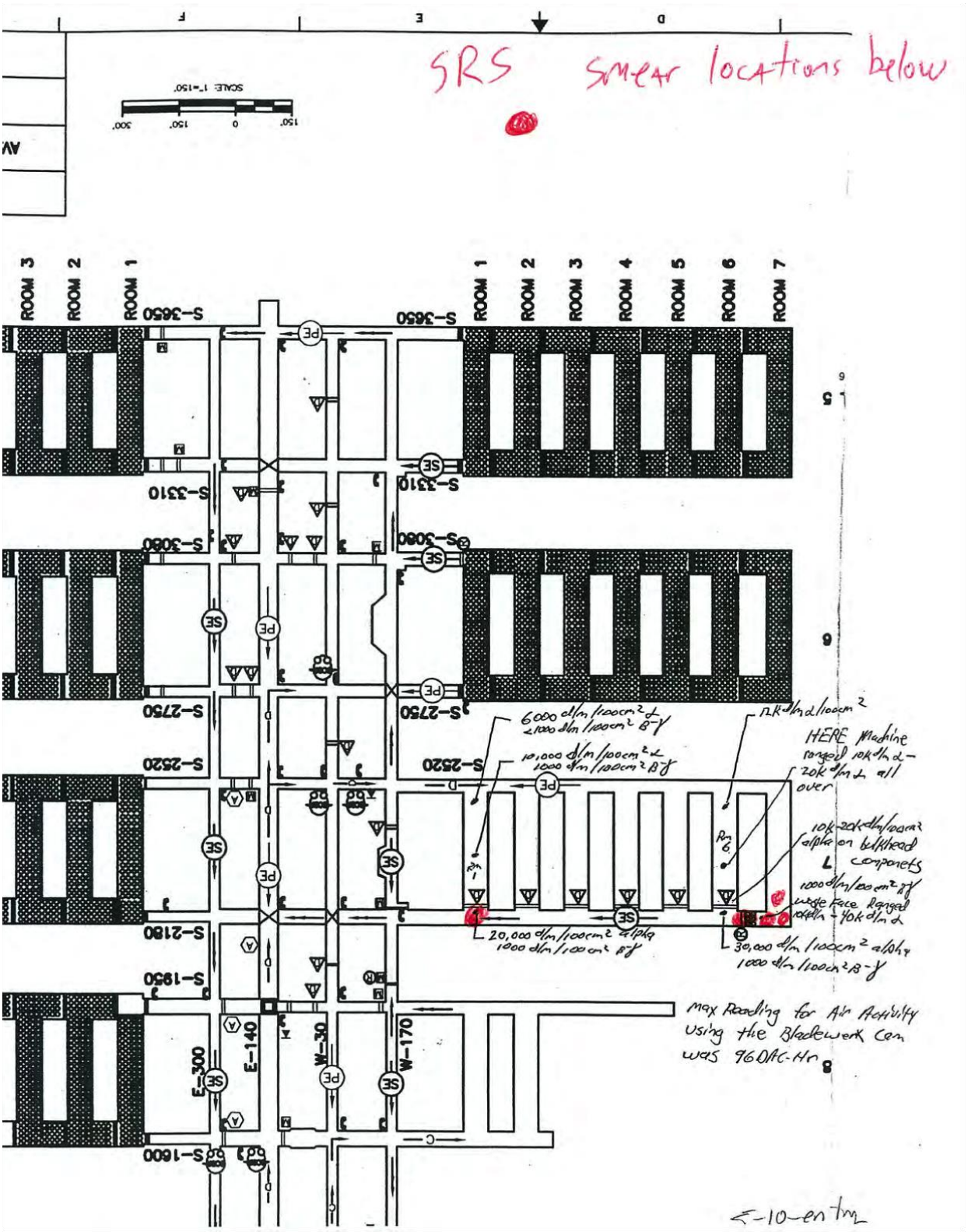

Figure 12b. Copy of COC 14-0168 sampling locations

Working Copy

Radiological Survey Report

SECTION A

Survey #	Date	Time	Shipment	Package #
14-1372	5-13-14	0600	NA	NA

Location: Samples to be shipped to SRS

Surveyor's printed name: Frank Beckman, R Groves

Reason for survey: Receipt ☐ Processing ☐ Emplacement ☐ Special Request ☒ RWP ☐
Weekly ☐ Monthly ☐ Quarterly ☐ Annual Other ☐

Model No.	Equipment/ Probe ID#	Eff.	Cal. Due Date	BKGD (cpm)	MDA (dpm) or DL (mrem/hr)
2360 / 43-93	1336 / 1265	α23.08	4-18-15	α 2	α 35.1
2360 / 43-93	1336 / 1265	β31.08	4-18-15	β- 180	β- 150.9
9DP	1668	NA	6-12-14	NA	NA
Tennelec	1604	See report	9-10-14	See report	See report
		N			
		A			

Type: Alpha ☒ Beta/Gamma ☒ Neutron ☐ Contamination ☒ Radiation ☒

SECTION B

Time	Released (Circle)	Radiological Assessment Filter (RAF) Activity if not related (otherwise N/A)
NA	(N/A) Yes No	NA

SECTION C — **COMMENT**

Smears 1-8 are < 20 dpm/100cm² alpha and < 200 dpm/100cm² Beta. Direct frisk on smear location #1 has elevated Beta counts due to sample activity in the plastic bag. Direct frisks on smear locations 2-8 are < 500 dpm/100cm² alpha and < 1000 dpm/100cm² Beta. See map for dose rates. FB 5-13-14

Surveyor's Signature/Date: Frank Beckman 5-13-14

This survey has been reviewed for accuracy, regulatory compliance, and radiological impacts. This survey contains: 3 Pages (including this page).

Manager's Signature/Date: 5/13/14

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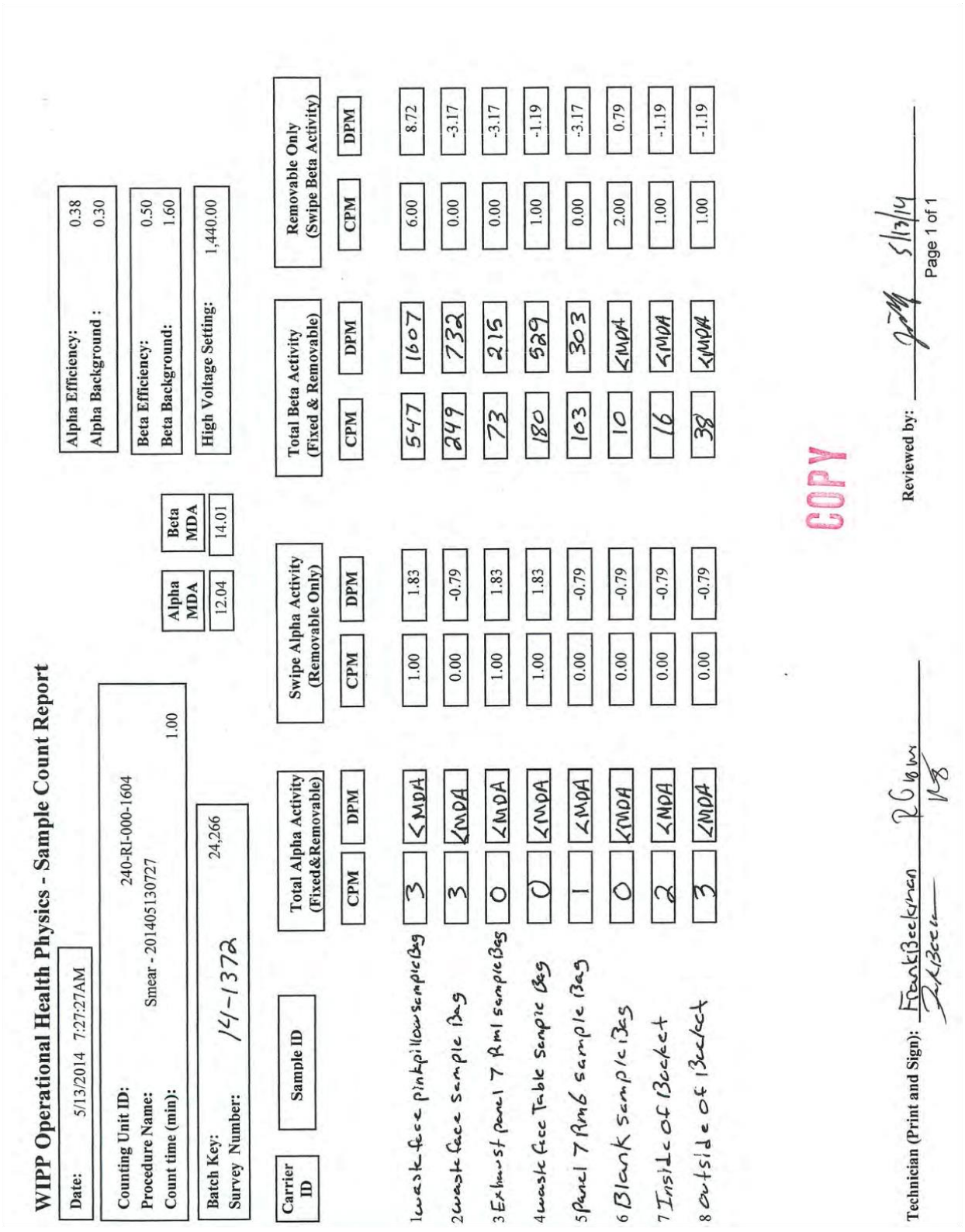
Figure 12c. Copy of COC 14-0168 radiological screening



WIPP Operational Health Physics - Sample Count Report

Date: 5/13/2014 7:27:27AM

Counting Unit ID: 240-RI-000-1604
Procedure Name: Smear - 20140513072
Count time (min): 1.00

Batch Key: 24,266
Survey Number: 14-1372

Alpha Efficiency: 0.38
Alpha Background : 0.30

Beta Efficiency: 0.50
Beta Background: 1.60

High Voltage Setting: 1,440.00

	Alpha MDA	Beta MDA
	12.04	14.01

Carrier ID	Sample ID	Total Alpha Activity (Fixed&Removable)		Swipe Alpha Activity (Removable Only)		Total Beta Activity (Fixed & Removable)		Removable Only (Swipe Beta Activity)	
		CPM	DPM	CPM	DPM	CPM	DPM	CPM	DPM
1	wash face pink pillow sample bag	3	<MDA	1.00	1.83	547	1607	6.00	8.72
2	wash face sample bag	3	<MDA	0.00	-0.79	249	732	0.00	-3.17
3	Exhaust panel 7 Rm1 sample bag	0	<MDA	1.00	1.83	73	215	0.00	-3.17
4	wash face Table sample bag	0	<MDA	1.00	1.83	180	529	1.00	-1.19
5	Panel 7 Rm6 sample bag	1	<MDA	0.00	-0.79	103	303	0.00	-3.17
6	Blank sample bag	0	<MDA	0.00	-0.79	10	<MDA	2.00	0.79
7	Inside of Bucket	2	<MDA	0.00	-0.79	16	<MDA	1.00	-1.19
8	outside of Bucket	3	<MDA	0.00	-0.79	38	<MDA	1.00	-1.19

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Technician (Print and Sign): FrankBeckman

Reviewed by: 5/13/14

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Figure 12d. Copy of COC 14-0168 radiological screening

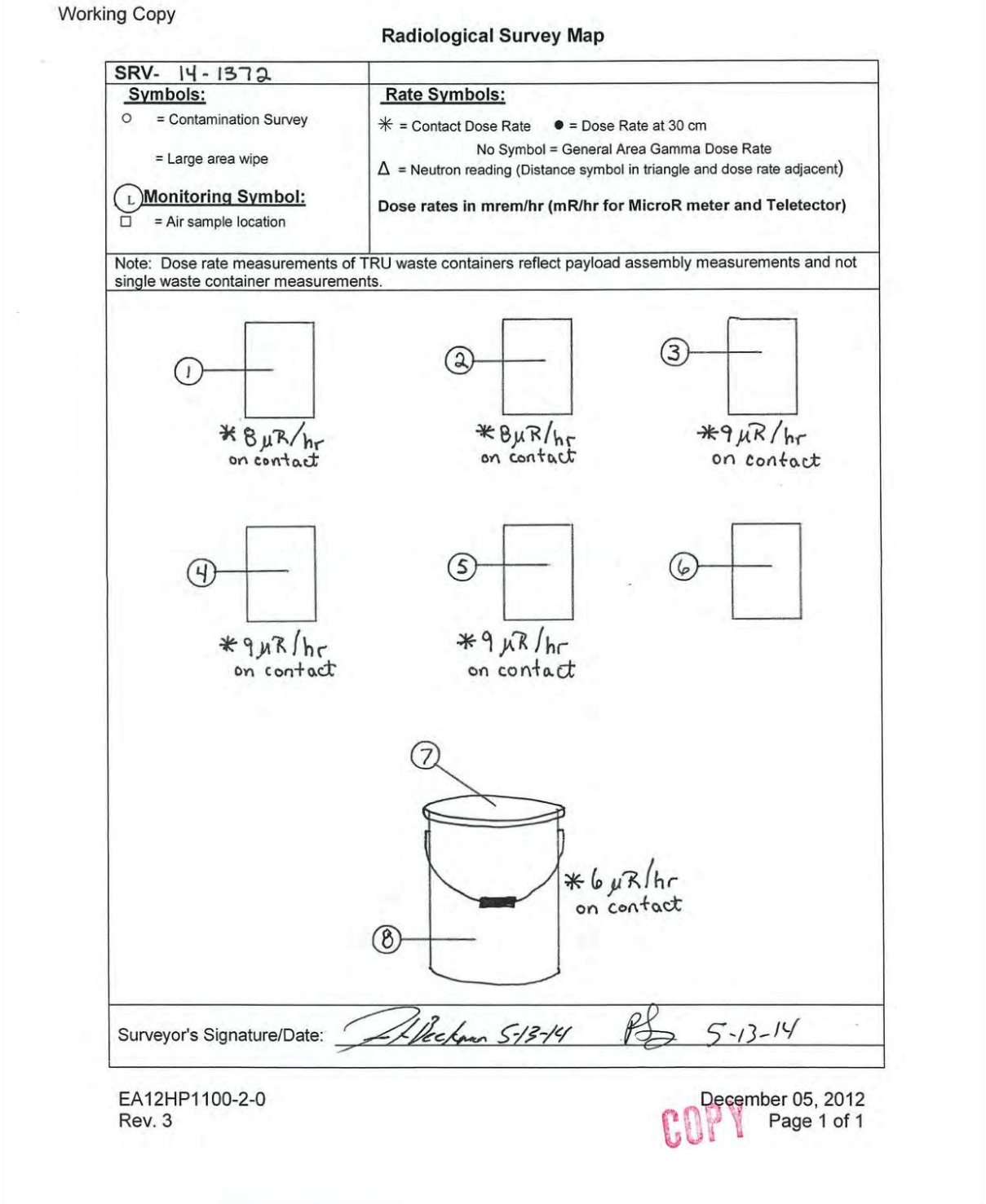

Figure 12e. Copy of COC 14-0168 radiological screening, sampling locations

SRS

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Attachment 4 – Request for Analysis/Chain-of-Custody Record

Sampling program: ☑ Radiological Control ☐ SEC **COC Number**: 14-0173 **Page** 1 **of** 1

SAMPLE IDENTIFICATION NUMBER	SAMPLE TYPE	SAMPLE VOL. FT.^{3}	ANALYSIS TYPE	SPECIAL INSTRUCTIONS
#1 Table/Chair WASTE FACE	Masslinn / disc smear	n/a	Gamma Spec	N/A
#2 Pink Pad WASTE FACE	masslinn / disc smear	n/a	Gamma Spec	
#3 Slip Sheet WASTE FACE	masslinn / disc smear	n/a	Gamma Spec	
#4 Room 1 Exhaust Drift	masslinn / disc smear	n/a	Gamma Spec	
#5 clean / blank	masslinn / disc smear	n/a	Gamma Spec	
			N/A	

TURNAROUND TIME REQUIRED: NORMAL ____ RUSH: ✓

		Printed Name	Signature	Date/Time
1.	Relinquished by:	RGroves	PS	5-16-14/0900
1.	Received by:	Robert S. Nieman		5/20/14 0800
2.	Relinquished by:	Robert S. Nieman		5/20/14 0940
2.	Received by:	Victoria Stewart	Victoria Stewart	5/22/14 09:3
3.	Relinquished by;			
3.	Received by:			

TC 65834

Figure 13a. Copy of COC 14-0173

Working Copy

Radiological Survey Report

SECTION A

Survey #	Date	Time	Shipment	Package #
14-1406	5-16-14	0830	N/A	N/A

Location: SAMPLES FOR SRS OFFSITE

Surveyor's printed name: L. TURNBOW R. GROVES

Reason for survey: Receipt ☐ Processing ☐ Emplacement ☐ Special Request ☒ RWP ☐
Weekly ☐ Monthly ☐ Quarterly ☐ Annual Other ☐

Model No.	Equipment/ Probe ID#	Eff.	Cal. Due Date	BKGD (cpm)	MDA (dpm) or DL (mrem/hr)
2360/43-93 ALPHA	1226/1227	21.61	4-1-15	0	13.9
2360/43-93 BETA-GAMMA	1226/1227	21.08	4-1-15	84	170.9
MODEL 9DP	1656	N/A	9-26-14	N/A	N/A
TENNELEC SERIES 5	1604	SEE REPORT	9-10-14	SEE REPORT	SEE REPORT
	N				
	A				

Type: Alpha ☒ Beta/Gamma ☒ Neutron ☐ Contamination ☒ Radiation ☒

SECTION B — **Radiological Assessment Filter (RAF)**

Time	Released (Circle)	Activity if not related (otherwise N/A)
N/A	(N/A) Yes No	N/A

SECTION C — **COMMENT**

Smears 1-8 indicates activity to be < 20 dpm/100cm² α and < 200 dpm/100cm² β-γ. Direct frisks indicates activity to be < 500dpm/100cm² α and < 1000 dpm/100cm² β-γ. See map for dose rates and Smear/direct frisk locations. Survey performed for release of Samples for lab Analysis. 5-16-14

Surveyor's Signature/Date: L. Turnbow 5-16-14
5-16-14

This survey has been reviewed for accuracy, regulatory compliance, and radiological impacts. This survey contains: 3 Pages (including this page).

