APPENDIX S
RADIOLOGICAL SURVEY OF LOAD LINES 2, 3, AND 4

THIS PAGE INTENTIONALLY LEFT BLANK.

EXECUTIVE SUMMARY

RADIATION SURVEY REPORT NO. LRB-TD-EH-R1-04-03
LOADLINES 2,3 & 4 REPORT
RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO
11 SEP 01

1. PURPOSE. Radiological surveys of load lines 2,3&4 were conducted to demonstrate that no residual radioactive contamination attributable to Ravenna Army Ammunition Plant (RVAAP) activities is detectable using accepted survey methods for decommissioning. These surveys also demonstrate that the radiological parameters from residual radioactive contamination are below the release criteria for each area surveyed. In addition, records were reviewed to determine if documentation existed to support the proper disposal of the radioactive sources (i.e.Cobalt-60 sealed sources) used in the load lines at the RVAAP.

2. CONCLUSIONS.

2.1 A review of the survey results indicates that there is no detectable cobalt 60 contamination in the load lines.

2.2 Records exist that indicate that the three, sealed cobalt 60 sources were shipped off site in 1971 and 1972.

TABLE OF CONTENTS

APPENDICES

RADIATION SURVEY REPORT NO. LRB-TD-EH-R1-04-03
LOADLINES 2,3 & 4 REPORT
RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO
11 SEP 01

1. REFERENCES. See Appendix A for a list of references.

2. PURPOSE. The objectives of the Final Status Survey for load lines 2, 3 & 4 were to:

2.1 Certify that no residual radioactive contamination attributable to RVAAP activities is detectable using accepted survey methods for decommissioning.

2.2 Demonstrate that the radiological parameters from residual radioactive contamination are below the release criteria for each area surveyed.

2.1 Document the disposal of the radioactive sources i.e.Co-60 sealed sources) used in the load lines and result of the FSS.

3. GENERAL.

3.1 Project management for the survey was conducted by the U.S. Army Corps of Engineers, Buffalo District (USACELRB).

3.2 The survey was managed by Mr. Craig Rieman, Chief, Environmental Health, USACELRB. A team of consisting of Mr. Clint Verelle, USACELRB Health Physicist and Mr. Mat Masset, USACELRB, Chemist performed the field surveys.

3.3 The USACE personnel mentioned above have varied expertise in radiological health issues and are qualified to perform the survey. Each individual was provided occupational health and safety training by USACELRB to administer a safe working environment.

3.4 Quality Assurance oversight and independent verification of the project was provided by the USACE Baltimore District (USACENAB) rather than the U.S. Army Center for Health Promotion and Preventive Medicine, Industrial Health Physics Program (USACHPPM-IHPP) as planned because of schedule conflicts. Mr. Karl Ford, Health Physicist reviewed the work

plan and to insure a comprehensive survey. He also observed surveys in progress to insure the plan was followed.

3.5 A list of abbreviations used in this report can be found in Appendix A.

4. Site and Project Background.

4.1 Site Background.

4.1.1 DOD activities at Ravenna Army Ammunition Plant(RVAAP) date back to 1940 and include the storage, handling, and packing of military ammunition and explosives. The site is located in northeastern Ohio in Portage and Trumbell Counties, see Appendix B. The installation includes 21,419 acres in a tract approximately 3.5 miles wide by 11 miles long. RVAAP is a government owned contractor operated facility under the control of the US Army Industrial Operations Command.

4.1.2 A site assessment was conducted and documented in: Preliminary Assessment for Ravenna Army Ammunition Plant, February 1996, by Science Applications International Corporation (SAIC). This site assessment did not adequately address the radiological concerns at RVAAP.

4.1.3 A historical assessment of radiological use at RVAAP was conducted in July of 1990, by Olin Ordnance. The report generated from that assessment identified the Monazite Sand Storage and Projectile Radiography operations. These operations were licensed by the Atomic Energy Commission [now the US Nuclear Regulatory Commission (NRC)]. Both licenses were terminated.

4.1.4 Radioactive materials (RAM) were known to be used or stored at four locations on RVAAP.

- Monazite Sand Storage Area
- Projectile Radiography on Load Line 3
- Building 2F4
- Building 130

4.1.4.1 The radiography sources were two 1,000 Ci and one 500 Ci Co-60 sealed sources. The sources were located on load line 3 in building 10A and were properly disposed. Records of surveys were not available for review so this area will be surveyed according to this plan. Other load lines reportedly

utilized industrial x-ray machines, however, this information has not been verified. Consequently a Final Status Survey for load lines 2&4 as well as load line 3 will be conducted.

4.1.4.2 The Monazite sand location and Buildings 2F4 and 130 are not addressed in this plan as directed by Mr. John Jent.

4.2 Chronology.

4.2.1 The USACELRB began preparations for the survey in August 2001.

4.2.2 USACELRB finalized the survey work plan on 8 August 2001; RADIATION FINAL STATUS SURVEY PLAN FOR LOADLINES 2,3&4, RAVENNA ARMY AMMUNITION PLANT, RAVENNA, OHIO, September 2001

4.2.3 On 11 September 2001 the USACELRB conducted the radiological surveys. USACENAB was unable to complete all QA surveys due to RVAAP site security procedures activated in response to the terrorists attacks on that day.

4.2.4 On 19-21 September 2001, USACENAB conducted additional QA survey activities to support the close-out of ammunition load lines 2,3 & 4.

4.2.5 The USACELRB received the QA results from USACENAB on 30 October 2001.

4.3 Site Conditions at time of Survey.

4.3.1 The load lines 2,3 & 4 AOC are abandoned facilities which have deteriorated due to a lack of maintenance over time. Temporary lighting was established so that appropriate work conditions existed.

4.3.2 Various building materials had crumbled from the walls and ceiling in the load lines.

4.3.3 Onsite support was available to the USACE team during the survey; excellent support was provided by Mr. Mark Patterson and the RVAAP security personnel.

4.3.4 An appropriate reference area in Building 1055 was selected (IAW MARSSIM and sampled prior to beginning surveys of the survey units.

4.4 Potential Contaminant. The potential radiological contaminant of concern at RVAAP Loadlines 2,3&4 is Cobalt 60 (Co-60). Co-60 has a 5.2 year half-life and decays by beta emission with a 1.173 MeV gamma.

4.4.1 Co-60 has a 5.2 year half-life and decays by beta emission with a 1.173 MeV gamma.

5. RADIATION SURVEYS and RESULTS.

5.1 Instruments/Equipment.

5.1.1 A list of instruments is provided in table 5-1.

Table 5-1. Instrumentation used during the RVAAP Survey.

Instrument (scalar)	Probe Model	Probe Type	Display (units)
Ludlum 2221	Ludlum 44-10	NaI 2x2 crystal	cpm
Ludlum 2221	Ludlum 44-9	Geiger-Mueller pancake	cpm
Ludlum 2929	Ludlum 43-10-1	NaI 2x2 crystal	cpm

5.1.2 All instruments met QA requirements of the FSSP.

5.1.3 The gamma probe used was a 2 inch x 2 inch sodium iodide crystal.

5.1.4 The sensitivity of the gamma survey meter is less than 1 uR/hr and correlates well with NUREG 1575, Table 6.7.

5.1.5 Operational instrument checks were performed with a NIST traceable Cesium-137 source. Checks were made at approximately 1 mm from the source. The same procedures were used for each check to assure reproducibility.

5.1.6 The beta instrument(Ludlum 2221, with 44-9 GM probe) was used to check personnel for contamination and to scan personnel out of the survey areas. This instrument response to a check source was checked daily prior to use.

5.2 INSTRUMENTATION SURVEYS. A suitable reference area for the environmental survey was located and instrument readings

were collected using the same methods used in the AOC. Reference areas were located outside the load lines on like materials being surveyed.

5.2.1 A gamma walkover scan was performed in each load line to identify potential elevated areas. The gamma rate survey was conducted using the NaI gamma instrument walkover scan of 100% of the area with the probe held within six inches of the surface.

5.2.2 Various elevated measurement locations were marked or consideration as sample points.

5.2.3 One minute integrated counts were also done at each sample location and randomly in each grid square. The 1-minute count was conducted in contact with the ground utilizing the gamma instrument and recorded in counts per minute (cpm).

5.2.4 Direct measurements were taken in areas of elevated activity relative to the survey area as determined by scan data.

5.2.5 Direct measurements were made at contact by one minute counts utilizing a Geiger-Mueller pancake probe.

5.2.6 Wipe samples were not collected since the total activity measurements were less than the removable DCGL ($1000 dpm/100 cm^2$) during all direct measurement surveys.

5.3 Sampling and Results Samples were collected in accordance with the sampling plan, result are as follows.

5.3.1 Load Line 2 survey results may be found in Appendix B

5.3.1.1 Both the basement and first floor floors of load line 2 NaI scan results indicated background levels of gamma measurements. Background for the survey was determined outside of the load line on similar building materials. NaI scan results ranged from 2,000 to 6,500 cpm for the load line 2 basement with background being 6,000 cpm. NaI scan results ranged from 4,800 to 12,000 cpm for the load line 2 first floor with background being 9,000 cpm.

5.3.1.2 The results of 10 static, one-minute NaI measurements on the basement floor and 23 measurements on the first floor, floor were consistent with the scan data.