Manager's Signature/Date: 5/16/14

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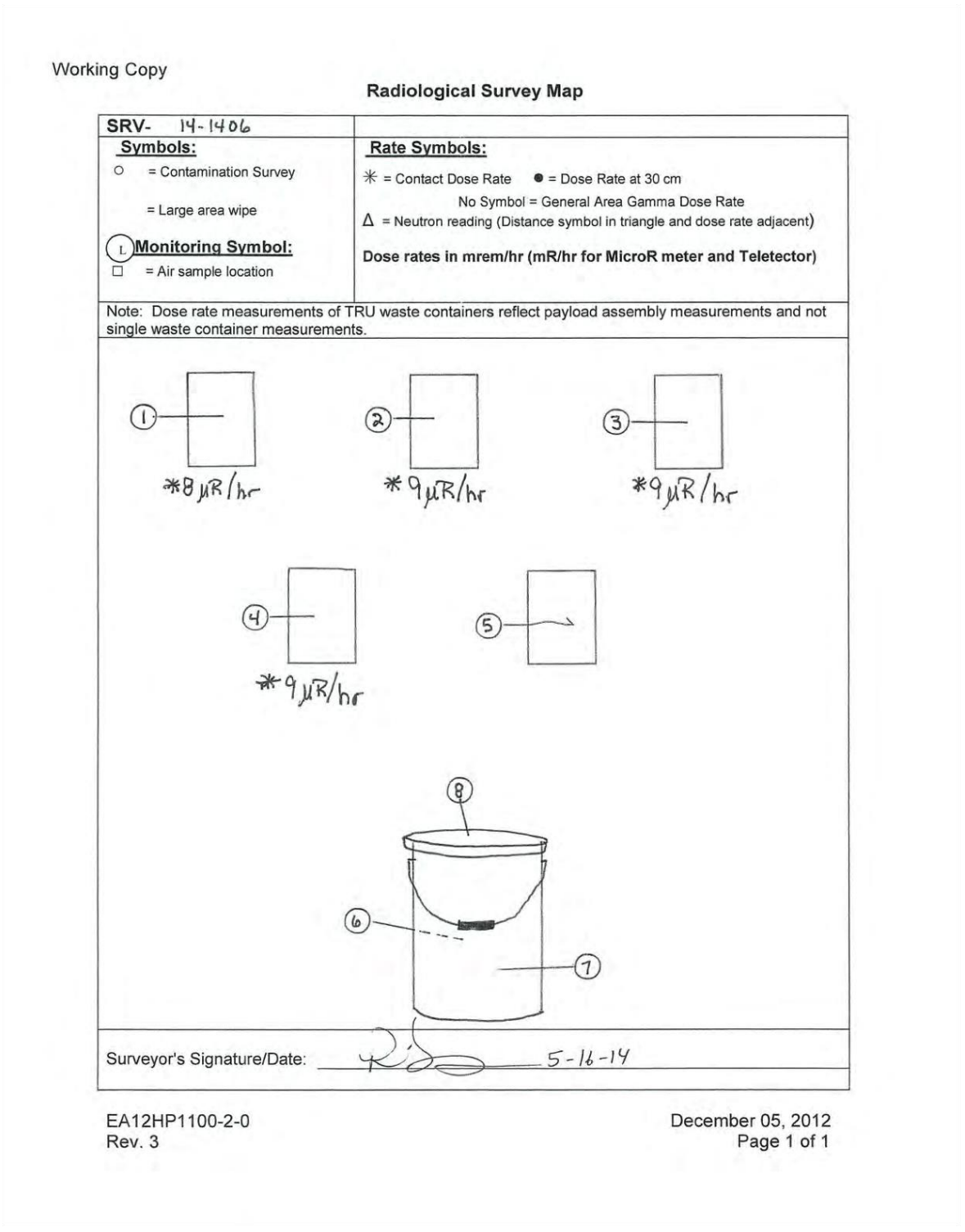
Figure 13b. Copy of COC 14-0173 radiological screening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Radiological Survey Map

SRV- 14-1406

Symbols:

○ = Contamination Survey

= Large area wipe

(L) **Monitoring Symbol:**

☐ = Air sample location

Rate Symbols:

✳ = Contact Dose Rate ● = Dose Rate at 30 cm

No Symbol = General Area Gamma Dose Rate

Δ = Neutron reading (Distance symbol in triangle and dose rate adjacent)

Dose rates in mrem/hr (mR/hr for MicroR meter and Teletector)

Note: Dose rate measurements of TRU waste containers reflect payload assembly measurements and not single waste container measurements.

Surveyor's Signature/Date: 5-16-14

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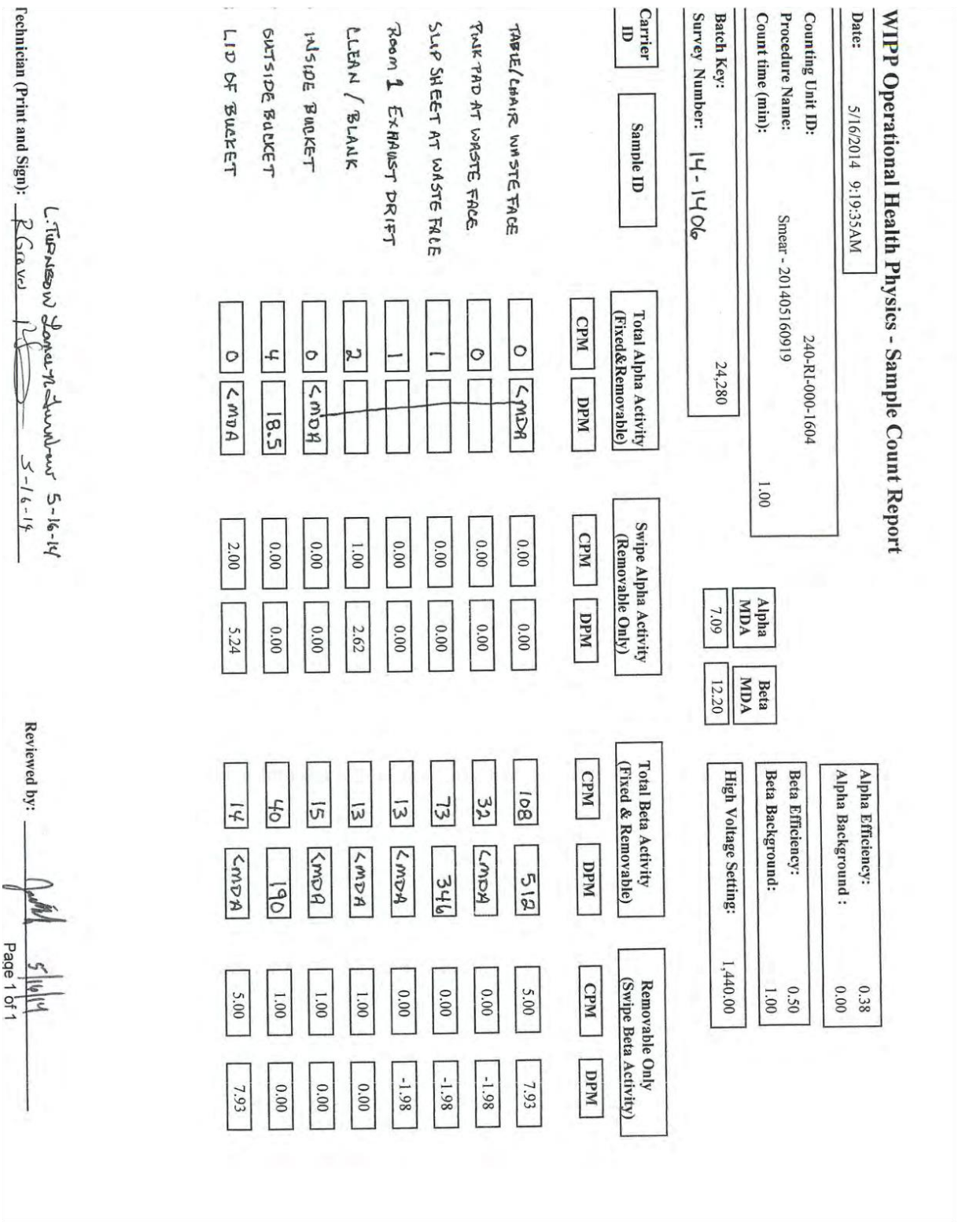
Figure 13c. Copy of COC 14-0173 radiological screening, sampling locations



WIPP Operational Health Physics - Sample Count Report

Date: 5/16/2014 9:19:35AM

Counting Unit ID: 240-RI-000-1604
Procedure Name: Smear - 20140516O919
Count time (min): 1.00

Batch Key:
Survey Number: 14-1406

Alpha MDA: 7.09
Beta MDA: 12.20

Alpha Efficiency: 0.38
Alpha Background : 0.00

Beta Efficiency: 0.50
Beta Background: 1.00

High Voltage Setting: 1,440.00

Carrier ID	Sample ID	Total Alpha Activity (Fixed&Removable)		Swipe Alpha Activity (Removable Only)		Total Beta Activity (Fixed & Removable)		Removable Only (Swipe Beta Activity)	
		CPM	DPM	CPM	DPM	CPM	DPM	CPM	DPM
	TABLE/CHAIR WASTE FACE	0	<MDA	0.00	0.00	108	512	5.00	7.93
	TANK PAD AT WASTE FACE	0		0.00	0.00	32	<MDA	0.00	-1.98
	SLIP SHEET AT WASTE FACE	1		0.00	0.00	73	346	0.00	-1.98
	Room 1 EXHAUST DRIFT	1		0.00	0.00	13	<MDA	0.00	-1.98
	CLEAN / BLANK	2		1.00	2.62	13	<MDA	1.00	0.00
	INSIDE BUCKET	0	<MDA	0.00	0.00	15	<MDA	1.00	0.00
	OUTSIDE BUCKET	4	18.5	0.00	0.00	40	190	1.00	0.00
	LID OF BUCKET	0	<MDA	2.00	5.24	14	<MDA	5.00	7.93

L. Thornton Lorem Schuldmann 5-16-14

Technician (Print and Sign): R Graves 5-16-14

Reviewed by: 5/19/14

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Figure 13d. Copy of COC 14-0173 radiological screening

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Attachment 4 – Request for Analysis/Chain-of-Custody Record

Sampling program: ☑ Radiological Control ☐ SEC

COC Number: 14-0175 Page 1 of 1

SAMPLE IDENTIFICATION NUMBER	SAMPLE TYPE	SAMPLE VOL. FT.³	ANALYSIS TYPE	SPECIAL INSTRUCTIONS
#1 Pink mat @ waste face	Mass line	1 ft	Gamma Spec	
#2 Slip Sheet	mass line	1 ft	Gamma Spec	
#3 Table/Chairs waste face	mass line	1 ft	Gamma Spec	
#4 Camera legs	mass line	1 ft	Gamma Spec	
#5 Clean / Blank	mass line	1 ft	Gamma Spec	

TURNAROUND TIME REQUIRED: NORMAL ____ RUSH: ✓

		Printed Name	Signature	Date/Time		Printed Name	Signature	Date/Time
1.	Relinquished by:	L. Turnbow	[signature]	5-21-14 0800	1. Received by:	Robert S. Nieman	[signature]	5/21/14 08
2.	Relinquished by:	Roberts, Nieman	[signature]	5/21/14 0832	2. Received by:	Victoria Stewart	[signature]	5/22/14
3.	Relinquished by:				3. Received by:			

Leigh Brown 1700 4980 3337 TC 65852

Figure 14a. Copy of COC 14-0175

Working Copy

Radiological Survey Report

SECTION A				
Survey #	Date	Time	Shipment	Package #
14-1440	5-20-14	0930	N/A	N/A
Location: SAMPLES FOR SRS OFFSITE FROM 5-19-14			Surveyor's printed name: L. TURNBOW RGRWS	
Reason for survey: Receipt ☐ Processing ☐ Emplacement ☐ Special Request ☒ RWP ☐ Weekly ☐ Monthly ☐ Quarterly ☐ Annual Other ☐				

Model No.	Equipment/ Probe ID#	Eff.	Cal. Due Date	BKGD (cpm)	MDA (dpm) or DL (mrem/hr)
2360/43-93 ALPHA	1682/1427	22.22	5-13-15	0.6	26.1
2360/43-93 BETA-GAMMA	1682/1427	25.94	5-13-15	83	138.1
MODEL 9DP	1666	N/A	4-9-15	N/A	N/A
TENNELEC SERIES 5	1604	SEE REPORT	9-10-14	SEE REPORT	SEE REPORT
			N		
			A		

Type: Alpha ☒ Beta/Gamma ☒ Neutron ☐ Contamination ☒ Radiation ☒

SECTION B		Radiological Assessment Filter (RAF)
Time	Released (Circle)	Activity if not related (otherwise N/A)
N/A	(N/A) Yes No	N/A

SECTION C	COMMENT
ALL SMEAR ACTIVITY < 20 DPM/100 cm² ALPHA AND < 200 DPM/100 cm² BETA-GAMMA. ALL DIRECT FRISK INDICATE < 500 DPM/100 cm² ALPHA AND < 1,000 DPM/100 cm² BETA-GAMMA. SEE MAP FOR DOSE RATES AND SMEAR & DIRECT FRISK LOCATIONS.	

Surveyor's Signature/Date: L. Turnbow 5-20-14 / [signature] 5-20-14

This survey has been reviewed for accuracy, regulatory compliance, and radiological impacts. This survey contains: 3 Pages (including this page).

Manager's Signature/Date: [signature] 5-20-14

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Figure 14b. Copy of COC 14-0175 radiological screening.