5.3.1.3 A total of 33 direct beta measurements were collected in load line 2. Both the basement and first floor

floors of load line 2 direct beta measurement results indicated background levels of beta activity. Background for the survey was determined outside of the load line on similar building materials. Direct beta measurement results ranged from 18 cpm to 50 cpm for the load line 2 basement with background being 40 cpm. Direct beta measurement results ranged from 19 to 55 cpm for the load line 2 first floor with background being 40 cpm. Wipe samples were not collected since the total activity measurements were less than the removable DCGL (1000dpm/100cm^2).

5.3.2 Load Line 3 survey results may be found in Appendix C

5.3.2.1 The floor survey of load line 3 NaI scan results indicated background levels of gamma measurements. Background for the survey was determined outside of the load line on similar building materials. NaI scan results ranged from 3,400 to 16,000 cpm for load line 3 with background being 13,000 cpm.

5.3.2.2 The results of 32 static, one-minute NaI measurements on the floor were consistent with the scan data.

5.3.2.3 A total of 40 direct beta measurements were collected in load line 3. The floor surveys of load line 3 direct beta measurement results were comparable with background levels of beta activity. Background for the survey was determined outside of the load line on similar building materials. Direct beta measurement results ranged from 25 cpm to 60 cpm for the load line 3 with background being 50 cpm. Wipe samples were not collected since the total activity measurements were less than the removable DCGL (1000dpm/100cm^2).

5.3.3 Load Line 4 survey result may be found in Appendix D

5.3.3.1 The floor survey of load line 4 NaI scan results indicated background levels of gamma measurements. Background for the survey was determined outside of the load line on similar building materials. NaI scan results ranged from 3,000 to 9,300 cpm for load line 4 with background being 8,000 cpm.

5.3.3.2 The results of 41 static, one-minute NaI measurements on the floor were consistent with the scan data.

5.3.3.3 A total of 37 direct beta measurements were collected in load line 4. The floor surveys of load line 4 direct beta measurement results were comparable with background levels of beta activity. Background for the survey was determined outside of the load line on similar building

materials. Direct beta measurement results ranged from 25 cpm to 50 cpm for the load line 3 with background being 40 cpm. Wipe samples were not collected since the total activity measurements were less than the removable DCGL (1000dpm/100cm^2).

5.4 Survey Data Results.

5.4.1 Instrument Background Results. Background measurements from the reference area were taken for each monitoring instrument and method. The background values were consistent with expected values for the instruments and building materials. These background data are reported on each survey report.

5.4.2 All survey results were within expected background ranges for radioactivity and did not identify elevated contamination in load line 2.

5.4.2.1 The NaI scan and static survey results were within expected background ranges for gamma activity.

5.4.2.2 For the purpose of survey design very conservative Derived Concentration Guideline Levels (DCGL) were selected for Co-60. Actual site-specific, DCGLs were not established. USNRC Regulatory Guide 1.86 release values for Co-60 were utilized. The DCGL used for structures and equipment was 5000 dpm/100 cm^2 for total activity (DCGLw) and 1000 dpm/100 cm^2 for removable contamination. The total direct beta measurements reported beta activity less than 1000 dpm/100cm^2. This activity is well below the DCGL of 5000 dpm/100cm^2.

5.4.3 All survey results were within expected background ranges for radioactivity and did not identify elevated contamination in load line 3.

5.4.3.1 The NaI scan and static survey results were within expected background ranges for gamma activity and did not identify elevated contamination.

5.4.3.2 The total direct beta measurements reported beta activity less than 1000 dpm/100cm^2. This activity is well below the DCGL of 5000 dpm/100cm^2.

5.4.4 All survey results were within expected background ranges for radioactivity and did not identify elevated contamination in load line 4.

5.4.1 The NaI scan and static survey results were within expected background ranges for gamma activity and did not identify elevated contamination.

5.4.2 The total direct beta measurements reported beta activity less than 1000 dpm/100cm^2. This activity is well below the DCGL of 5000 dpm/100cm^2.

6. Historical Records Review.

6.1 The historical records available for review in regards to the final disposition of the three Co-60 sealed sources are provided in Appendix E.

6.1.1 A 29 November 1971 Radioactive Materials Movement (Shipment) record reports that on that date RVAAP shipped one 500 curie Co-60 source to Technical Operations, Inc. in Burlington, Massachusetts. Radiological surveys to meet Department of Transportation requirements were noted on the record.

6.1.2 A 9 March 1972 shipping document reports the request of shipment of two 1000 curie Co-60 sources. It appears that one Co-60 source was actually shipped to Technical Operations, Inc. in Burlington, Massachusetts. The shipping record notes that this shipment to be a “First Partial Shipment” which would indicate that a following shipment would be made for the second 1000 curie Co-60 source. No other documentation was available for review to determine the fate of the second 1000 curie Co-60 source.

6.1.3 A 25 July 1990 letter from Mr. H.R. Cooper of the Olin Ordinance, Ravenna Arsenal, Inc. to the US Environmental Protection Agency, Region 5 states that all three Co-60 sources were returned to the “licensed owner”.

6.1.4 No documentation of receipt of the shipments or Atomic Energy Commission license actions that would acknowledge the decommissioning of the Co-60 sources was available for review.

6.1.5 Based on the review of these documents it appears that the three Co-60 sources were returned to Technical Operations, Inc. in Burlington, Massachusetts. However, efforts are being taken to locate any additional pertinent information regarding the fate of the second 1,000-curie Co-60 source.

7. CONCLUSIONS.

7.1 A review of the survey results indicates that there is no detectable cobalt 60 contamination in the load lines.

7.2 Records exist that indicate that the three, sealed cobalt 60 sources were shipped off site in 1971 and 1972.

Craig R. Rieman
Chief, Environmental Health Section
Buffalo District Corps of Engineers

Appendix A

REFERENCES and ABBREVIATIONS

1. REFERENCES.

1.1 4 AR 385-11, 1 May 1980, Ionizing Radiation protection (Licensing, Control, Transportation, Disposal, and Radiation Safety).

1.2 ER and EM 385-1-80, 30 May 1997, Ionizing Radiation Protection, and Radiation Protection, USACE.

1.3 EM-385-1-1, 3 Sep 1996, Safety and Health Requirements Manual, USACE.

1.4 NUREG-1575, Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), August 2000.

1.5 TG 155, February 1993, Environmental Sampling Guide, US Army Environmental Hygiene Agency (USACHPPM).

1.6 Title 10, CFR, 1996 rev, Chapter I, Nuclear Regulatory Commission (USNRC).

1.7 USACESWT, Radiation Survey Plan, Radiation Final Status Survey Plan for Load Lines 2,3&4, Ravenna Army Ammunition Plant, Ravenna, OH, September 2001.

1.8 Preliminary Assessment for Ravenna Army Ammunition Plant, February 1996, by Science Applications International Corporation (SAIC).

1.9 Letter dated July 25, 1990, from Olin Ordnance, RVAAP, to USEPA, Subject: Request for information pursuant to section 104 (e) of CERCLA as amended for industrial landfill INC.

1.10 Regulation Guide 1.86, Termination of Operating Licenses for Nuclear Reactors, June 1974.

2. ABBREVIATIONS.

AOC	Areas of concern
bkg	background
BEC	Base Realignment and Closure Environmental Coordinator
BRAC	Base Realignment and Closure
cal	calibration
cm	centimeter
cm^2	square centimeter
cpm	counts per minute
Cs-137	Cesium-137
Co-60	Cobalt-60
DAC	Department of the Army Civilian
dpm	disintegrations per minute
$dpm/100cm^2$	disintegrations per minute per 100 square centimeters
eff	efficiency
g	gram
H-3	hydrogen-3 (tritium)
inst	instrument
IAW	In Accordance with
LLD	Lower Level of Detection
MACOM	major Army command
MDA	Minimum Detectable Activity
mCi	millicurie
NIST	National Institute of Standards and Technology
NRC	Nuclear Regulatory Commission
NUREG	Nuclear Regulatory Guide
pCi	picocurie
RVAAP	Ravenna Army Ammunition Plant
RCCCD	Radiologic, Classic and Clinical Chemistry Division
RPO	Radiation Protection Officer
SN	serial number
SOP	standing operating procedure
U-238	Uranium-238
USACE	United States Army Corps of Engineers
USACELRB	USACE, Buffalo District
USACENAB	USACE, Baltimore District
USAEHA	United States Army Environmental Hygiene Agency
USACHPPM	USA Center for Health Promotion & Preventive Medicine
uR/hr	microroentgen per hour
uCi	microcurie

Appendix B

Load Line 2 Survey Reports

FUSRAP Survey Cover Sheet

JA-RO-051-F1

1. General Information

Survey No: LL2 first floor 2x2 | Page: 1 of 1
Date: ## | Electronic File No.: LL2 first floor 2x2
Site: Ravenna
Tech(s): C. verelle

2. Item Surveyed

Ravenna Army Ammunition Plant Load Line #2 first floor

3. Release Limits

Radiological Contaminants: Co-60
Action Limits:Removable: NA | Total: NA
Other: 18K cpm
Ref: twice background

4. Survey BKG and Methods of Determination

9K cpm background determined by taking a 1 minute count on similar material outside of Load Line area