Working Copy

Radiological Survey Map

SRV- 14-1406

Symbols:

○ = Contamination Survey

= Large area wipe

(L) **Monitoring Symbol:**

☐ = Air sample location

Rate Symbols:

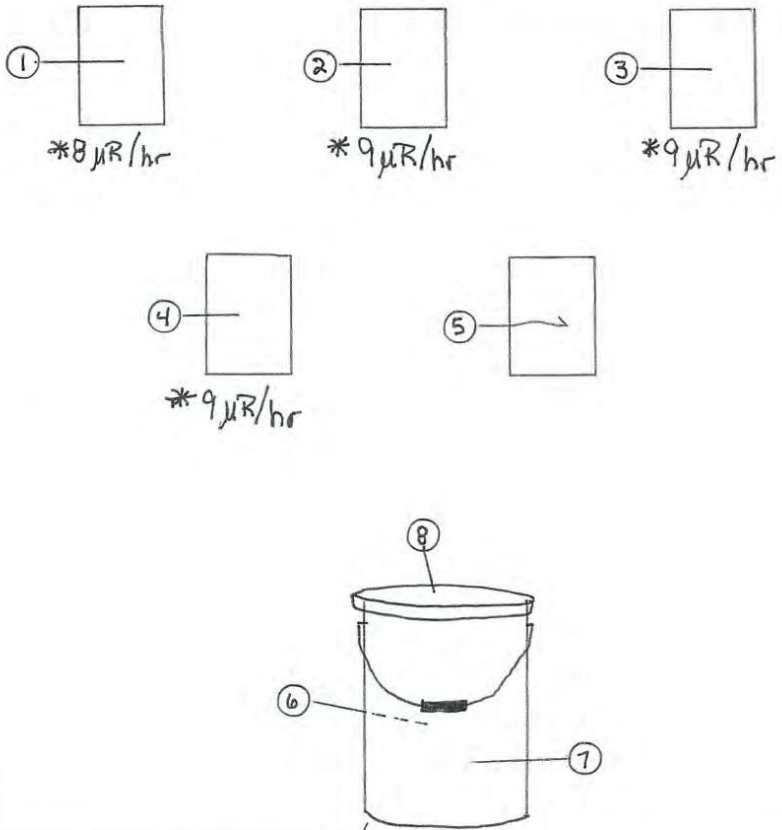
✳ = Contact Dose Rate ● = Dose Rate at 30 cm

No Symbol = General Area Gamma Dose Rate

Δ = Neutron reading (Distance symbol in triangle and dose rate adjacent)

Dose rates in mrem/hr (mR/hr for MicroR meter and Teletector)

Note: Dose rate measurements of TRU waste containers reflect payload assembly measurements and not single waste container measurements.



Surveyor's Signature/Date: 5-16-14

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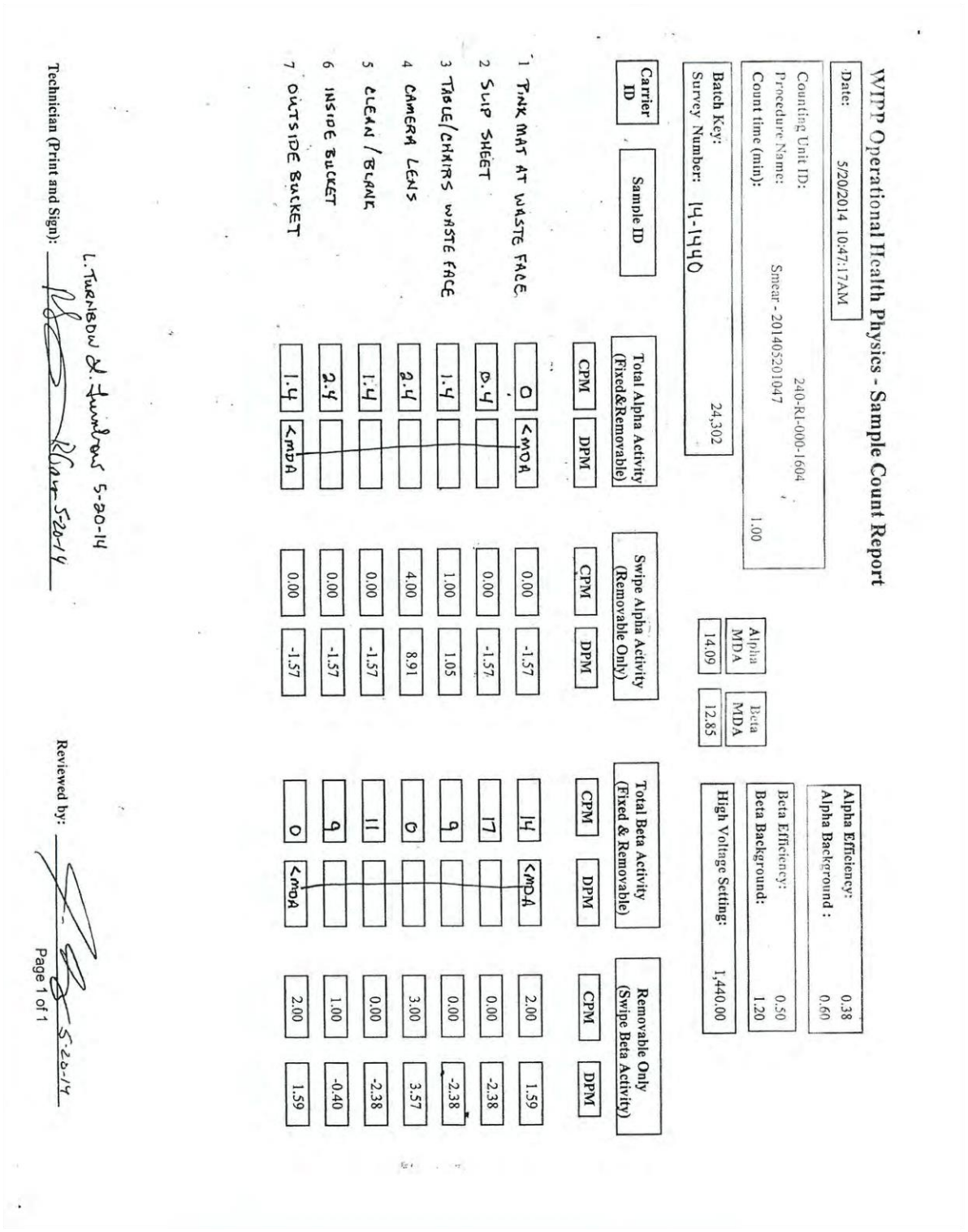
Figure 14c. Copy of COC 14-0175 radiological screening, sample locations



WIPP Operational Health Physics - Sample Count Report

Date: 5/20/2014 10:47:17AM

Counting Unit ID: 240-RI-000-1604
Procedure Name: Smear - 201405201047
Count time (min): 1.00

Batch Key:
Survey Number: 14-1440 24,302

Alpha MDA 14.09
Beta MDA 12.85

Alpha Efficiency: 0.38
Alpha Background : 0.60

Beta Efficiency: 0.50
Beta Background: 1.20

High Voltage Setting: 1,440.00

	Carrier ID	Sample ID	Total Alpha Activity (Fixed&Removable)		Swipe Alpha Activity (Removable Only)		Total Beta Activity (Fixed & Removable)		Removable Only (Swipe Beta Activity)	
			CPM	DPM	CPM	DPM	CPM	DPM	CPM	DPM
1		PINK MAT AT WASTE FACE	0	<MDA	0.00	-1.57	14	<MDA	2.00	1.59
2		SLIP SHEET	0.4		0.00	-1.57	17		0.00	-2.38
3		TABLE/CHAIRS WASTE FACE	1.4		1.00	1.05	9		0.00	-2.38
4		CAMERA LENS	2.4		4.00	8.91	6		3.00	3.57
5		CLEAN / BLANK	1.4		0.00	-1.57	11		0.00	-2.38
6		INSIDE BUCKET	2.4		0.00	-1.57	9		1.00	-0.40
7		OUTSIDE BUCKET	1.4	<MDA	0.00	-1.57	0	<MDA	2.00	1.59

L. Turnbow & Lumbows 5-20-14

Technician (Print and Sign): 5-20-14

Reviewed by: 5-20-14

Page 1 of 1

Figure 14d. Copy of COC 14-0175 radiological screening

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Attachment 4 – Request for Analysis/Chain-of-Custody Record SRS

Sampling program: ☑ Radiological Control ☐ SEC **COC Number:** 14-0179 **Page** 1 **of** 1

	SAMPLE IDENTIFICATION NUMBER	SAMPLE TYPE	SAMPLE VOL. FT.^{3}	ANALYSIS TYPE	SPECIAL INSTRUCTIONS
#1	East Slipsheet	smear	n/a	Gamma spec	
#2	West Slipsheet	smear	n/a	Gamma spec	
#3	Pig mat Center	smear	n/a	Gamma spec	
#4	Camera Lens	towelette	n/a	Gamma spec	
#5	Clean/Blank	smear	n/a	Gamma Spec	

TURNAROUND TIME REQUIRED: NORMAL _____ RUSH: ✓

1. Relinquished by: Matt Carruthers 5/27/14 0920 — Printed Name / Signature / Date/Time
1. Received by: Ruben Carrasco 5-27-14 0921 — Printed Name / Signature / Date/Time
2. Relinquished by: Ruben Carrasco 5-27-14 1030 — Printed Name / Signature / Date/Time
2. Received by: Victoria D. Stewart 5/29/14 0930 — Printed Name / Signature / Date/Time
3. Relinquished by; _____ — Printed Name / Signature / Date/Time
3. Received by: _____ — Printed Name / Signature / Date/Time

Figure 15a. Copy of COC 14-0179

SRS

Working Copy

COPY

Radiological Survey Report

SECTION A

Survey #	Date	Time	Shipment	Package #
14-1461	5-24-14	0915	NA	NA

Location: Sample Release to SRS COC #14-0179

Surveyor's printed name: RParrish

Reason for survey: Receipt ☐ Processing ☐ Emplacement ☐ Special Request ☒ RWP ☐
Weekly ☐ Monthly ☐ Quarterly ☐ Annual Other ☐

Model No.	Equipment/ Probe ID#	Eff.	Cal. Due Date	BKGD (cpm)	MDA (dpm) or DL (mrem/hr)
2360 α	1390/1403	21.30	5-15-15	0	14.08
2360 β⁻	1390/1403	21.72	5-15-15	88	169.47
9DP	1646	~~See NA Report~~	2-26-15	~~NA~~ NA	~~NA~~ NA RP 5-24-14
Tennelec	1604	~~See NA Report~~ RP 5-24-14	9-10-14	See Report	
		NA			

Type:

Alpha ☒ Beta/Gamma ☒ Neutron ☐ Contamination ☒ Radiation ☒

SECTION B

Time	Released (Circle)	Radiological Assessment Filter (RAF) Activity if not related (otherwise N/A)
NA	(N/A) Yes No	NA

SECTION C

COMMENT

All activities identified to be < 20 dpm/100 cm² α and < 200 dpm/100 cm² β⁻ for swipes 1-9. For dose rates see map.

RP 5-24-14

Surveyor's Signature/Date: RP 5-24-14

This survey has been reviewed for accuracy, regulatory compliance, and radiological impacts. This survey contains: 3 Pages (including this page).

Manager's Signature/Date: C. Littrell 5-24-14

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Page 1 of 2

Figure 15b. Copy of COC 14-0179 radiological screening

Working Copy

Radiological Survey Map

SRV- 14-1461

Symbols:

O = Contamination Survey

= Large area wipe

(L) **Monitoring Symbol:**

□ = Air sample location

Rate Symbols:

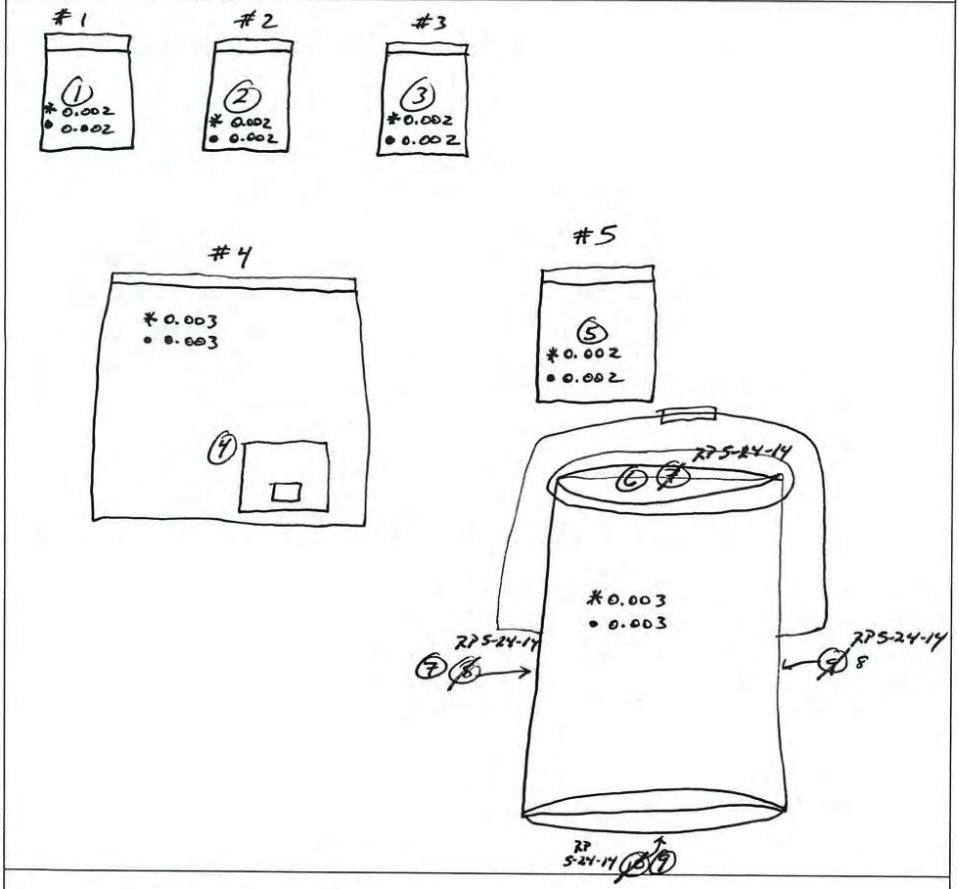
✳ = Contact Dose Rate ● = Dose Rate at 30 cm

No Symbol = General Area Gamma Dose Rate

Δ = Neutron reading (Distance symbol in triangle and dose rate adjacent)

Dose rates in mrem/hr (mR/hr for MicroR meter and Teletector)

Note: Dose rate measurements of TRU waste containers reflect payload assembly measurements and not single waste container measurements.



Surveyor's Signature/Date: RP 5-24-14

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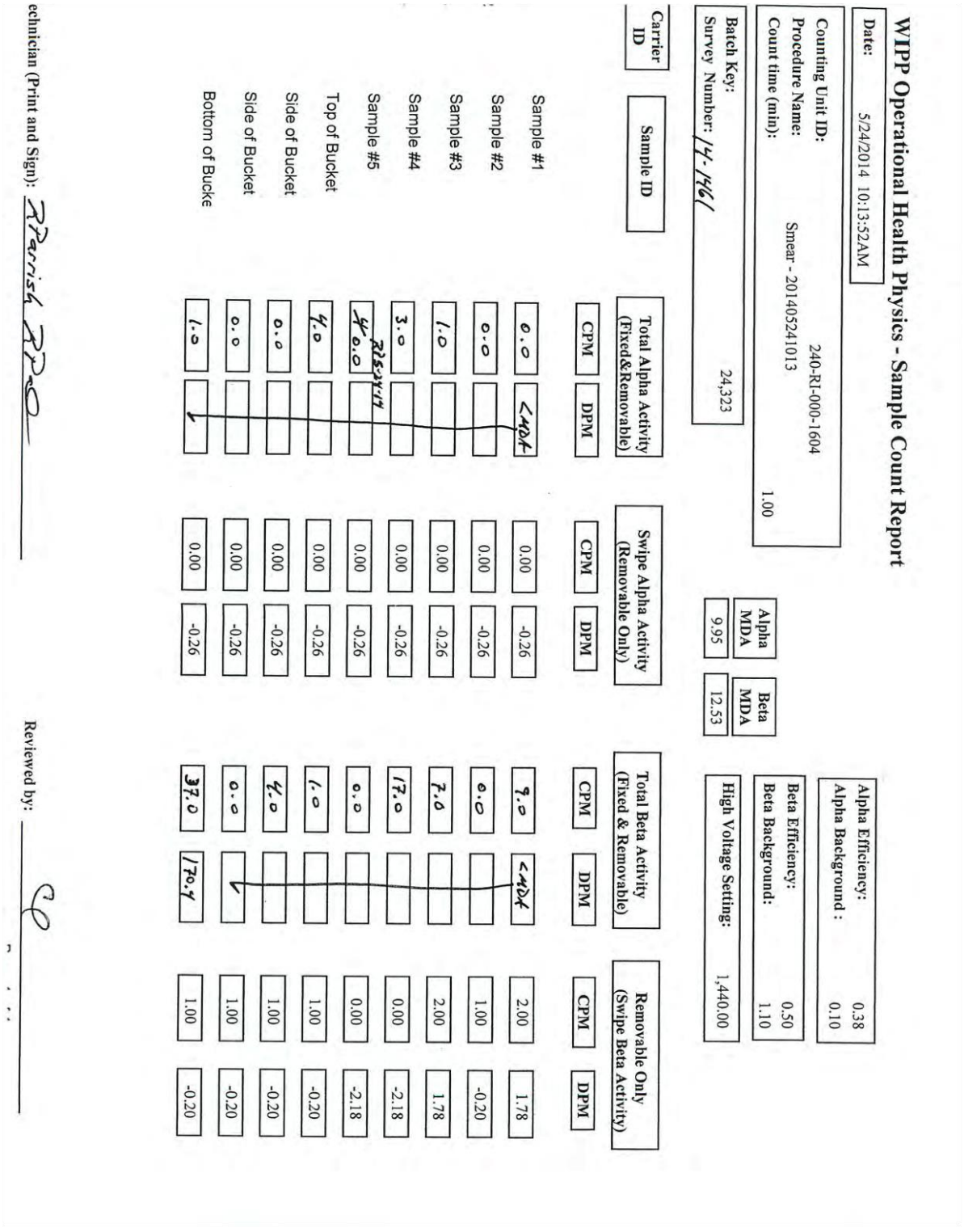
Page 1 of 1

Figure 15c. Copy of COC 14-0179 radiological screening, sampling locations



WIPP Operational Health Physics - Sample Count Report

Date: 5/24/2014 10:13:52AM

Counting Unit ID: 240-RI-000-1604
Procedure Name: Smear - 20140524 1013
Count time (min): 1.00

Batch Key:
Survey Number: 14-146

24,323

Alpha MDA 9.95
Beta MDA 12.53

Alpha Efficiency: 0.38
Alpha Background: 0.10

Beta Efficiency: 0.50
Beta Background: 1.10

High Voltage Setting: 1,440.00

Carrier ID	Sample ID	Total Alpha Activity (Fixed&Removable)		Swipe Alpha Activity (Removable Only)		Total Beta Activity (Fixed & Removable)		Removable Only (Swipe Beta Activity)	
		CPM	DPM	CPM	DPM	CPM	DPM	CPM	DPM
	Sample #1	0.0	<MDA	0.00	-0.26	9.0	<MDA	2.00	1.78
	Sample #2	0.0		0.00	-0.26	0.0		1.00	-0.20
	Sample #3	1.0		0.00	-0.26	7.0		2.00	1.78
	Sample #4	3.0		0.00	-0.26	17.0		0.00	-2.18
	Sample #5	40.0	RESAMPLE	0.00	-0.26	0.0		0.00	-2.18
	Top of Bucket	4.0		0.00	-0.26	1.0		1.00	-0.20
	Side of Bucket	0.0		0.00	-0.26	4.0		1.00	-0.20
	Side of Bucket	0.0		0.00	-0.26	0.0		1.00	-0.20
	Bottom of Bucke	1.0	1	0.00	-0.26	37.0	170.7	1.00	-0.20

echnician (Print and Sign): RParrish RPP

Reviewed by:

Figure 15d. Copy of COC 14-0179 radiological screening

Shipment/Disposal Radioactivity Calculations

Survey Samples to Los Alamos National Laboratory

Total activity on Swipes [based on alpha+beta values on package labels]

C:\Users\gofft\Documents\Goff Files\Shipment and Waste Documentation\[2014 05 27 to LANL.xls]Sheet1

Highest Exposure Rate [mR/hr]	**0.004**	**Total Weight of contaminated Materials (pounds)**	**0.017621**
Millicuries Am-241	**2.5E-05**	**Total Weight of contaminated Materials (grams)**	**8.0E+00**

Isotope	Isotopic Shipment Activities (milliCuries)[1]	Isotopic Shipment Activities (TBq)	Isotopic Radioactivity Concentration (nCi/gram)	Isotopic Radioactivity Concentration (Bq/gram)
Pu-238	3.9E-08	1.4E-12	4.9E-03	1.8E-01
Pu-239/240	9.0E-07	3.3E-11	1.1E-01	4.2E+00
Am-241[2]	2.5E-05	9.2E-10	3.1E+00	1.1E+02
U-233 /234	1.5E-11	5.5E-16	1.8E-06	6.8E-05
U-235	8.6E-13	3.2E-17	1.1E-07	4.0E-06
U-238	2.3E-13	8.5E-18	2.9E-08	1.1E-06
Pu-241	1.20E-06	4.4E-11	1.5E-01	5.5E+00
Isotope	Activity (milliCuries)	Isotope Total Shipment Activity (TBq)	Radioactivity Concentration (nCi/gram)	Radioactivity Concentration (Bq/gram)
Co-60	8.4E-11	3.1E-15	1.1E-05	3.9E-04
Cs-137	6.2E-11	2.3E-15	7.8E-06	2.9E-04
Sr-90	1.4E-11	5.1E-16	1.7E-06	6.3E-05
Cs-134	7.9E-11	2.9E-15	9.8E-06	3.6E-04

	Concentration [nCi/gm]	**Total Activities [TBq]**
Transuranic Isotopes total	**3.36**	**1.0E-09**
Fission Product Isotopes total	**3.0E-05**	**8.8E-15**
Sum of all isotopes Isotopes total	**3.36**	**1.0E-09**

Note 1	Activities for isotopes other than Am-241 are based on isotopic ratios based on air sample from underground release SGD 2014-067
Note 2	Activity in mCi for Am-241 directly input based on evaluations of survey or assay results

Prepared by Tom Goff 5/27/2014 Approved by 5/27/14

Figure 15e. Copy of COC 14-0179 radiological screening for shipping

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Attachment 4 – Request for Analysis/Chain-of-Custody Record

Sampling program: ☑ Radiological Control ☐ SEC **COC Number:** 14-0182 **Page** 1 **of** 1

SAMPLE IDENTIFICATION NUMBER	SAMPLE TYPE	SAMPLE VOL. FT.³	ANALYSIS TYPE	SPECIAL INSTRUCTIONS
#1 R-16 C-4 MGO	Sticky Pad	N/A	GAMMA SPEC	
#4 R-14 C-4 MGO	Sticky Pad	N/A	↓	↓
#5 R-14 C-6 MGO	PVC Sampler	N/A		
#6 R-14 C-2 MGO	PVC Sampler	N/A	↓	

TURNAROUND TIME REQUIRED: NORMAL ____ RUSH: ✓

1. Relinquished by: R Graves (Printed Name) (Signature) 6-2-14/1305 (Date/Time)
   Received by: Robert S. Nieman (Printed Name) (Signature) 6/2/14 1305 (Date/Time)
2. Relinquished by: Robert S. Nieman (Printed Name) (Signature) 6/2/14 1430 (Date/Time)
   Received by: Leigh W. Brown (Printed Name) LW Brown (Signature) 6/5/14 1440 (Date/Time)
3. Relinquished by: _____ (Printed Name) _____ (Signature) _____ (Date/Time)
   Received by: _____ (Printed Name) _____ (Signature) _____ (Date/Time)

Figure 16a. Copy of COC 14-0182

Working Copy

Radiological Survey Report

SECTION A				
Survey #	Date	Time	Shipment	Package #
14-1504	06-02-14	0930	N/A	N/A
Location: T.M.F. Underground Samples			Surveyor's printed name: K. Riley	

Reason for survey: Receipt ☐ Processing ☐ Emplacement ☐ Special Request ☒ RWP ☐
Weekly ☐ Monthly ☐ Quarterly ☐ Annual ☐ Other ☐

Model No.	Equipment/ Probe ID#	Eff.	Cal. Due Date	BKGD (cpm)	MDA (dpm) or DL (mrem/hr)
Tennelec	See Count Report		09-10-14	See Count Report	C-02-M/RP -14
2350-1	1404/1413	N/A	11-05-14	3.63 μR	4.0/A
			N		
			A		

Type:
Alpha ☒ Beta/Gamma ☐ Neutron ☒ Contamination ☒ Radiation ☒

SECTION B		Radiological Assessment Filter (RAF)
Time	Released (Circle)	Activity if not related (otherwise N/A)
N/A	(N/A) Yes No	N/A

SECTION C	COMMENT
Swipes #1 - 14 indicate < 20 dpm/100 cm² α and < 2[illegible] dpm/100 cm² β-γ. Background on 2350-1 instrument is 3.63 μR See map for location of swipes and dose rates. 06-02-14 μR *Sample #3 not shipped Due to dose too high. Released off site for Analysis.	

Surveyor Signature/Date: R Riley 06-02-14

This survey has been reviewed for accuracy, regulatory compliance, and radiological impacts. This survey consists: 4 Pages (including this page).

Manager's Signature/Date: 6-2-14

EA12H[illegible]0-1-0
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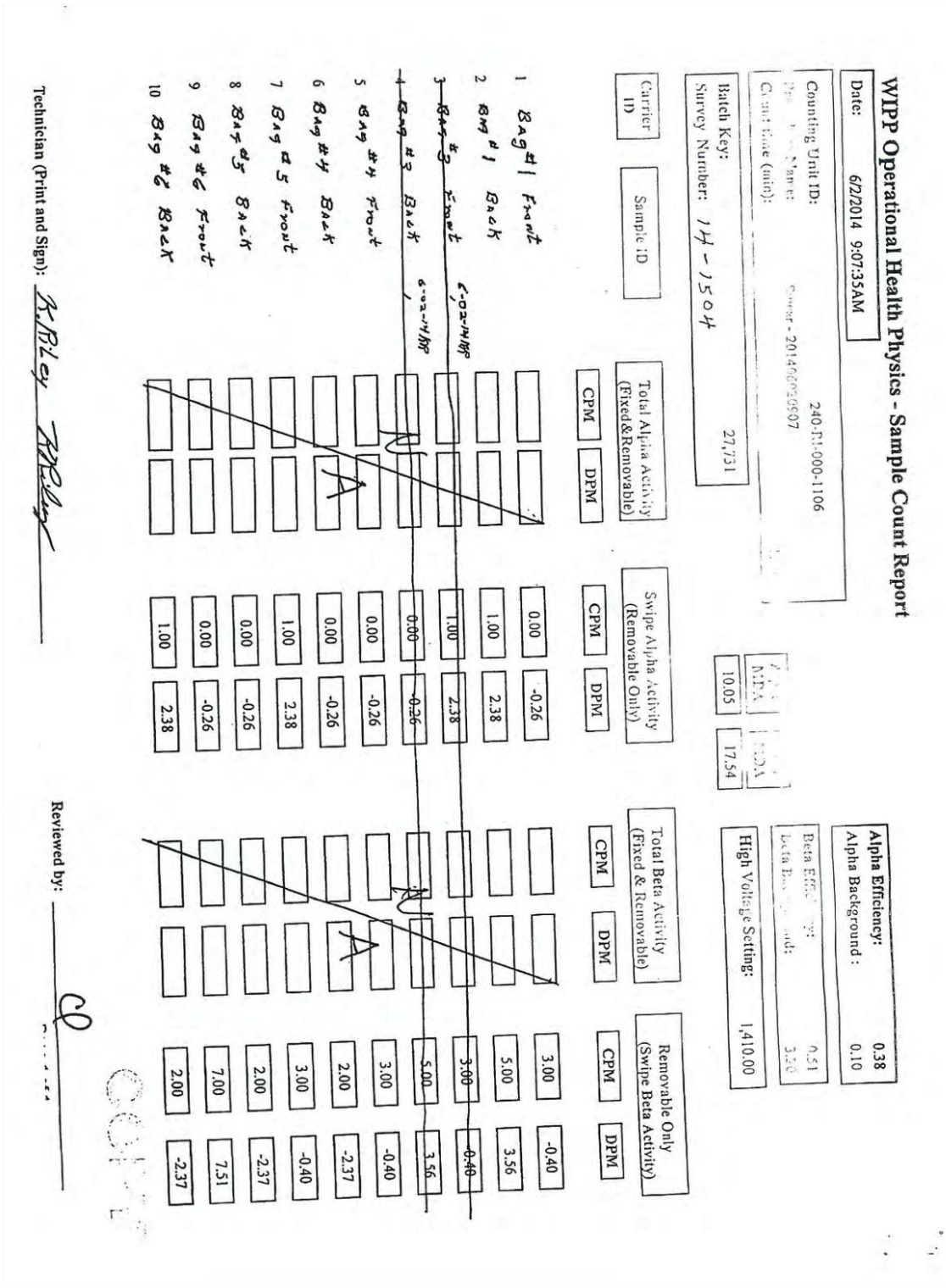
Figure 16b. Copy of COC 14-0182 radiological screening



WIPP Operational Health Physics - Sample Count Report

Date: 6/2/2014 9:07:35AM

Counting Unit ID: 240-RI-000-1106

Count time (min): 27,731

Batch Key: 14-1504

Survey Number:

Alpha Efficiency: 0.38

Alpha Background: 0.10

Beta Efficiency: 0.51

Beta Background: 3.20

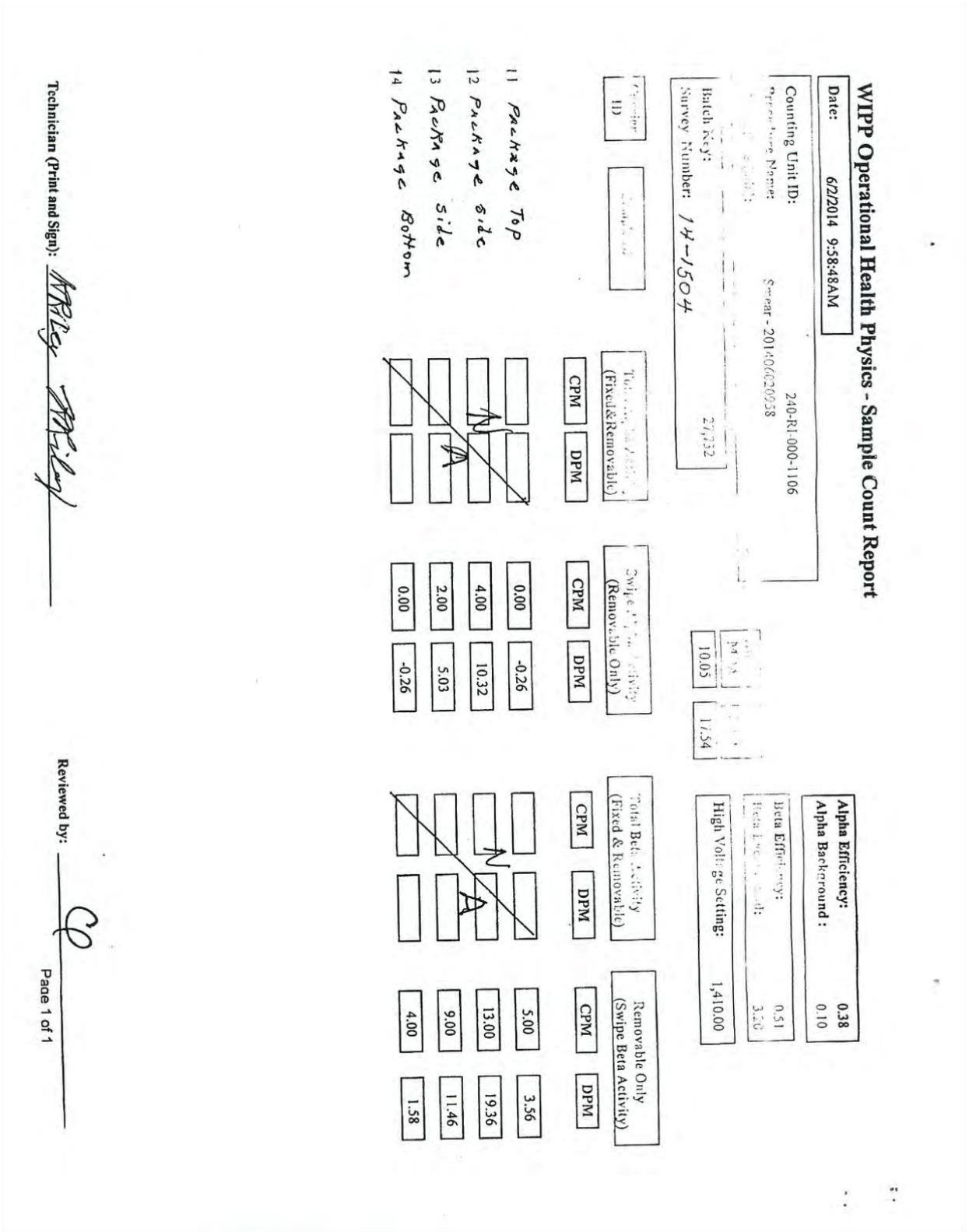
High Voltage Setting: 1,410.00

Carrier ID	Sample ID	Total Alpha Activity (Fixed&Removable) CPM	DPM	Swipe Alpha Activity (Removable Only) CPM	DPM	Total Beta Activity (Fixed & Removable) CPM	DPM	Removable Only (Swipe Beta Activity) CPM	DPM
1	Bag #1 Front			0.00	-0.26			3.00	-0.40
2	Bag #1 Back			1.00	2.38			5.00	3.56
3	Bag #2 Front			1.00	2.38			3.00	-0.40
4	Bag #2 Back			0.00	-0.26			5.00	3.56
5	Bag #3 Front			0.00	-0.26			3.00	-0.40
6	Bag #3 Back			0.00	-0.26			2.00	-2.37
7	Bag #5 Front			1.00	2.38			3.00	-0.40
8	Bag #5 Back			0.00	-0.26			2.00	-2.37
9	Bag #6 Front			0.00	-0.26			7.00	7.51
10	Bag #6 Back			1.00	2.38			2.00	-2.37