5. Survey Type/ Data Codes

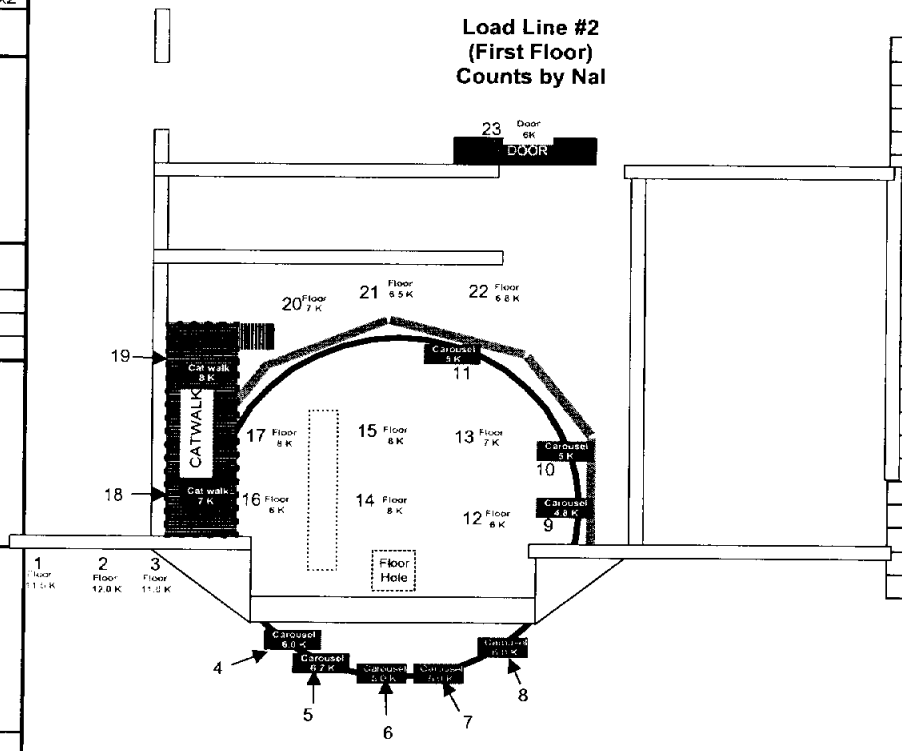
- [ ] Routine Surveys (HS-MISC)
- [ ] CH-SURV
- [ ] Uncontrolled Area
- [ ] RA-SURV
- [ ] Controlled Area
- [X] Other - Specify: Final Status Survey
- [ ] Equipment/Materials (HS-EQIP) Release to:

6 INSTRUMENTATION

#	Scaler W/ Detector	SN w/ SN	CAL DUE w/ CAL DUE
1	Ludlum 2221 / SPA-3	8498 / 8492	5/6/02 / 5/6/02
2			
3			
4			
5			

7. Survey Drawing/ Description/ Comments

Load Line #2 (First Floor) Counts by NaI



#	CPM
1	11.5K
2	12.0K
3	11.0K
4	6.0K
5	6.7K
6	5.0K
7	5.0K
8	6.0K
9	4.8K
10	5.0K
11	5.0K
12	6.0K
13	7.0K
14	8.0K
15	8.0K
16	6.0K
17	8.0K
18	7.0K
19	8.0K
20	7.0K
21	6.5K
22	6.8K
23	6.0K

Range: 4.8K to 12.0K

SSHR Review: Clint Verelle	Date: 9/11/2001
RSSS Review: Craig Rieman	Date: 9/13/2001

FUSRAP Survey Cover Sheet

JA-RO-051-F1

1. General Information

Survey No: LL2 first floor Page: 1 of 2

Date: ## Electronic File No.: LL2 first floor

Site/ WBS No.: Ravenna

Tech(s): C. Verelle

2. Item Surveyed

Ravenna Army Ammunition Plant
Load Line 2 first floor

3. Release Limits

Radiological Contaminants: Co-60

Action Limits:Removable: 1000 dpm/100 cm² Total: 5000 dpm/100²

Other: NA

Ref: Reg Guide 1.86

4. Survey BKG and Methods of Determination

Background 40 cpm determined by taking 1 minute count on similar material outside load line area

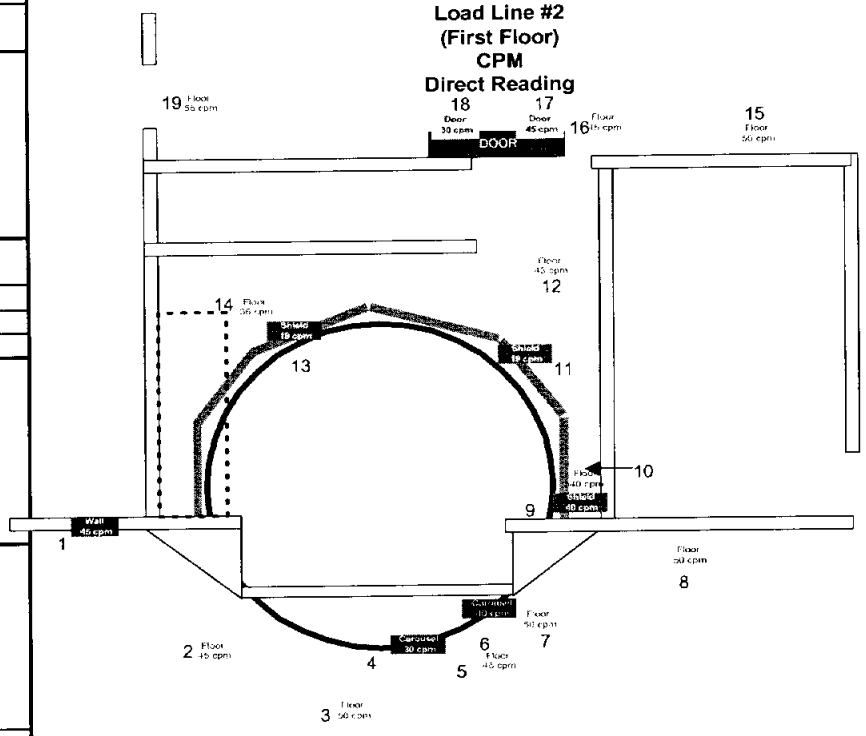
5. Survey Type/ Data Codes

- [ ] Routine Surveys (HS-MISC)
- [ ] CH-SURV
- [ ] Uncontrolled Area
- [ ] RA-SURV
- [ ] Controlled Area
- [X] Other - Specify: Final Status Survey
- [ ] Equipment/Materials (HS-EQIP) Release to:

6 INSTRUMENTATION

#	Scaler W/ Detector	SN w/ SN	CAL DUE w/ CAL DUE
1	Ludlum 2221 / 44-9	8490 / 8351	9/19/01 / 9/19/01
2			
3			
4			
5			

7. Survey Drawing/ Description/ Comments



#	CPM
1	45
2	45
3	50
4	30
5	45
6	40
7	50
8	50
9	40
10	40
11	19
12	43
13	19
14	36
15	50
16	45
17	45
18	30
19	55

Range: 19 - 55 cpm

SSHR Review:	Clint Verelle	Date:	9/11/2001
RSSS Review:	Craig Rieman	Date:	9/13/2001

FUSRAP Survey Data Sheet

Survey No. LL2 first floor Page 2 of 2

Date 9/11/2001 Site Ravenna

Surveyor(s): C. Verelle Count Rm NA

Comments: Load Line 2, first floor

Notes:

Instr. - Instrument
x = Corr. Coefficient
Yint = Y Intercept
E = eff = cpm/dpm
ACF = Area Correction Factor
t_B = Background Count Time
t_S = Sample Count Time
R_b = Bkgd count rate
**Bcpm = Background cpm = R_b

dose rt (urem) = Direct Reading Instr.
Gamma (cpm) = Direct Reading Instr.
corr u rem (u rem) =

Direct

Alpha (dpm) = (cpm - Bcpm)/(eff * ACF)
Beta (dpm) = (cpm - Bcpm)/(eff * ACF)

Removable

Alpha (dpm) = (cpm - Bcpm)/ eff
Beta (dpm) = (cpm - Bcpm)/ eff
* dpm readings are per 100cm²

	Parameters	dose rate	Gamma	Corr uR	Total Alpha		Total Beta-Gamma		Removable Alpha		Removable Beta-Gamma	
	Instr.						L2221 / 44-9					
	x											
	Yint											
	E						0.107					
BKG	Bcpm		*				40					
	ACF						0.155					
	t_B						1					
	t_S						1					
	L_c						887.15					
	MDC						1955.18					

No.	Descriptions	x	y	z	urem/uR	cpm	uR	cpm	*dpm	cpm	*dpm	cpm	*dpm	cpm	*dpm
1	See map									45	301.48				
2	See map									45	301.48				
3	See map									50	602.95				
4	See map									30	-602.95				
5	See map									45	301.48				
6	See map									40	0.00				
7	See map									50	602.95				
8	See map									50	602.95				
9	See map									40	0.00				
10	See map									40	0.00				
11	See map									19	-1266.20				
12	See map									43	180.89				
13	See map									19	-1266.20				
14	See map									36	-241.18				
15	See map									50	602.95				
16	See map									45	301.48				
17	See map									45	301.48				
18	See map									30	-602.95				
19	See map									55	904.43				

$$L_c = \frac{1.645\sqrt{R_b \cdot t_S(1 + t_S / t_B)}}{E * t_S * ACF}$$

$$MDC = \frac{3 + 3.29\sqrt{R_b \cdot t_S(1 + t_S / t_B)}}{E * t_S * ACF}$$

PROJECT HP: _____ (INI) RSO: _____ (INI)

FUSRAP Survey Cover Sheet

JA-RO-051-F1

1. General Information

Survey No: LL2 basement 2x2 Page: 1 of 1
Date: ## Electronic File No.: LL2 basement 2x2
Site: Ravenna
Tech(s): C. verelle

2. Item Surveyed

Ravenna Army Ammunition Plant Load Line #2 basement

3. Release Limits

Radiological Contaminants: Co-60
Action Limits:Removable: NA Total: NA
Other: 12K cpm
Ref: twice background

4. Survey BKG and Methods of Determination

6K cpm background determined by taking a 1 minute count on similar material outside of Load Line area

5. Survey Type/ Data Codes

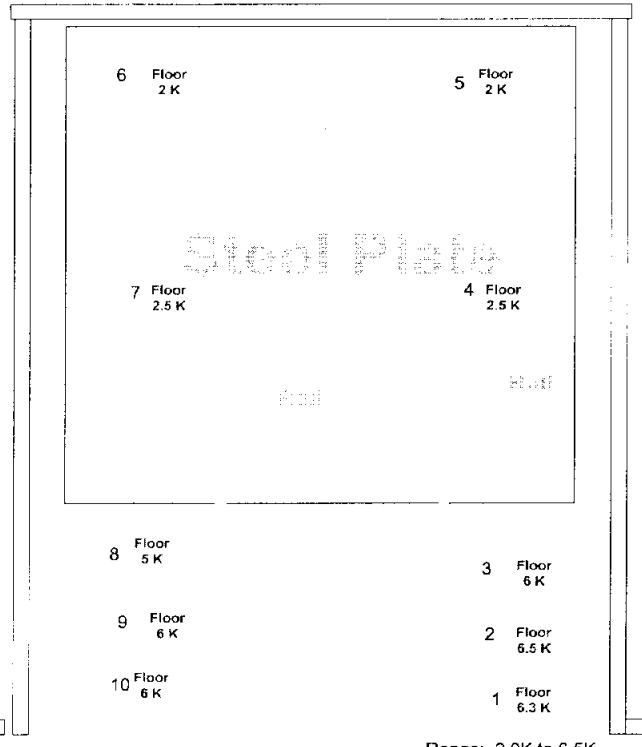
- [ ] Routine Surveys (HS-MISC)
- [ ] CH-SURV
- [ ] Uncontrolled Area
- [ ] RA-SURV
- [ ] Controlled Area
- [x] Other - Specify: Final status Survey
- [ ] Equipment/Materials (HS-EQIP) Release to:

6 INSTRUMENTATION

#	Scaler W/ Detector	SN w/ SN	CAL DUE w/ CAL DUE
1	Ludlum 2221 / SPA-3	8498 / 8492	5/6/02 / 5/6/02
2			
3			
4			
5			

7. Survey Drawing/ Description/ Comments

Load Line #2
BASEMENT
Counts by NaI



#	CPM
1	6.3K
2	6.5K
3	6.0K
4	2.5K
5	2.0K
6	2.0K
7	2.5K
8	5K
9	6K
10	6K

Range: 2.0K to 6.5K

SSHR Review: Clint Verelle Date: 9/11/2001

RSSS Review: Craig Rieman Date: 9/13/2001

FUSRAP Survey Cover Sheet

JA-RO-051-F1

1. General Information

Survey No: LL2 basement — Page: 1 of 2
Date: ## — Electronic File No.: LL2 basement
Site: Ravenna
Tech(s): C. Verelle

2. Item Surveyed

Ravenna Army Ammunition Plant

Load Line #2 basement

3. Release Limits

Radiological Contaminants: Co-60
Action Limits:Removable: 1000 dpm/100 cm^2 Total: 5000 dpm/100 cm^2
Other: NA
Ref: Reg Guide 1.86

4. Survey BKG and Methods of Determination

40 cpm background determined by taking a 1 minute count on similar material outside Load Line area.

5. Survey Type/ Data Codes

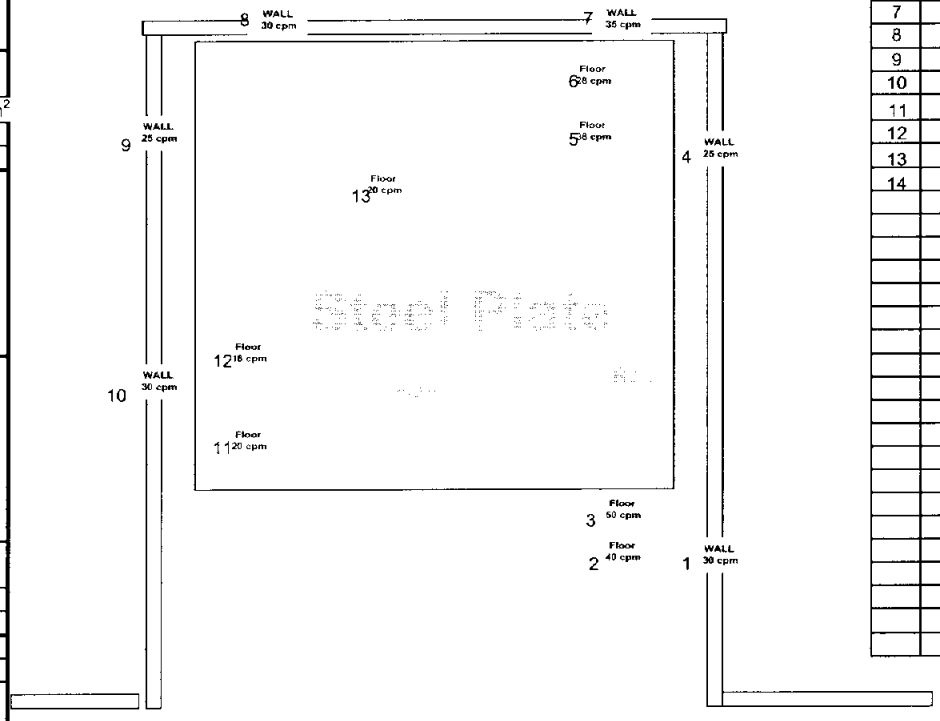
- [ ] Routine Surveys (HS-MISC)
- [ ] CH-SURV
- [ ] Uncontrolled Area
- [ ] RA-SURV
- [ ] Controlled Area
- [x] Other - Specify: Final Status Survey
- [ ] Equipment/Materials (HS-EQIP) Release to:

6 INSTRUMENTATION

#	Scaler W/ Detector	SN w/ SN	CAL DUE w/ CAL DUE
1	Ludlum 2221 / 44-9	8490 / 8351	9/19/01 / 9/19/01
2			
3			
4			
5			

7. Survey Drawing/ Description/ Comments

Load Line #2
BASEMENT
CPM
Direct Reading



#	CPM
1	30
2	40
3	50
4	25
5	38
6	28
7	35
8	30
9	25
10	30
11	20
12	18
13	20
14	30

SSHR Review: Clint Verelle — Date: 9/11/2001
RSSS Review: Craig Rieman — Date: 9/13/2001

Survey No. LL2 basement Page 2 of 2

Date 9/11/2001 Site Ravenna

Surveyor(s): C. Verelle Count Rm NA

Comments: Load Line #2 basement

Notes:

Instr. - Instrument
x = Corr. Coefficient
Yint = Y Intercept
E = eff = cpm/dpm
ACF = Area Correction Factor
t_B = Background Count Time
t_S = Sample Count Time
R_b = Bkgd count rate
**Bcpm = Background cpm = R_b

dose r: (urem) = Direct Reading instr
Gamma (cpm) = Direct Reading instr.
corr urem (urem)

Direct

Alpha (dpm) = (cpm - Bcpm)/(eff * ACF)
Beta (dpm) = (cpm - Bcpm)/(eff * ACF)

Removable

Alpha (dpm) = (cpm - Bcpm)/ eff
Beta (dpm) = (cpm - Bcpm)/ eff
* dpm readings are per 100cm²

	Parameters	dose rate	Gamma	Corr uR	Total Alpha		Total Beta-Gamma	Removable Alpha	Removable Beta-Gamma
	Instr.						L2221/ 44-9		
	x								
	Yint								
	E						0.107		
BKG	Bcpm		*				40		
	ACF						0.155		
	t_B						1		
	t_S						1		
	L_c						887.15		
	MDC						1955.18		

No.	Descriptions	x	y	z	urem/uR	cpm	uR	Total cpm	Total *dpm	Total cpm	Total *dpm	Removable cpm	Removable *dpm	Removable cpm	Removable *dpm
1	See map									30	-602.95				
2	See map									40	0.00				
3	See map									50	602.95				
4	See map									25	-904.43				
5	See map									38	-120.59				
6	See map									28	-723.55				
7	See map									35	-301.48				
8	See map									30	-602.95				
9	See map									25	-904.43				
10	See map									30	-602.95				
11	See map									20	-1205.91				
12	See map									18	-1326.50				
13	See map									20	-1205.91				
14										30	-602.95				
15															
16															
17															
18															
19															

$$L_c = \frac{1.645\sqrt{R_b \cdot t_S(1 + t_S / t_B)}}{E * t_S * ACF}$$

$$MDC = \frac{3 + 3.29\sqrt{R_b \cdot t_S(1 + t_S / t_B)}}{E * t_S * ACF}$$

PROJECT HP: _____ (INI) RSO: _____ (INI)