Technician (Print and Sign): R. Riley

Reviewed by:

Figure 16c. Copy of COC 14-0182 radiological screening



WIPP Operational Health Physics - Sample Count Report

Date: 6/2/2014 9:58:48AM

Counting Unit ID: 240-RI-000-1106

Smear - 20140606020958

Batch Key: 27,732

Survey Number: 14-1504

ID		Total Beta Activity (Fixed&Removable) CPM	Total Beta Activity (Fixed&Removable) DPM	Swipe Beta Activity (Removable Only) CPM	Swipe Beta Activity (Removable Only) DPM	Total Beta Activity (Fixed & Removable) CPM	Total Beta Activity (Fixed & Removable) DPM	Removable Only (Swipe Beta Activity) CPM	Removable Only (Swipe Beta Activity) DPM
11 Package Top				0.00	-0.26			5.00	3.56
12 Package side				4.00	10.32			13.00	19.36
13 Package side				2.00	5.03			9.00	11.46
14 Package Bottom				0.00	-0.26			4.00	1.58

10.05	17.54

Alpha Efficiency:	0.38
Alpha Background :	0.10
Beta Efficiency:	0.51
	3.20
High Voltage Setting:	1,410.00

Technician (Print and Sign):

Reviewed by:

Page 1 of 1

Figure 16d. Copy of COC 14-0182 radiological screening

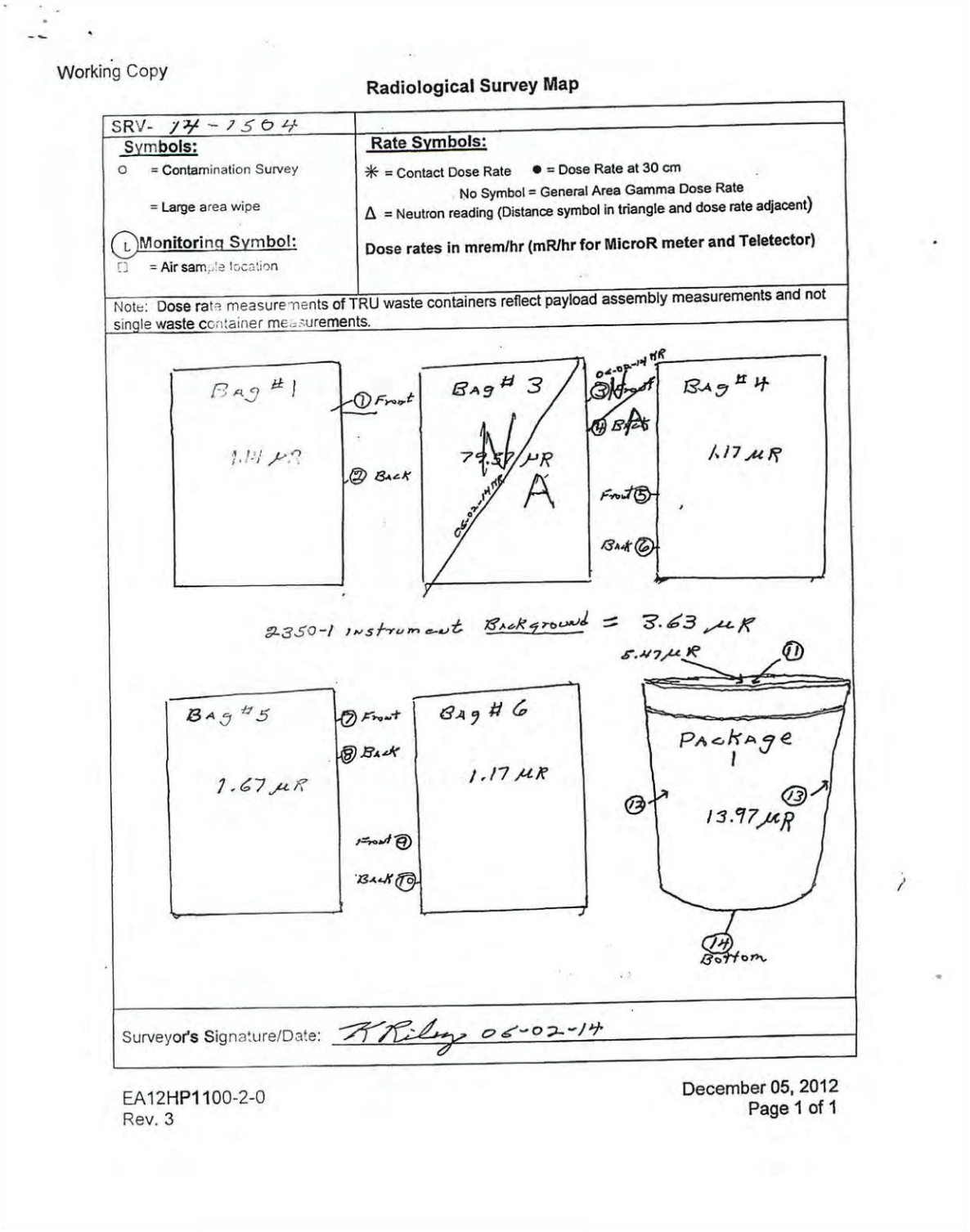


Figure 16e. Copy of COC 14-0182 radiological screening, sampling locations

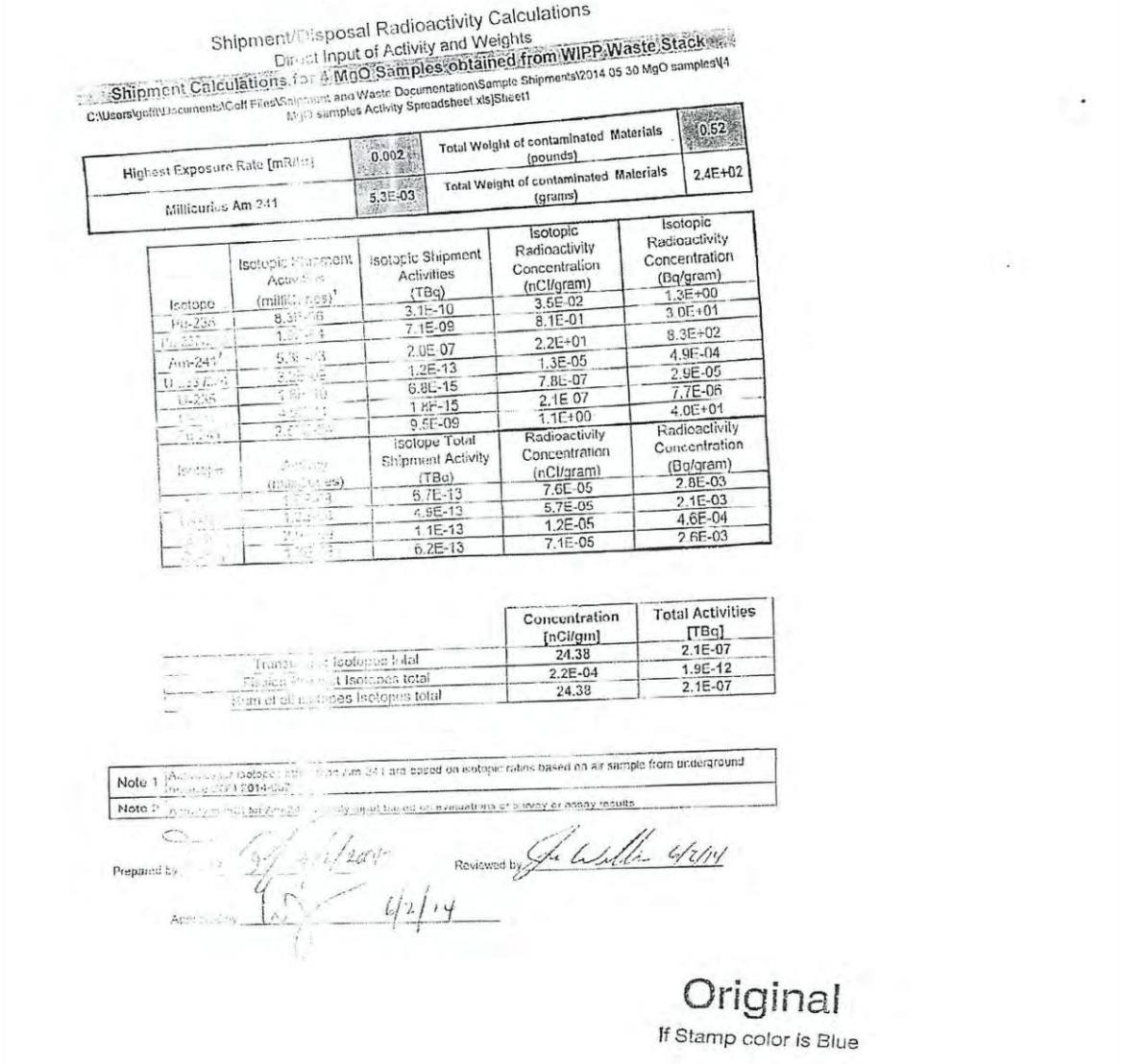
	HAVE	HAVE	HAVE	ALLOWED	HAVE/ ALLOWED	ALLOWED	HAVE/ ALLOWED	ALLOWED	ALLOWED	HAVE/ ALLOWED	HAVE/ALLOWED		HAVE/ALLOWED
	Sample (mCi)	Sample (Ci)	Act conc (Ci/g)	Act conc (Ci/g)	Act Conc	Consign ment	Consign	A2 (Ci)	Ltd Qty	Ltd Qty	Type A	RQ (Ci)	RQ
Am241	**5.30E-03**	**5.30E-06**	**2.21E-08**	**2.70E-11**	**8.18E+02**	**2.70E-07**	**1.96E+01**	**0.027**	**2.70E-05**	**1.96E-01**	**1.96E-04**	**0.01**	**5.30E-04**
Cs134	**1.70E-08**	**1.70E-11**	**7.08E-14**	**2.70E-10**	**2.62E-04**	**2.70E-07**	**6.30E-05**	**16**	**0.016**	**1.06E-09**	**1.06E-12**	**1**	**1.70E-11**
Cs137	**1.30E-08**	**1.30E-11**	**5.42E-14**	**2.70E-10**	**2.01E-04**	**2.70E-07**	**4.81E-05**	**16**	**0.016**	**8.13E-10**	**8.13E-13**	**1**	**1.30E-11**
Co60	**1.80E-08**	**1.80E-11**	**7.50E-14**	**2.70E-10**	**2.78E-04**	**2.70E-06**	**6.67E-06**	**11**	**0.011**	**1.64E-09**	**1.64E-12**	**10**	**1.80E-12**
Pu238	**8.30E-06**	**8.30E-09**	**3.46E-11**	**2.70E-11**	**1.28E+00**	**2.70E-07**	**3.07E-02**	**0.027**	**0.000027**	**3.07E-04**	**3.07E-07**	**0.01**	**8.30E-07**
Pu239/240	**1.90E-04**	**1.90E-07**	**7.92E-10**	**2.70E-11**	**2.93E+01**	**2.70E-08**	**7.04E+00**	**0.027**	**0.000027**	**7.04E-03**	**7.04E-06**	**0.01**	**1.90E-05**
Pu241	**2.56E-04**	**2.56E-07**	**1.07E-09**	**2.70E-09**	**3.95E-01**	**2.70E-06**	**9.48E-02**	**1.6**	**0.0016**	**1.60E-04**	**1.60E-07**	**1**	**2.56E-07**
Sr90	**2.90E-09**	**2.90E-12**	**1.21E-14**	**2.70E-09**	**4.48E-06**	**2.70E-07**	**1.07E-05**	**8.1**	**0.0081**	**3.58E-10**	**3.58E-13**	**0.1**	**2.90E-11**
U233/234	**3.20E-09**	**3.20E-12**	**1.33E-14**	**2.70E-10**	**4.94E-05**	**2.70E-07**	**1.19E-05**	**0.16**	**0.00016**	**2.00E-08**	**2.00E-11**	**0.1**	**3.20E-11**
U235	**1.80E-10**	**1.80E-13**	**7.50E-16**	**2.70E-10**	**2.78E-06**	**2.70E-07**	**6.67E-07**	*	*			**0.1**	**1.80E-12**
U238	**4.90E-11**	**4.90E-14**	**2.04E-16**	**2.70E-10**	**7.56E-07**	**2.70E-07**	**1.81E-07**	*	*			**0.1**	**4.90E-13**
Total	**5.75E-03**	**5.75E-06**	**2.40E-08**		**8.49E+02**		**2.68E+01**	*unlimited*	*unlimited*	**2.04E-01**	**2.04E-04**		**5.50E-04**
					>1 reg		>1 reg			ltd qty <1	<1		<1 not RQ

Mass (g): **2.40E+02**

A2 determination

	HAVE	ALLOWED	VE/ALLOWED	Activity Fraction	f(i)/A(i)
LSA-I	2.21E-08	8.10E-10	2.73E+01	**9.21E-01**	**3.41E+01**
			>1 Not LSA-I	**2.95E-06**	**1.85E-07**
				2.26E-06	**1.41E-07**
				3.13E-06	2.84E-07
				1.44E-03	5.34E-02
				3.30E-02	**1.22E+00**
LSA-II	2.21E-08	0.0000027	8.18E-03	**4.45E-02**	**2.78E-02**
			<1 LSA-II ok	**5.04E-07**	**6.22E-08**
				5.56E-07	3.48E-06
				3.13E-08	
				8.52E-09	A2 (Ci)
				1.00E+00	3.54E+01 2.82E-02

Figure 16f. Copy of COC 14-0182 radiological screening



Shipment/Disposal Radioactivity Calculations

Direct Input of Activity and Weights

Shipment Calculations for 4 MgO Samples obtained from WIPP Waste Stack

C:\Users\goff\Documents\Goff Files\Shipment and Waste Documentation\Sample Shipments\2014 05 30 MgO samples\[4 MgO samples Activity Spreadsheet.xls]Sheet1

Highest Exposure Rate [mR/hr]	0.002	Total Weight of contaminated Materials (pounds)	0.52
Millicuries Am 241	5.3E-03	Total Weight of contaminated Materials (grams)	2.4E+02

Isotope	Isotopic Shipment Activities (millicuries)[1]	Isotopic Shipment Activities (TBq)	Isotopic Radioactivity Concentration (nCi/gram)	Isotopic Radioactivity Concentration (Bq/gram)
Pu-238	8.3E-06	3.1E-10	3.5E-02	1.3E+00
[illegible]	[illegible]	7.1E-09	8.1E-01	3.0E+01
Am-241[2]	[illegible]	2.0E-07	2.2E+01	8.3E+02
[illegible]	[illegible]	1.2E-13	1.3E-05	4.9E-04
U-235	[illegible]	6.8E-15	7.8E-07	2.9E-05
[illegible]	[illegible]	1.8E-15	2.1E-07	7.7E-06
[illegible]	[illegible]	9.5E-09	1.1E+00	4.0E+01

Isotope	Activity (millicuries)	Isotope Total Shipment Activity (TBq)	Radioactivity Concentration (nCi/gram)	Radioactivity Concentration (Bq/gram)
[illegible]	[illegible]	6.7E-13	7.6E-05	2.8E-03
[illegible]	[illegible]	4.9E-13	5.7E-05	2.1E-03
[illegible]	[illegible]	1.1E-13	1.2E-05	4.6E-04
[illegible]	[illegible]	6.2E-13	7.1E-05	2.6E-03

	Concentration [nCi/gm]	Total Activities [TBq]
Transuranic Isotopes total	24.38	2.1E-07
Fission Product Isotopes total	2.2E-04	1.9E-12
Sum of all isotopes Isotopes total	24.38	2.1E-07

Note 1	Activities of isotopes other than Am 241 are based on isotopic ratios based on air sample from underground [illegible] 2014-[illegible]
Note 2	Activity in mCi for Am 241 is only input based on evaluations of survey or assay results

Prepared by [illegible] 6/2/2014 Reviewed by [illegible] 6/2/14

Approved by [illegible] 6/2/14

Original

If Stamp color is Blue

Figure 16g. Copy of COC 14-0182 radiological screening for shipment

Radioactivity Estimations for Shipment of MgO Samples

C:\Users\goffi\Documents\Goff Files\Shipment and Waste Documentation\Sample Shipments\2014 05 30 MgO samples\Activity Calculations.docx

Introduction

NWP will be obtaining samples of MgO/salt from the Panel 7; Room 7 waste stack. The samples will include volumes of MgO in PVC pipes. The shielding of the PVC pipe sections and the volumetric characteristics of the MgO is not accounted for in the standard conversion factors used for bags of waste associated with the radiological event of 2/14/2014. This document will describe the development of an activity per exposure rate for these samples.