Appendix C

Load Line 3 Survey Reports

FUSRAP Survey Cover Sheet

JA-RO-051-F1

1. General Information

Survey No: LL3 2x2 Page: 1 of 1
Date: 9/11/2001 Electronic File No.: LL3 2x2
Site: Ravenna
Tech(s): C. Verelle

2. Item Surveyed

Ravenna Army Ammunition Plant Load Line #3

3. Release Limits

Radiological Contaminants: Co-60
Action Limits:Removable: NA Total: NA
Other: 26K cpm
Ref: twice background

4. Survey BKG and Methods of Determination

13K cpm background determined by taking a 1 minute count on similar material outside of Load Line area

5. Survey Type/ Data Codes

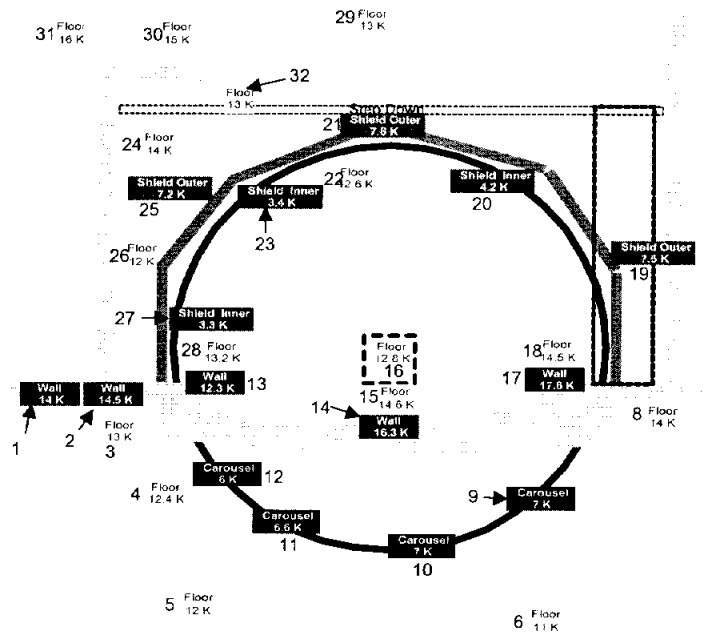
- [ ] Routine Surveys (HS-MISC)
- [ ] CH-SURV
- [ ] Uncontrolled Area
- [ ] RA-SURV
- [ ] Controlled Area
- [X] Other - Specify:
- [ ] Equipment/Materials (HS-EQIP) Release to:

6 INSTRUMENTATION

#	Scaler W/ Detector	SN w/ SN	CAL DUE w/ CAL DUE
1	Ludlum 2221 /SPA-3	8498 / 8492	5/6/02 / 5/6/02
2			
3			
4			
5			

7. Survey Drawing/ Description/ Comments

Load Line #3
Counts by NaI



#	CPM
1	14K
2	14.5K
3	13K
4	12.4K
5	12K
6	11K
7	13K
8	14K
9	7K
10	7K
11	6.6K
12	6K
13	12.3K
14	16.3K
15	14.6K
16	12.8K
17	17.6K
18	14.5K
19	7.5K
20	4.2K
21	7.6K
22	12.6K
23	3.4K
24	14K
25	7.2K
26	12K
27	3.3K
28	13.2K
29	13K
30	15K
31	16K
32	13K

Range: 3.4K to 16k

SSHR Review: Clint Verelle	Date: 9/11/2001
RSSS Review: Craig Rieman	Date: 9/13/2001

FUSRAP Survey Cover Sheet

JA-RO-051-F1

1. General Information

Survey No: LL3 Page: 1 of 4

Date: ## Electronic File No.: LL3

Site: Ravenna

Tech(s): C. Verelle

2. Item Surveyed

Ravenna Army Ammunition Plant Load Line #3

3. Release Limits

Radiological Contaminants: Co-60

Action Limits Removable: !000 dpm/100 cm^2 Total: 5000 dpm/100 cm^2

Other: NA

Ref: Reg Guide 1.86

4. Survey BKG and Methods of Determination

50 cpm background determined by taking a 1 minute count on similar material outside load line area

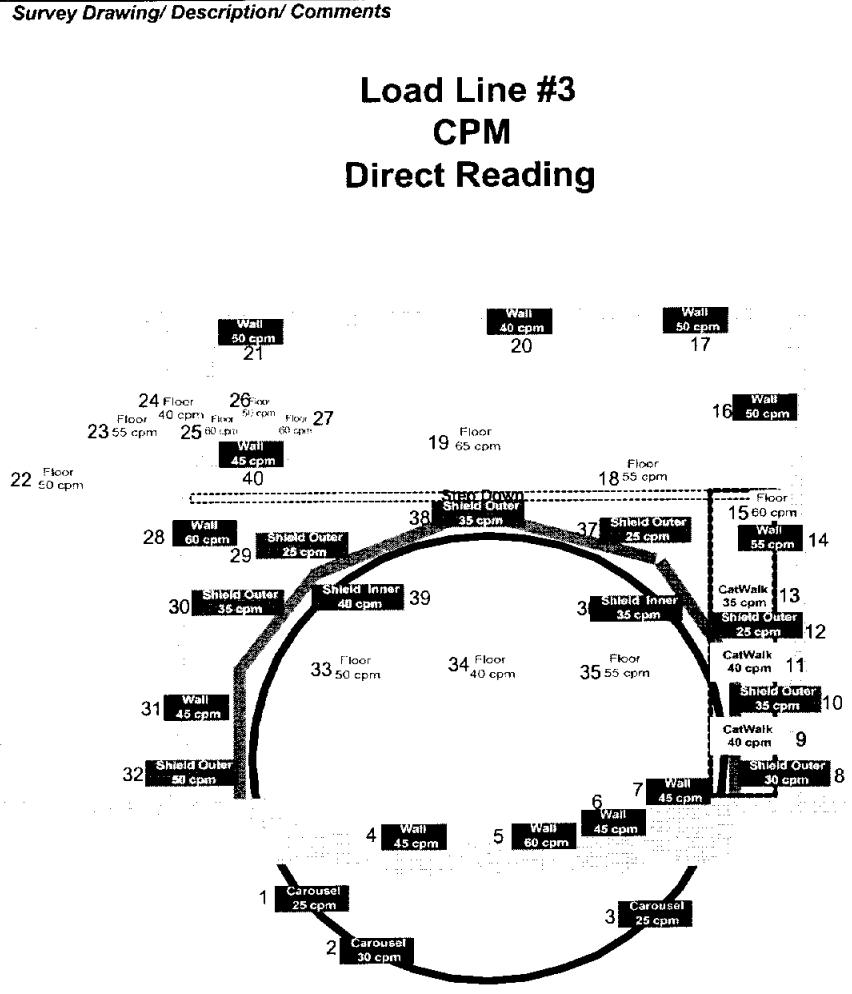
5. Survey Type/ Data Codes

- [ ] Routine Surveys (HS-MISC)
- [ ] CH-SURV
- [ ] Uncontrolled Area
- [ ] RA-SURV
- [ ] Controlled Area
- [X] Other - Specify: Final Status Survey
- [ ] Equipment/Materials (HS-EQIP) Release to:

6 INSTRUMENTATION

#	Scaler W/ Detector	SN w/ SN	CAL DUE w/ CAL DUE
1	Ludlum 2221 / 44-9	8490 / 8351	9/19/01 / 9/19/01
2			
3			
4			
5			

7. Survey Drawing/ Description/ Comments



#	CPM
1	25
2	30
3	25
4	45
5	60
6	45
7	45
8	30
9	40
10	35
11	40
12	25
13	35
14	55
15	60
16	50
17	50
18	55
19	65
20	40
21	50
22	50
23	50
24	40
25	60
26	60
27	60
28	60
29	25
30	35
31	45
32	50
33	50
34	40
35	55
36	35
37	25
38	35
39	40
40	45
20D	42

SSHR Review: Clint Verelle Date: 9/11/2001

RSSS Review: Craig Rieman Date: 9/13/2001

FUSRAP Survey Data Sheet

Survey No. LL3 Page 2 of 4

Date 9/11/2001 Site Ravenna

Surveyor(s): C. Verelle Count Rm NA

Comments: Load Lime #3

Notes:

Instr. - Instrument
x = Corr. Coefficient
Yint = Y intercept
E = eff = cpm/dpm
ACF = Area Correction Factor
t_B = Background Count Time
t_S = Sample Count Time
R_0 = Bkgd count rate
**Bcpm = Background cpm = R_b

dose rt (urem) = Direct Reading Instr.
Gamma (cpm) = Direct Reading Instr.
corr urem (urem) :

Direct
Alpha (dpm) = (cpm - Bcpm)/(eff * ACF)
Beta (dpm) = (cpm - Bcpm)/(eff * ACF)

Removable
Alpha (dpm) = (cpm - Bcpm)/ eff
Beta (dpm) = (cpm - Bcpm)/ eff

* dpm readings are per 100cm²

	Parameters	dose rate	Gamma	Corr uR	Total Alpha		Total Beta-Gamma		Removable Alpha		Removable Beta-Gamma	
	Instr.						L2221 / 44-9					
	x											
	Yint											
	E						0.107					
BKG	Bcpm		*				50					
	ACF						0.155					
	t_B						1					
	t_S						1					
	L_c						991.86					
	MDC						2164.61					

No.	Descriptions	x	y	z	urem/uR	cpm	uR	cpm	*dpm	cpm	*dpm	cpm	*dpm	cpm	*dpm
1	See map									25	-1507.39				
2										30	-1205.91				
3										25	-1507.39				
4										45	-301.48				
5										60	602.95				
6										45	-301.48				
7										45	-301.48				
8										30	-1205.91				
9										40	-602.95				
10										35	-904.43				
11										40	-602.95				
12										25	-1507.39				
13										35	-904.43				
14										55	301.48				
15										60	602.95				
16										50	0.00				
17										50	0.00				
18										55	301.48				
19										65	904.43				

$$L_c = \frac{1.645\sqrt{R_b \cdot t_S(1 + t_S / t_B)}}{E * t_S * ACF}$$

$$MDC = \frac{3 + 3.29\sqrt{R_b \cdot t_S(1 + t_S / t_B)}}{E * t_S * ACF}$$

PROJECT HP: _____ (INI) RSO: _____ (INI)

FUSRAP Survey Data Sheet

Survey No. LL3 Page 3 of 4

Date 9/11/2001 Site Ravenna

Surveyor(s): C. Verelle Count Rm NA

Comments: Load Line #3

Notes:

Instr. = Instrument

x = Corr. Coefficient

Yint = Y Intercept

E = eff = cpm/dpm

ACF = Area Correction Factor

t_B = Background Count Time

t_S = Sample Count Time

R_b = Bkgd count rate

**Bcpm = Background cpm = R_b

dose rt (urem) = Direct Reading Instr.

Gamma (cpm) = Direct Reading Instr

corr u'rem (urem)

Direct

Alpha (dpm) = (cpm - Bcpm)/(eff * ACF)

Beta (dpm) = (cpm - Bcpm)/(eff * ACF)

Removable

Alpha (dpm) = (cpm - Bcpm)/ eff

Beta (dpm) = (cpm - Bcpm)/ eff

* dpm readings are per 100cm²

	Parameters	dose rate	Gamma	Corr uR	Total Alpha		Total Beta-Gamma		Removable Alpha		Removable Beta-Gamma	
	Instr.						L2221 / 44-9					
	x											
	Yint											
	E						0.107					
BKG	Bcpm						50					
	ACF						0.155					
	t_B						1					
	t_S						1					
	L_c						991.86					
	MDC						2154.61					

No.	Descriptions	x	y	z	urem/uR	cpm	uR	cpm	*dpm	cpm	*dpm	cpm	*dpm	cpm	*dpm
20	See map									40	-602.95				
21										50	0.00				
22										50	0.00				
23										50	0.00				
24										40	-602.95				
25										60	602.95				
26										60	602.95				
27										60	602.95				
28										60	602.95				
29										25	-1507.39				
30										35	-904.43				
31										45	-301.48				
32										50	0.00				
33										50	0.00				
34										40	-602.95				
35										55	301.48				
36										35	-904.43				
37										25	-1507.39				
38										35	-904.43				

$$L_c = \frac{1.645\sqrt{R_b \cdot t_s(1 + ts/tB)}}{E * ts * ACF}$$

$$MDC = \frac{3 + 3.29\sqrt{R_b \cdot t_s(1 + ts/tB)}}{E * ts * ACF}$$

PROJECT HP: _____ (INI) RSO: _____ (INI)

FUSRAP Survey Data Sheet

Survey No.	LL3	Page 4	of 4	Comments: Load Line #3	
Date	9/11/2001	Site	Ravenna		
Surveyor(s):	C. Varelle	Count Rm	NA		

Notes:

Instr. - Instrument
x = Corr. Coefficient
Yint = Y Intercept
E = eff = cpm/dpm
ACF = Area Correction Factor
t_B = Background Count Time
t_S = Sample Count Time
R_b = Bkgd count rate
**Bcpm = Background cpm = R_b

dose rt (urem) = Direct Reading Instr.
Gamma (cptm) = Direct Reading Instr.
corr u rem (urem) :

Direct

Alpha (dpm) = (cpm - Bcpm)/(eff * ACF)
Beta (dpm) = (cpm - Bcpm)/(eff * ACF)

Removable

Alpha (dpm) = (cpm - Bcpm)/ eff
Beta (dpm) = (cpm - Bcpm)/ eff
* dpm readings are per 100cm²

Parameters	dose rate	Gamma	Corr uR	Total Alpha	Total Beta-Gamma	Removable Alpha	Removable Beta-Gamma
Instr.					L2221 / 44-9		
x							
Yint							
E					0.107		
BKG Bcpm		*			50		
ACF					0.155		
t_B					1		
t_S					1		
L_c					991.86		
MDC					2164.61		

No	Descriptions	x	y	r	urem/uR	cpm	uR	Total Alpha cpm	Total Alpha *dpm	Total Beta-Gamma cpm	Total Beta-Gamma *dpm	Removable Alpha cpm	Removable Alpha *dpm	Removable Beta-Gamma cpm	Removable Beta-Gamma *dpm
39	See map									40	-602.95				
40										45	-301.48				
20D										42	-482.36				

$$L_c = \frac{1.645\sqrt{R_b \cdot t_s(1 + ts/tB)}}{E * ts * ACF}$$

$$MDC = \frac{3 + 3.29\sqrt{R_b \cdot t_s(1 + ts/tB)}}{E * ts * ACF}$$

PROJECT HP: _____ (INI) RSO: _____ (INI)

Appendix D

Load Line 4 Survey Reports

FUSRAP Survey Cover Sheet

JA-RO-051-F1

1. General Information

Survey No LL 4 2x2 — Page 1 of 1
Date ## — Electronic File No. LL 2 2x2
Site: Ravenna
Tech(s): C. Verelle

2. Item Surveyed

Ravenna Army Amminution Plant Load Line #4

3. Release Limits

Radiological Contaminants: Co-60
Action Limits:Removable: NA — Total: NA
Other: 16K cpm
Ref: twice background

4. Survey BKG and Methods of Determination

8K cpm background determined by taking a 1 minute count on similar material outside Load Line area

5. Survey Type/ Data Codes

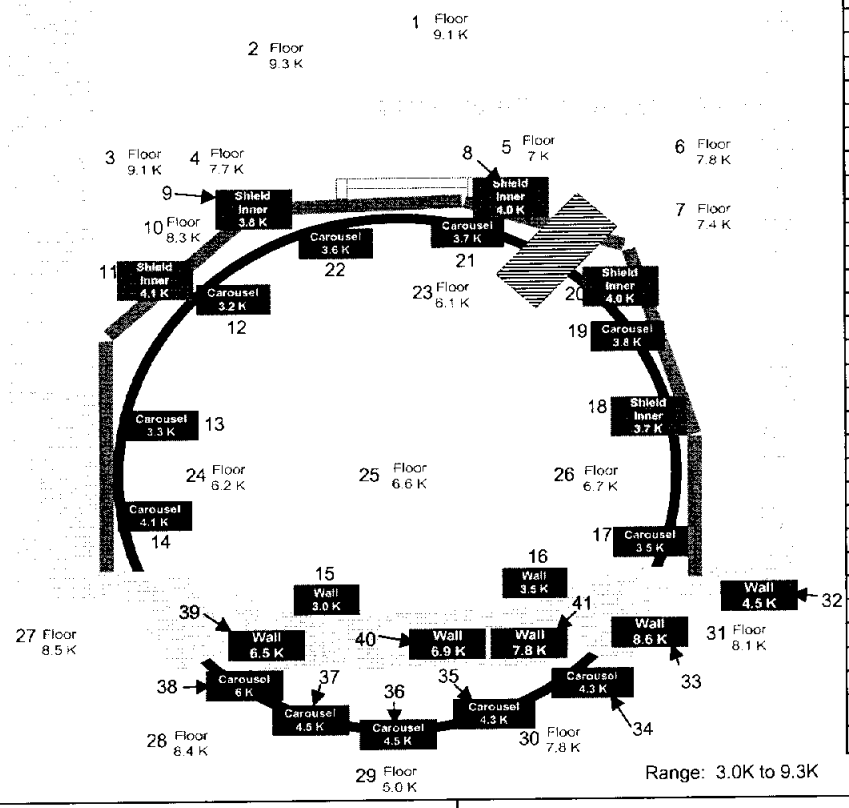
- [ ] Routine Surveys (HS-MISC)
- [ ] CH-SURV
- [ ] Uncontrolled Area
- [ ] RA-SURV
- [ ] Controlled Area
- [X] Other - Specify: Final status Survey
- [ ] Equipment/Materials (HS-EQIP) Release to:

6 INSTRUMENTATION

#	Scaler W/ Detector	SN w/ SN	CAL DUE w/ CAL DUE
1	Ludlum 2221 / SPA-3	8498 / 8492	5/6/02 / 5/6/02
2			
3			
4			
5			

7. Survey Drawing/ Description/ Comments

Load Line #4
Counts by NaI



Range: 3.0K to 9.3K

#	CPM
1	9.1K
2	9.3K
3	9.1K
4	7.7K
5	7.0K
6	7.8K
7	7.4K
8	4.0K
9	3.8K
10	8.3K
11	4.1K
12	3.2K
13	3.3K
14	4.1K
15	3.0K
16	3.5K
17	3.5K
18	3.7K
19	3.8K
20	4.0K
21	3.7K
22	3.6K
23	6.1K
24	6.2K
25	6.6K
26	6.7K
27	8.5K
28	8.4K
29	5.0K
30	7.8K
31	8.1K
32	4.5K
33	8.6K
34	4.3K
35	4.3K
36	4.5K
37	4.5K
38	6.0K
39	6.5K
40	6.9K
41	7.8K

SSHR Review: Clint Verelle — Date: 9/11/2001
RSSS Review: Craig Rieman — Date: 9/13/2001

FUSRAP Survey Cover Sheet

JA-RO-051-F1

1. General Information

Survey No LL4 Page 1 of 3

Date ## Electronic File No. LL4

Site: Ravenna

Tech(s): C. Verelle

2. Item Surveyed

Ravenna Army Ammunition Plant Load Line #4

3. Release Limits

Radiological Contaminants: Co-60

Action Limits:Removable: 1000 dpm/100 cm^2 Total: 5000 dpm/100 cm^2

Other: NA

Ref: Reg Guide 1.86

4. Survey BKG and Methods of Determination

40 cpm background based on 1 minute count on similar material outside Load Line area

5. Survey Type/ Data Codes

☐ Routine Surveys (HS-MISC) ☐ CH-SURV

☐ Uncontrolled Area ☐ RA-SURV

☐ Controlled Area

☒ Other - Specify: Final Status Survey

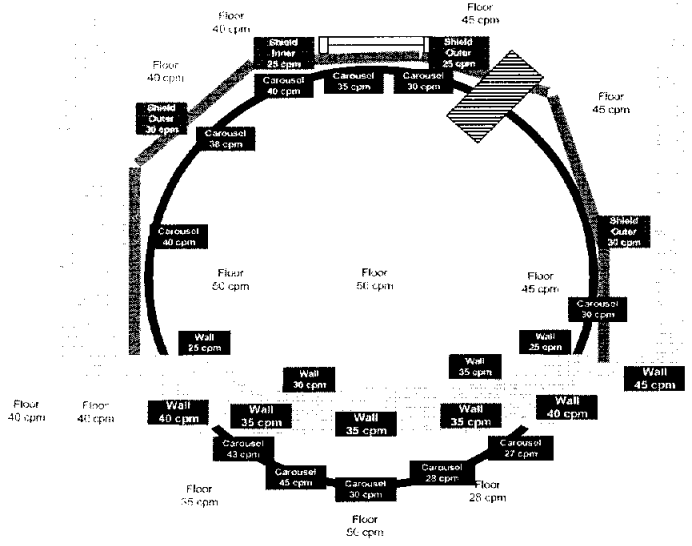
☐ Equipment/Materials (HS-EQIP) Release to:

6 INSTRUMENTATION

#	Scaler W/ Detector	SN w/ SN	CAL DUE w/ CAL DUE
1	L2221 / 44-9	8490 / 8357	9/19/01 / 9/19/01
2			
3			
4			
5			

7. Survey Drawing/ Description/ Comments

Load Line #4
CPM
Direct Reading



#	CPM
1	40
2	40
3	35
4	50
5	28
6	45
7	40
8	27
9	29
10	30
11	45
12	43
13	40
14	35
15	35
16	35
17	30
18	30
19	25
20	35
21	30
22	25
23	40
24	38
25	40
26	35
27	30
28	50
29	50
30	45
31	45
32	45
33	40
34	40
35	30
36	25
37	25
20D	37

SSHR Review: Clint Verelle Date: 9/11/2001

RSSS Review: Craig Rieman Date: 9/13/2001

FUSRAP Survey Data Sheet

Survey No. LL4 Page 2 of 3

Date 9/11/2001 Site Ravenna

Surveyor(s): C. Verelle Count Rm NA

Comments: Load Line 4

Notes:

Instr. - Instrument

x = Corr. Coefficient

Yint = Y Intercept

E = eff = cpm/dpm

ACF = Area Correction Factor

t_B = Background Count Time

t_S = Sample Count Time

R_b = Bkgd count rate

*Bcpm = Background cpm = R_b

dose rt (urem) = Direct Reading Instr.

Gamma (cpm) = Direct Reading Instr.

corr u rem (u rem)

Direct

Alpha (dpm) = (cpm - Bcpm)/(eff * ACF)

Beta (dpm) = (cpm - Bcpm)/(eff * ACF)

Removable

Alpha (dpm) = (cpm - Bcpm)/ eff

Beta (dpm) = (cpm - Bcpm)/ eff

* dpm readings are per 100cm^2

	Parameters	dose rate	Gamma	Corr uR	Total Alpha		Total Beta-Gamma		Removable Alpha		Removable Beta-Gamma	
	Instr.						L2221 / 44-9					
	x											
	Yint											
	E						0.107					
BKG	Bcpm		*				40					
	ACF						0.155					
	t_B						1					
	t_S						1					
	L_c						887.15					
	MDC						1955.18					

No.	Descriptions	x	y	z	urem/uR	cpm	uR	cpm	*dpm	cpm	*dpm	cpm	*dpm	cpm	*dpm
1	See map									40	0.00				
2										40	0.00				
3										35	-301.48				
4										50	602.95				
5										28	-723.55				
6										45	301.48				
7										40	0.00				
8										27	-783.84				
9										28	-723.55				
10										30	-602.95				
11										45	301.48				
12										43	180.89				
13										40	0.00				
14										35	-301.48				
15										35	-301.48				
16										35	-301.48				
17										30	-602.95				
18										30	-602.95				
19										25	-904.43				

$$L_c = \frac{1.645\sqrt{R_b \cdot t_S(1 + t_S / t_B)}}{E * t_S * ACF}$$

$$MDC = \frac{3 + 3.29\sqrt{R_b \cdot t_S(1 + t_S / t_B)}}{E * t_S * ACF}$$

PROJECT HP: _____ (INI) RSO: _____ (INI)

FUSRAP Survey Data Sheet

Survey No.	LL4	Page 3	of 3	Comments: Load Line 4	
Date	9/11/2001	Site	Ravenna		
Surveyor(s):	C. Verelle	Count Rm	NA		

Notes:

Instr. - Instrument
x = Corr. Coefficient
Yint = Y Intercept
E = eff = cpm/dpm
ACF = Area Correction Factor
t_B = Background Count Time
t_S = Sample Count Time
R_b = Bkgd count rate
**Bcpm = Background cpm = R_b

dose rt (u rem) = Direct Reading Instr.
Gamma (cpm) = Direct Reading Instr.
corr u rem (u rem) =

Direct

Alpha (dpm) = (cpm - Bcpm)/(eff * ACF)
Beta (dpm) = (cpm - Bcpm)/(eff * ACF)

Removable

Alpha (dpm) = (cpm - Bcpm)/ eff
Beta (dpm) = (cpm - Bcpm)/ eff
* dpm readings are per 100cm²

	Parameters	dose rate	Gamma	Corr uR	Total Alpha	Total Beta-Gamma	Removable Alpha	Removable Beta-Gamma
	Instr.					L2221 / 44-9		
	x							
	Yint							
	E					0.107		
BKG	*Bcpm*		*			40		
	ACF					0.155		
	t_B					1		
	t_S					1		
	L_c					887.15		
	MDC					1955.18		

No.	Descriptions	x	y	r	urem/uR	cpm	uR	Total cpm	Total *dpm	Total cpm	Total *dpm	Removable cpm	Removable *dpm	Removable cpm	Removable *dpm
20	See map									35	-301.48				
21										30	-602.95				
22										25	-904.43				
23										40	0.00				
24										38	-120.59				
25										40	0.00				
26										35	-301.48				
27										30	-602.95				
28										50	602.95				
29										50	602.95				
30										45	301.48				
31										45	301.48				
32										45	301.48				
33										40	0.00				
34										40	0.00				
35										30	-602.95				
36										25	-904.43				
37										25	-904.43				
20D										37	-180.89				

$$L_c = \frac{1.645\sqrt{R_b \cdot t_S(1 + t_S / t_B)}}{E * t_S * ACF}$$

$$MDC = \frac{3 + 3.29\sqrt{R_b \cdot t_S(1 + t_S / t_B)}}{E * t_S * ACF}$$

PROJECT HP: _____ (INI) RSO: _____ (INI)

Appendix E

Historical Records

Olin
ORDNANCE

RAVENNA ARSENAL, INC.
8451 STATE ROUTE 5, RAVENNA, OHIO 44266-9297
TELEPHONE: (216) 358-7111 • FAX: (216) 297-3216

July 25, 1990

THRU: Contracting Officer's Representative
Ravenna Army Ammunition Plant
8451 State Route 5
Ravenna, Ohio 44266-9297

TO: U. S. Environmental Protection Agency
Region 5
ATTN: 5HS - 11 (Mr. David Meyer)
230 S. Dearborn Street
Chicago, IL 60604

Subject: Request For Information Pursuant to Section 104 (e) of CERCLA As Amended For Industrial Landfill, Inc.
(Ref. USEPA's 21 June 1990 Letter to Ravenna Army Ammunition Plant, Same Subject as Above)

Dear Mr. Meyer,

As requested by the reference USEPA letter, the Ravenna Army Ammunition Plant (RVAAP) has researched its historical use of radiological materials. There's record of two periods in which radiological materials have been stored and/or used at RVAAP.