Shipment consists of:

- 5 samples of MgO in a 6" sections of ¾" PVC pipe
- 3 samples on 2 ½" x 6" foam sample heads.

The approach will be to model 6" pipe in 3 plastic bags and determine the appropriate uR/h per nCi conversion factor. Radioactivity on the foam sample heads will be assumed to be contained in ¾" pipe sections. As the shielding will be less for these samples, the activity calculation will be conservative.

Methodology

A MicroShield model will be developed to estimate the exposure rate from an activity of Am-241 in a sample tube.

Assumptions:

The wall thickness of the PVC pipe is 0.113" [EngineeringToolBox.com]
The inside diameter of the pipe is 0.824" [EngineeringToolBox.com]. $Volume_{[6" tube]}=1in^3=16.4cm^3$.
The density of PVC pipe is 1.4 gm/cm^3. [PNNL-15870]
The density of MgO is 3.6 gm/cm^3. [PNNL-15870] Mass inside 6" ¾' pipe = 59 grams
The thickness of the plastic bags is 4 mil [0.004 inches]
The density of the plastic bags is 0.95 gm/cm^3. [PNNL-15870]

Calculations

The MicroShield model indicates that 1 Curie Am-241 in a 3/4" PVC pipe would generate a "contact" exposure rate of about 3,000 mR/hour.

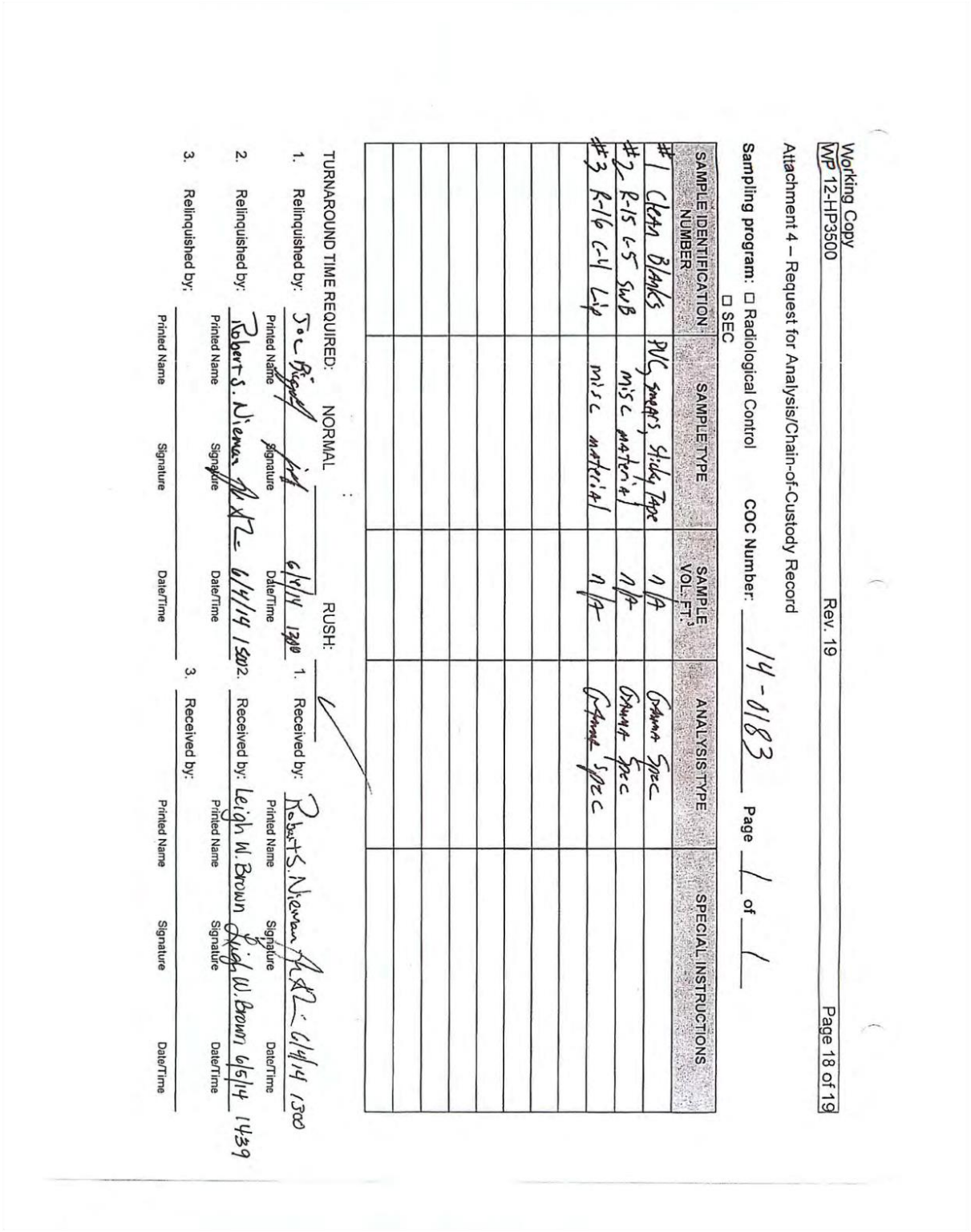
This would correlate to a conversion rate of:

$$\frac{3{,}000\ mR}{h} \times \frac{10^3\ uR}{mR} \times \frac{Ci}{10^3\ mCi} = \boxed{3{,}000\ uR/h \text{ per } mCi = 3.3E\text{-}4\ mCi/uR/h}$$

The activity should be input to the Shipment/Disposal Activity spreadsheet. The weight of the radioactive materials can be estimated by multiplying the number of sample tubes by 59 grams.

Prepared by [signature] 5/29/14 Reviewed by [signature] 5/29/14 Approved by [signature] 5/29/14

Figure 16h. Copy of COC 14-0182 radiological screening for shipment MgO



Working Copy

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Attachment 4 – Request for Analysis/Chain-of-Custody Record

Sampling program: ☐ Radiological Control ☐ SEC **COC Number:** 14-0183 **Page** 1 **of** 1

SAMPLE IDENTIFICATION NUMBER	SAMPLE TYPE	SAMPLE VOL. FT.^{3}	ANALYSIS TYPE	SPECIAL INSTRUCTIONS
#1 Clean Blanks	PVC, smears, Sticky Tape	n/A	Gamma Spec	
#2 R-15 C-5 SWB	misc material	n/A	Gamma Spec	
#3 R-16 C-4 Lip	misc material	n/A	Gamma Spec	

TURNAROUND TIME REQUIRED: NORMAL ____ RUSH: ✓

1. Relinquished by: Joe Biggs [signature] 6/4/14 1300 (Printed Name / Signature / Date/Time)
2. Relinquished by: Robert S. Nieman [signature] 6/4/14 1500 (Printed Name / Signature / Date/Time)
3. Relinquished by: ____ (Printed Name / Signature / Date/Time)

1. Received by: Robert S. Nieman [signature] 6/4/14 1300 (Printed Name / Signature / Date/Time)
2. Received by: Leigh W. Brown [signature] 6/5/14 1439 (Printed Name / Signature / Date/Time)
3. Received by: ____ (Printed Name / Signature / Date/Time)

Figure 17a. Copy of COC 14-0183

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Radiological Survey Report

SECTION A				
Survey #	Date	Time	Shipment	Package #
14-1520	6-4-14	1300	NA	NA

Location: TMF (Shipping container) Surveyor's printed name: Frank Beckman

Reason for survey: Receipt ☐ Processing ☐ Emplacement ☐ Special Request ☒ RWP ☐
Weekly ☐ Monthly ☐ Quarterly ☐ Annual ☐ Other ☐

Model No.	Equipment/ Probe ID#	Eff.	Cal. Due Date	BKGD (cpm)	MDA (dpm) or DL (mrem/hr)
2360/43-93	1754/1754	20.6	5-12-15	α 0.2	α 22.3
2360/43-93	1754/1754	28.4	5-12-15	α 77	β 721.9
9DP	1648	NA	2-25-15	NA	NA
Tennelec	1105	See Report	3-14-15	See Report	See Report
		NA			

Survey Type:

Alpha ☐ Beta/Gamma ☐ Neutron ☐ Contamination ☐ Radiation ☐

SECTION B		Radiological Assessment Filter (RAF)
Time	Released (circle)	Activity if not related (otherwise N/A)
NA	N/A Yes No	NA

SECTION C — **COMMENTS**

Survey performed on shipping container with underground samples inside to be sent to SRS. Smears 1 and 2 are <200dpm/100cm² Alpha, and <2000dpm/100cm² Beta. Direct frisks on smear locations are <500dpm/100cm² Alpha and <1000dpm/100cm² Beta. See map for doserates. FB 6-4-14

Surveyor's Signature/Date: [signature] 6-4-14

This survey has been reviewed for accuracy, regulatory compliance, and radiological impacts. This survey contains: 3 Pages (including this page).

Manager's Signature/Date: C. Lowell 6-4-14

EA12HP1100-1-0
Rev. 2

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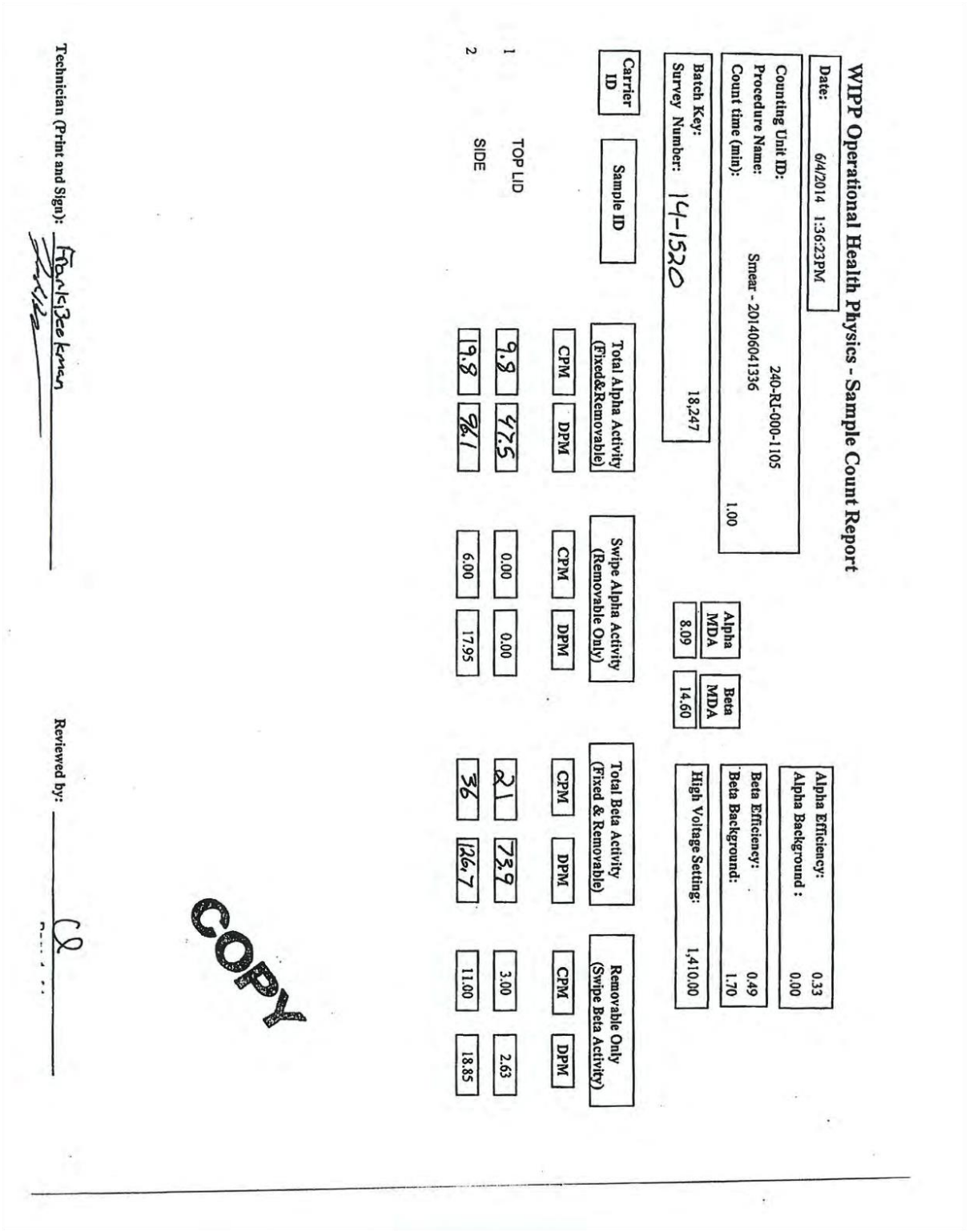
December 05, 2012
Page 1 of 2

Figure 17b. Copy of COC 14-0183 radiological screening



WIPP Operational Health Physics - Sample Count Report

Date: 6/4/2014 1:36:23PM

Counting Unit ID: 240-RL-000-1105
Procedure Name: Smear - 20140604133 6
Count time (min): 1.00