The utilized material were two (ea.) units of 1,000 Curies, Cobalt 60, solid radiographic source and one (ea.) unit of 500 Curies, Cobalt 60, solid radiographic source. These three radiographic sources were used from 1969 to 1972 for quality assurance processes to determine uniformity of solidified explosive following melt pour into military projectiles. These cobalt sources were returned to the licensed lender/owner following their discontinued use at RVAAP. All actions that transpired regarding this lend-use agreement were oversighted by the then known Atomic Energy Commission (AEC). Attachment #1 delineates return of these active sources to the licensed owner.

The other radiological material that existed at RVAAP was monazite ore. The ore was a low-specific-activity material that generated a radiological characteristic by naturally contained thorium. The thorium constituent was identified as being less that 10% of the monazite ore compound. The ore was under ownership by Federal Supply Service, Property Management Division of the General Services Administration (GSA) that had leased above ground tank (fully enclosed) space at RVAAP. The exact time of the ore's

emplacement within the RVAAP confines is uncertain due to installation records being destroyed; it can only be approximated. that the ore had arrived at RVAAP sometime in the late 1950's or early 1960's. In June 1974 the monazite ore was removed from RVAAP and exported to Rotterdam, Holland under an AEC licensed transaction. Following the ore's removal, processes were undertaken to decontaminate the storage tanks and affected ground surface area probably contaminated with the ore's fines during the loading operation. All collected contaminants were identified as being transported to an AEC approved burial location in Kentucky. RVAAP made a diligent effort to make personal contact with respective personnel of GSA and the service organization involved with the decontamination process; with the objective to confirm the subject activity and pinpoint the exact location of the disposal site. No personal contacts were able to be completed due to disbandment of the specified agency within GSA; GSA records were lost due to the agency's policy to destroy documents of completed transactions that are seven years or older; and the vendor performing the decontamination has since gone out of business without any traceability to the whereabouts of employees and company records. RVAAP terminated any further efforts in obtaining additional information on the subject. Attachment #2 provides all available historical records associated to the monazite ore.

RVAAP's point of contact for further discussion or request regarding any of the above subject matter will be Mr. Thomas M. Chanda, Environmental Engineer, at phone 216-297-3221.

Sincerely,

RAVENNA ARSENAL, INC.

H. R. Cooper
Plant Engineer

TMC/wt/tc90056

Attachment

cf: AMCCOM
ATTN: AMSMC-ISE-M (Capt. Michael Leggieri)

cc: N. Wulff
G. Wolfgang
T. Chanda
File

RADIOACTIVE MATERIALS MOVEMENT

[X] SHIPMENT [ ] RECEIPT

For use of this form, see AR 55-55; the proponent agency is Office of the Deputy Chief of Staff for Logistics.

(See instructions on reverse.)

DETAILS OF SHIPMENT

1. TO: (Include ZIP Code)	2. FROM: (Include ZIP Code)
Technical Operations, Inc. Radiation Products Division Northwest Industrial Park Burlington, Massachusetts	Ravenna Arsenal, Inc. AEC Lic. 34-13013-02 Ravenna Army Ammunition Plant Ravenna, Ohio 44266

3. SHIPMENT NUMBER	4. SECURITY CLASSIFICATION	5. MODE OF SHIPMENT (i.e., Railway Express)
APSA-7-3507-71	N/A	Commercial Truck

6. COMMODITY DESCRIPTION			7. RADIOACTIVITY		
CONTAINERS	NUMBER OF ITEMS	NOMENCLATURE	QUANTITY, ISOTOPE AND FORM	a. LEVEL AT SURFACE	a. LEVEL AT ONE METER
a	b	c	d		
1 Wooden Transport Package Model No. SK-1351	1	Cobalt 60 Radiographic Source T.O. Model #520	500 Curies, Cobalt 60, Solid	2 MR/HR	1 MR/

SHIPMENT

THE ABOVE DESCRIBED ARTICLES ARE PROPERLY CLASSIFIED, PACKAGED, MARKED, AND LABELED. THE ARTICLES ARE IN PROPER CONDITION FOR TRANSPORTATION AND THE SPREADABLE ACTIVITY AND DOSE RATES ARE WITHIN THE SPECIFIED LIMITS, AS PRESCRIBED BY APPLICABLE REGULATIONS OF THE DEPARTMENT OF TRANSPORTATION AND DEPARTMENT OF THE ARMY.

8. REMARKS

Shipped in compliance with Special Permit (SP) No. 5800
Reference 6th Ind. LOG-TR-TEB-5882, July 14, 1971
Shipment Number APSA-7-3507-71

9. SPECIAL PRECAUTIONS

2 DA 119 Labels on Package Exterior
1 DA 110 Label on Package Exterior
2 DA 110 Labels on Truck Exterior
1 DA 135 Label in Truck Cab
1 Leak Test Form
1 Cobalt 60 Source Decay Chart
D.O.T. Specification Plywood Container D.O.T. (SP) No. 5800

10. SIGNATURE OF RADIATION PROTECTION OFFICER (Shipping Organization)		DATE
[signature]	Ravenna Arsenal, Inc.	Nov. 29, 1971
11. SIGNATURE OF TRANSPORTATION OFFICER (Shipping Organization)	GRADE AND TITLE	DATE
[signature]	GS-4	Nov. 29, 1971
12. ORGANIZATION		
[illegible]		

DA FORM 2791-R, 1 Oct 70 REPLACES DA FORM 2791, 1 JUN 64, WHICH IS OBSOLETE.
(Paper size, 8" x 10½"; image size, 7-4/10" x 10")

REQUISITION AND INVOICE/SHIPPING DOCUMENT

NO.	SHEETS		
1	1	9 MAR. 72	APSA-7-1729-72

1. FROM: AMMO PROC & SUPPLY AGENCY, USAR, JOLIET, ILL. 60436

2. TO: RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO 44266

3. SHIP TO + MARK FOR: TECHNICAL OPERATIONS, INC.
BURLINGTON, MASSACHUSETTS 01803

7. DATE MATERIEL REQUIRED:

8. PRIORITY:

9. AUTHORITY OR PURPOSE:

10. SIGNATURE:

11a. VOUCHER NUMBER AND DATE: T-5107-72 2073

b.

12. DATE SHIPPED: 2074 (3/15/72)

13. MODE OF SHIPMENT: ASSOCIATED TRANSPORT

14. BILL OF LADING NUMBER: F-3603060

15. AIR MOVEMENT DESIGNATOR OR PORT REFERENCE NO.:

4. APPROPRIATION SYMBOL AND SUBHEAD: 2122034 265-8251 p4180(.16.9999 A1-2-A0001)-2200 S11-173

OBJECT CLASS	EXPENDITURE ACCOUNT (From)	EXPENDITURE ACCOUNT (To)	CHARGEABLE ACTIVITY	BUREAU CONTROL ACTIVITY NO.	BUREAU CONTROL NO.	AMOUNT

ITEM NO. (a)	FEDERAL STOCK NUMBER, DESCRIPTION, AND CODING OF MATERIEL AND/OR SERVICES (b)	UNIT OF ISSUE (c)	QUANTITY REQUESTED (d)	SUPPLY ACTION (e)	TYPE CONTAINER (f)	CONTAINER NOS. (g)	UNIT PRICE (h)	TOTAL COST (i)
	1000 CURIE COBALT 60 RADIOGRAPHIC UNITS, SER. #1299. "RADIO ACTIVE MATERIAL" FIRST PARTIAL SOURCE SER. #1299 GAMMA PROJECT #39. PH&C - 2122030 265-8251 P4880 11 173 AMCMS: 4880.16.9985 PRON: A1-2-B0087-01-F0G2 FIRST PARTIAL SHIPMENT	EA.	2	1				$17,750.00

GATE PASS

J. R. Lawson
SIGNATURE

3-15-72
DATE

16. TRANSPORTATION VIA MATS OR MSTS CHARGEABLE TO:

17. SPECIAL HANDLING:

RECAPITULATION OF SHIPMENT

18. ISSUED BY:

CHECKED BY:

PACKED BY:

TOTAL CONTAINERS	TYPE CONTAINER	DESCRIPTION	TOTAL WEIGHT	TOTAL CUBE
1	PAL.	1000 CURIE COBALT	3,000#	
1	PAL.	← TOTAL →	3,000#	

19. RECEIPT

CONTAINERS RECEIVED EXCEPT AS NOTED	DATE	BY	SHEET TOTAL
QUANTITIES RECEIVED EXCEPT AS NOTED	DATE	BY	GRAND TOTAL
POSTED	DATE	BY	20. RECEIVER'S VOUCHER NO.

DD, FORM 1 MAR 68 1149

REPLACES EDITION OF 1 MAY 58 WHICH MAY BE USED

To - Rupture

S-38