Batch Key:
Survey Number: 14-1520 18,247

Alpha MDA 8.09
Beta MDA 14.60

Alpha Efficiency: 0.33
Alpha Background : 0.00

Beta Efficiency: 0.49
Beta Background: 1.70

High Voltage Setting: 1,410.00

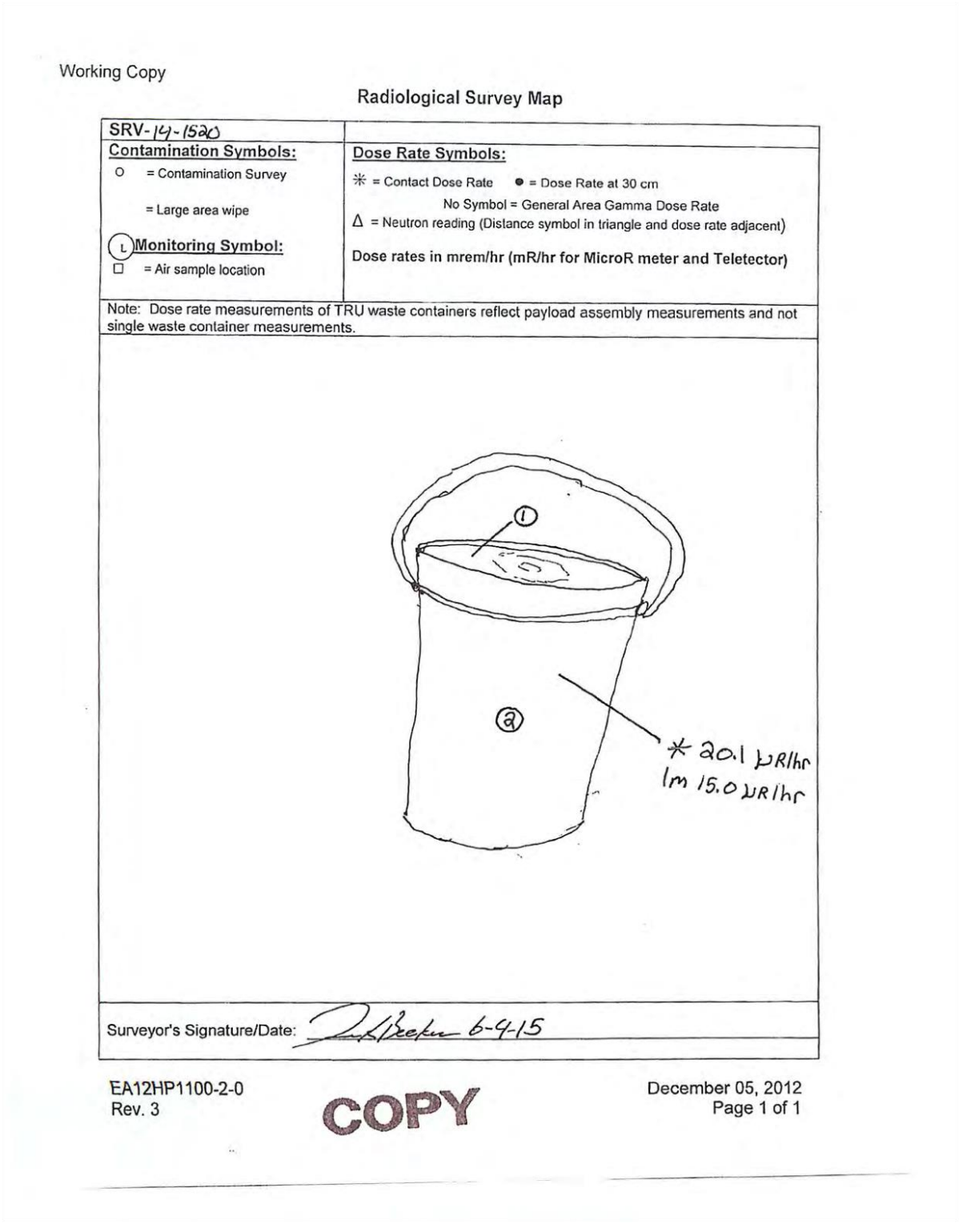
Carrier ID	Sample ID		Total Alpha Activity (Fixed&Removable)		Swipe Alpha Activity (Removable Only)		Total Beta Activity (Fixed & Removable)		Removable Only (Swipe Beta Activity)	
			CPM	DPM	CPM	DPM	CPM	DPM	CPM	DPM
1	TOP LID		9.8	47.5	0.00	0.00	21	73.9	3.00	2.63
2	SIDE		19.8	98.1	6.00	17.95	36	126.7	11.00	18.85

Technician (Print and Sign): Frank Bee Kmen

Reviewed by:

COPY

Figure 17c. Copy of COC 14-0183 radiological screening



Working Copy

Radiological Survey Map

SRV-14-1520

Contamination Symbols:

O = Contamination Survey

= Large area wipe

(L) **Monitoring Symbol:**

☐ = Air sample location

Dose Rate Symbols:

✳ = Contact Dose Rate ● = Dose Rate at 30 cm

No Symbol = General Area Gamma Dose Rate

Δ = Neutron reading (Distance symbol in triangle and dose rate adjacent)

Dose rates in mrem/hr (mR/hr for MicroR meter and Teletector)

Note: Dose rate measurements of TRU waste containers reflect payload assembly measurements and not single waste container measurements.

Surveyor's Signature/Date: 6-4-15

EA12HP1100-2-0
Rev. 3

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December 05, 2012
Page 1 of 1

Figure 17d. Copy of COC 14-0183 radiological screening, sampling locations

Working Copy

Radiological Survey Report

SECTION A

Survey #	Date	Time	Shipment	Package #
14-1515	6-3-14	1100	N/A	N/A

Location: T.M.F. UNDERGROUND SAMPLES

Surveyor's printed name: S R HOKN

Reason for survey: Receipt ☐ Processing ☐ Emplacement ☐ Special Request ☒ RWP ☐
Weekly ☐ Monthly ☐ Quarterly ☐ Annual ☐ Other ☐

Model No.	Equipment/ Probe ID#	Eff.	Cal. Due Date	BKGD (cpm)	MDA (dpm) or DL (mrem/hr)
TENNELEC	SEE REPORT		9-10-14	SEE REPORT	
2350-1	1398/1411		12-18-14	3.07 MR	4.0 MR
		N			
		A			

Type:
Alpha ☒ Beta/Gamma ☐ Neutron ☒ Contamination ☒ Radiation ☒

SECTION B

Radiological Assessment Filter (RAF)

Time	Released (Circle)	Activity if not related (otherwise N/A)
N/A	(N/A) Yes No	N/A

SECTION C

COMMENT

SWIPES #1 – #6 INDICATE < 20 dpm/100cm² α AND < 200 dpm/100cm² β-γ
SEE MAP FOR LOCATIONS OF SWIPES AND DOSE RATES
OFF-SITE RELEASE

Surveyor's Signature/Date: S R Hokn 6-3-14

This survey has been reviewed for accuracy, regulatory compliance, and radiological impacts. This survey contains: 3 Pages (including this page).

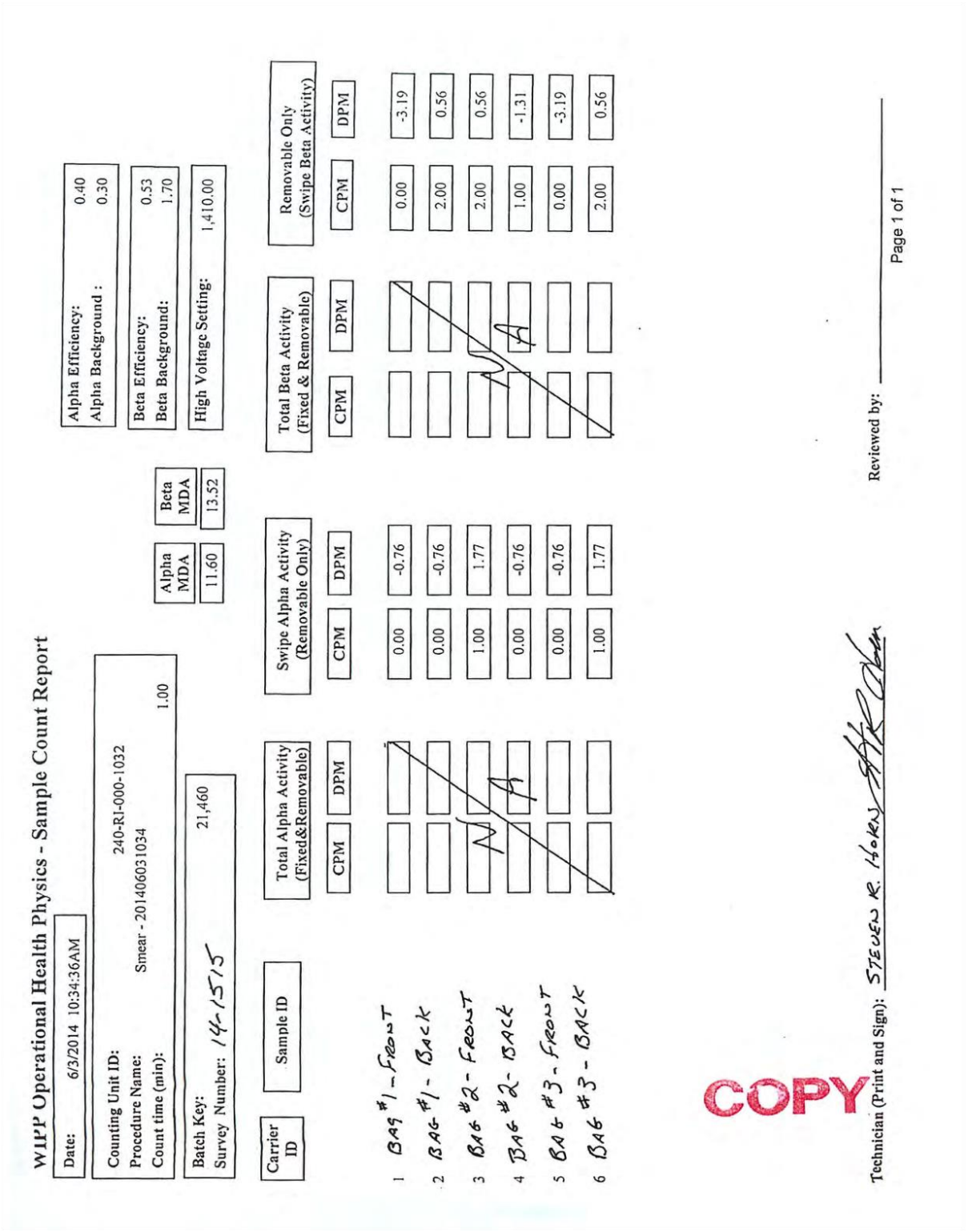
Manager's Signature/Date: C. Lawrence 6-3-14

EA12HP1100-1-0
Rev. 2

COPY

December 05, 2012
Page 1 of 2

Figure 17e. Copy of COC 14-0183 radiological screening



WIPP Operational Health Physics - Sample Count Report

Date: 6/3/2014 10:34:36AM

Counting Unit ID: 240-RI-000-1032
Procedure Name: Smear - 20140603 1034
Count time (min): 1.00

Batch Key: 21,460
Survey Number: 14-1515

Alpha Efficiency: 0.40
Alpha Background : 0.30

Beta Efficiency: 0.53
Beta Background: 1.70

High Voltage Setting: 1,410.00

	Alpha MDA	Beta MDA
	11.60	13.52

	Carrier ID	Sample ID	Total Alpha Activity (Fixed&Removable)		Swipe Alpha Activity (Removable Only)		Total Beta Activity (Fixed & Removable)		Removable Only (Swipe Beta Activity)	
			CPM	DPM	CPM	DPM	CPM	DPM	CPM	DPM
1		BAG #1 - FRONT			0.00	-0.76			0.00	-3.19
2		BAG #1 - BACK			0.00	-0.76			2.00	0.56
3		BAG #2 - FRONT			1.00	1.77			2.00	0.56
4		BAG #2 - BACK			0.00	-0.76			1.00	-1.31
5		BAG #3 - FRONT			0.00	-0.76			0.00	-3.19
6		BAG #3 - BACK			1.00	1.77			2.00	0.56

COPY

Technician (Print and Sign): STEVEN R. HOKES

Reviewed by: _____

Page 1 of 1

Figure 17f. Copy of COC 14-0183 radiological screening

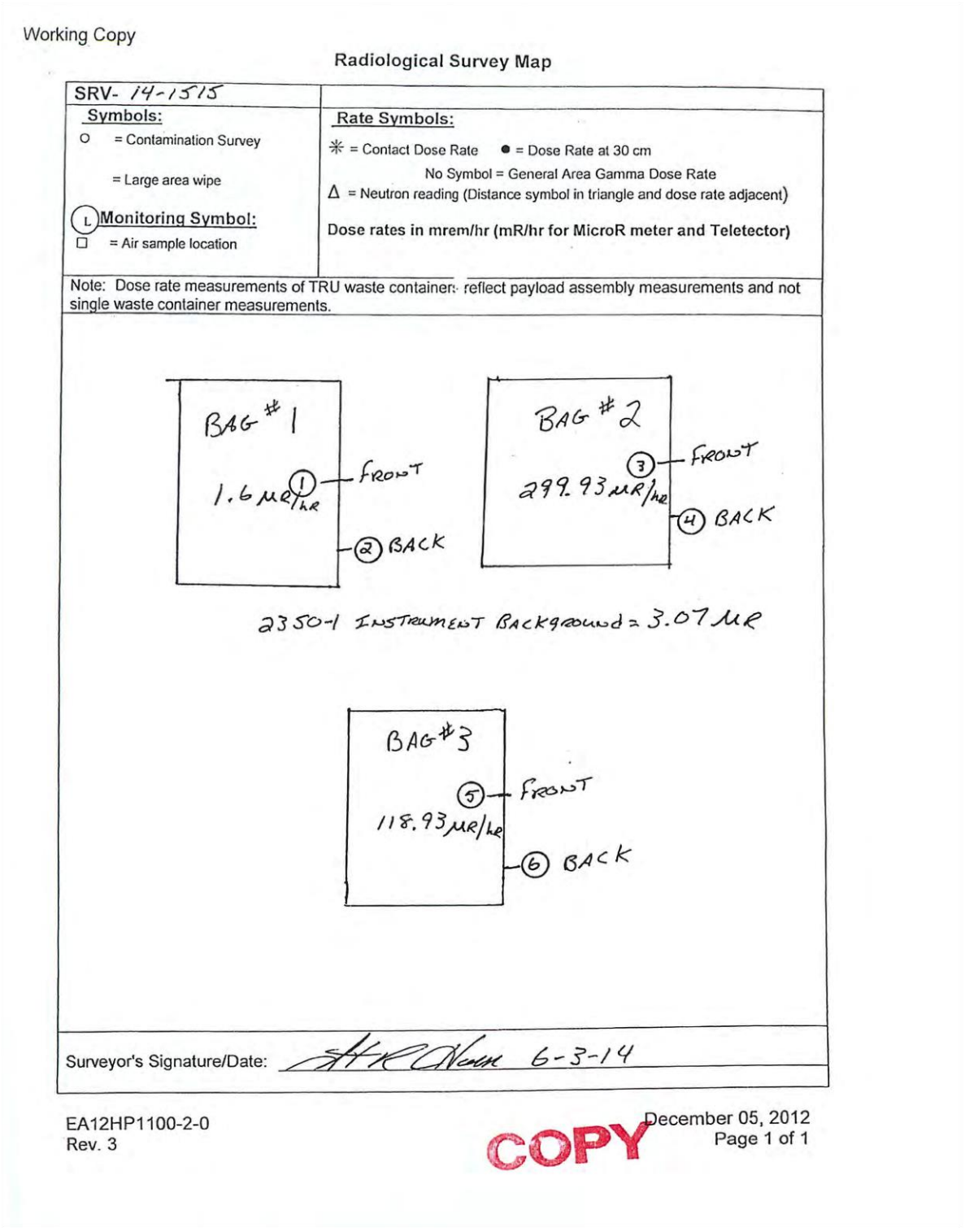
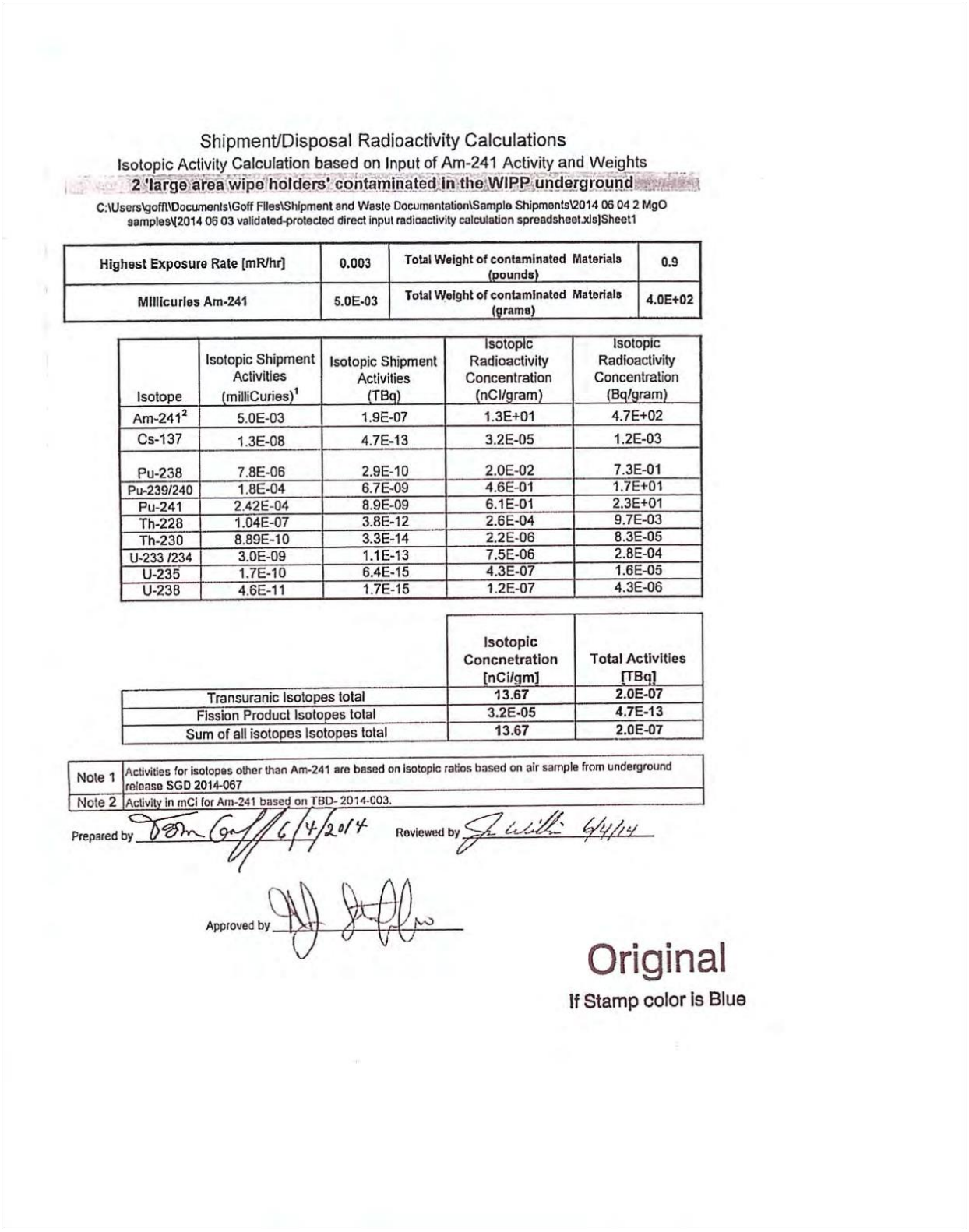


Figure 17g. Copy of COC 14-0183 radiological screening, sampling locations



Shipment/Disposal Radioactivity Calculations

Isotopic Activity Calculation based on Input of Am-241 Activity and Weights

2 'large area wipe holders' contaminated in the WIPP underground

C:\Users\goff\Documents\Goff Files\Shipment and Waste Documentation\Sample Shipments\2014 06 04 2 MgO samples\[2014 06 03 validated-protected direct input radioactivity calculation spreadsheet.xls]Sheet1

Highest Exposure Rate [mR/hr]	0.003	Total Weight of contaminated Materials (pounds)	0.9
Millicuries Am-241	5.0E-03	Total Weight of contaminated Materials (grams)	4.0E+02

Isotope	Isotopic Shipment Activities (milliCuries)[1]	Isotopic Shipment Activities (TBq)	Isotopic Radioactivity Concentration (nCi/gram)	Isotopic Radioactivity Concentration (Bq/gram)
Am-241[2]	5.0E-03	1.9E-07	1.3E+01	4.7E+02
Cs-137	1.3E-08	4.7E-13	3.2E-05	1.2E-03
Pu-238	7.8E-06	2.9E-10	2.0E-02	7.3E-01
Pu-239/240	1.8E-04	6.7E-09	4.6E-01	1.7E+01
Pu-241	2.42E-04	8.9E-09	6.1E-01	2.3E+01
Th-228	1.04E-07	3.8E-12	2.6E-04	9.7E-03
Th-230	8.89E-10	3.3E-14	2.2E-06	8.3E-05
U-233 /234	3.0E-09	1.1E-13	7.5E-06	2.8E-04
U-235	1.7E-10	6.4E-15	4.3E-07	1.6E-05
U-238	4.6E-11	1.7E-15	1.2E-07	4.3E-06

	Isotopic Concnetration [nCi/gm]	Total Activities [TBq]
Transuranic Isotopes total	13.67	2.0E-07
Fission Product Isotopes total	3.2E-05	4.7E-13
Sum of all isotopes Isotopes total	13.67	2.0E-07

Note 1	Activities for isotopes other than Am-241 are based on isotopic ratios based on air sample from underground release SGD 2014-067
Note 2	Activity in mCi for Am-241 based on TBD- 2014-003.

Prepared by 6/4/2014 Reviewed by 6/4/14

Approved by

Original

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Figure 17h. Copy of COC 14-0183 radiological screening for shipment

Radioactivity Estimations for Shipment of MgO Samples

C:\Users\gofft\Documents\Goff Files\Shipment and Waste Documentation\Sample Shipments\2014 06 04 2 MgO samples\Activity Calculations.docx

Introduction

NWP has obtained samples of MgO/salt from the Panel 7; Room 7 waste stack. The sample includes a blank sample pipe and 2 contaminated sample holders. This document will describe the development of an activity per exposure rate for these samples.

The approach will be to model the 6" pipe in 3 plastic bags and determine the appropriate uR/h per mCi and mCi/uR/h conversion factors.

Methodology

A MicroShield model will be developed to estimate the exposure rate from an activity of Am-241 on a 'large area wipe' holder in three plastic bags.

Assumptions:

- The surface of the wipe holder is about 2 ½" x 6" foam.
- Self shielding of any Am-241 in the foam matrix is ignored as the calculations will be based on the photon generation and measurements.
- It is assumed that the wipe holder is in 3- 4 mil poly bags [0.012 inches]

Calculations

The results of the MicroShield model are shown on Attachment 1. As can be seen from the model, 1 milli-Curie of Am-241 would generate about 85 mR/hr through 3 4 mil plastic bags at ½"

This would correlate to a conversion rate of:

$$\frac{85\ \text{mR/h}}{\text{mCi}} \times \frac{10^3\ \text{uR}}{\text{mR}} = \boxed{85{,}000\ \text{uR/h per mCi} = 1.2\text{E-}5\ \text{mCi/uR/h}}$$

The measured exposure rates on the two wipe holders are 120 and 300 uR/h [Bags 2 & 3 on survey 14-1515, attached]. This correlates to Am activities of 1.4E-3 and 3.6E-3 mCi for a total of 5E-3 mCi.

The activity should be input to the Shipment/Disposal Activity spreadsheet. The weight of the wipe holders was measured at 7 ounces ~ 200 grams. Therefore, the input weight is 14 ounces or 0.875 pounds.

Prepared by Tom Goff Reviewed by 6/14/14 Approved by

Original

If Stamp color is Blue

Figure 17i. Copy of COC 14-0183 radiological screening for shipment MgO

Radioactivity Estimations for Shipment of MgO Samples

C:\Users\gofft\Documents\Goff Files\Shipment and Waste Documentation\Sample Shipments\2014 06 04 2 MgO samples\Activity Calculations.docx

Attachment 1
Model of Wipe Photon Emissions

MicroShield v6.02 (6.02-00176)
Washington-TRU-Solutions

Page : 1
DOS File : _large area wipe holder.ms6
Run Date: June 3, 2014
Run Time: 3:12:12 PM
Duration : 00:00:00

File Ref: _____
Date: _____
By: _____
Checked: _____

Case Title: Wipe Holder
Description: 1 mCi on surface of Wipe Holder
Geometry: 4 - Rectangular Area - Vertical

Source Dimensions

Width	6.35 cm	2.5 in
Height	15.24 cm	6.0 in

Dose Points

	X	Y	Z
# 1	1.27 cm	7.62 cm	3.175 cm
	0.5 in	3.0 in	1.3 in

Shields

Shield Name	Dimension	Material	Density
Shield 1	.012 in	plastic	0.95
Air Gap		Air	0.00122

Source Input
Grouping Method : Actual Photon Energies

Nuclide	curies	becquerels	µCi/cm²	Bq/cm²
Am-241	1.0000e-003	3.7000e+007	1.0333e+001	3.8233e+005

Buildup
The material reference is : Shield 1

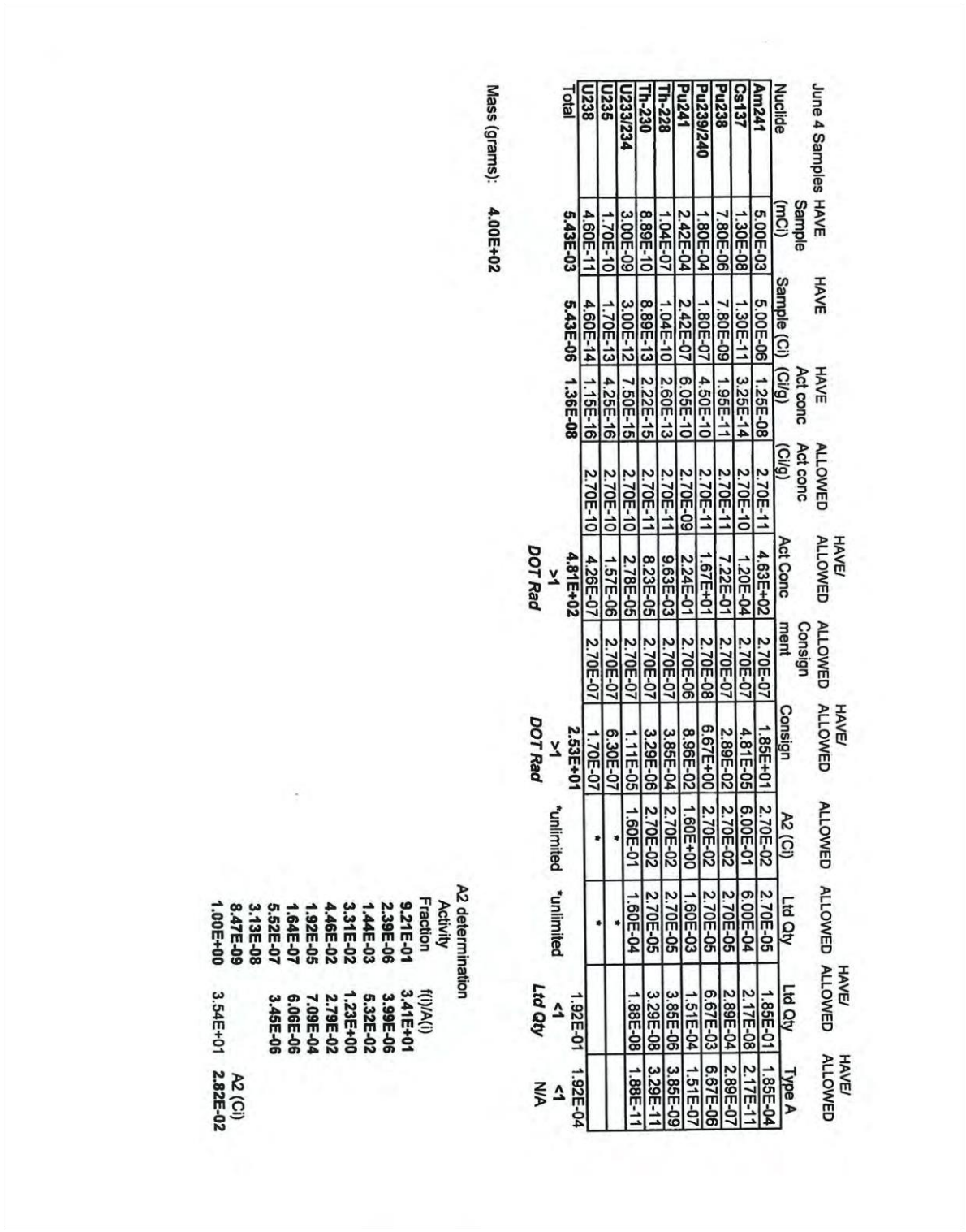
Integration Parameters

Z Direction	20
Y Direction	20

Results

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.0139	1.580e+07	6.574e+02	6.676e+02	7.166e+01	7.277e+01
0.0263	8.880e+05	1.396e+02	1.430e+02	2.050e+00	2.099e+00
0.0332	3.922e+04	8.478e+00	8.691e+00	6.238e-02	6.395e-02
0.0595	1.328e+07	5.535e+03	5.637e+03	1.110e+01	1.131e+01
0.0692	6.635e+04	3.233e+01	3.291e+01	5.552e-02	5.652e-02
TOTALS:	3.008e+07	6.372e+03	6.489e+03	8.493e+01	8.630e+01

Figure 17j. Copy of COC 14-0183 radiological screening for shipment MgO



June 4 Samples

Nuclide	HAVE Sample (mCi)	HAVE Sample (Ci)	HAVE Act conc (Ci/g)	ALLOWED Act conc (Ci/g)	HAVE/ ALLOWED	Act Conc	ALLOWED Consign ment	HAVE/ ALLOWED	Consign	A2 (Ci)	ALLOWED	Ltd Qty	ALLOWED	Ltd Qty	HAVE/ ALLOWED	Type A	HAVE/ ALLOWED
Am241	5.00E-03	5.00E-06	1.25E-08	2.70E-11		4.63E+02	2.70E-07		1.85E+01	2.70E-02		2.70E-05		1.85E-01		1.85E-04	
Cs137	1.30E-08	1.30E-11	3.25E-14	2.70E-10		1.20E-04	2.70E-07		4.81E-05	6.00E-01		6.00E-04		2.17E-08		2.17E-11	
Pu238	7.80E-06	7.80E-09	1.95E-11	2.70E-11		7.22E-01	2.70E-07		2.89E-02	2.70E-02		2.70E-05		2.89E-04		2.89E-07	
Pu239/240	1.80E-04	1.80E-07	4.50E-10	2.70E-11		1.67E+01	2.70E-08		6.67E+00	2.70E-02		2.70E-05		6.67E-03		6.67E-06	
Pu241	2.42E-04	2.42E-07	6.05E-10	2.70E-09		2.24E-01	2.70E-06		8.96E-02	1.60E+00		1.60E-03		1.51E-04		1.51E-07	
Th-228	1.04E-07	1.04E-10	2.60E-13	2.70E-11		9.63E-03	2.70E-07		3.85E-04	2.70E-02		2.70E-05		3.85E-06		3.85E-09	
Th-230	8.89E-10	8.89E-13	2.22E-15	2.70E-11		8.23E-05	2.70E-07		3.29E-06	2.70E-02		2.70E-05		3.29E-08		3.29E-11	
U233/234	3.00E-09	3.00E-12	7.50E-15	2.70E-10		2.78E-05	2.70E-07		1.11E-05	1.60E-01		1.60E-04		1.88E-08		1.88E-11	
U235	1.70E-10	1.70E-13	4.25E-16	2.70E-10		1.57E-06	2.70E-07		6.30E-07	*		*					
U238	4.60E-11	4.60E-14	1.15E-16	2.70E-10		4.26E-07	2.70E-07		1.70E-07	*		*					
Total	**5.43E-03**	**5.43E-06**	**1.36E-08**			**4.81E+02**			**2.53E+01**					1.92E-01		1.92E-04	
						>1			>1	*unlimited		*unlimited		<1		<1	
						DOT Rad			***DOT Rad***					***Ltd Qty***		N/A	

Mass (grams): **4.00E+02**

A2 determination

Activity Fraction	f(i)/A(i)
9.21E-01	**3.41E+01**
2.39E-06	**3.99E-06**
1.44E-03	**5.32E-02**
3.31E-02	**1.23E+00**
4.46E-02	**2.79E-02**
1.92E-05	**7.09E-04**
1.64E-07	**6.06E-06**
5.52E-07	**3.45E-06**
3.13E-08	
8.47E-09	A2 (Ci)
1.00E+00	3.54E+01 **2.82E-02**

Figure 17k. Copy of COC 14-0183 radiological screening