



ATTACHMENT 1  
DEPARTMENT OF THE ARMY  
TWIN CITIES ARMY AMMUNITION PLANT  
NEW BRIGHTON, MINNESOTA 55112-5000



April 24, 1989

REPLY TO  
ATTENTION OF

SMCTC-EV (200-1a)

SUBJECT: Radiation Protection Study Completed at TCAAP 19-23 Sept 1988

3M Company  
ATTN: Mr. J. W. Johnson  
Building 590  
Twin Cities Army Ammunition Plant  
New Brighton, MN 55112-5796

Dear Sir:

The enclosed report from the U.S. Army Environmental Hygiene Agency (USAEHA) covers the survey completed of your facility on September 19-23, 1988.

Request that you note the recommendations as follows:

1. Proceed with efforts to return the five sump pits to unrestricted use. The USAEHA survey revealed that the sumps may be now so released.
2. In connection with the renewal of the DA Permit #P22-57-01, it would appear that the Environmental Assessment is in order and that your next move is to advertise in the New Brighton Bulletin for thirty (30) days, as stated in your Finding of No Significant Impact (FNSI) dated October 28, 1985.

If you have any questions, please contact Mr. Clarence C. Oster, SMCTC-EV, (612) 633-2301, Ext. 662.

Sincerely,

Theodore E. Schulte  
Commander's Representative

Enclosure

Copies Furnished:

Cdr, AMC, ATTN: AMCSF-P, Darwin Taras (w/encl)  
Cdr, AMCCOM, ATTN: AMSMC-ISE (w/encl)  
AMSMC-SFS (w/encl)  
TCAAP, ATTN: SMCTC-CP, Ellen Tillman (w/encl)  
Plt Mgr, FCC-TCAAP, New Brighton, MN (w/encl)



**A  
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A**

**UNITED STATES ARMY  
ENVIRONMENTAL HYGIENE  
AGENCY**

**ABERDEEN PROVING GROUND, MD 21010-5422**

**RADIATION PROTECTION STUDY NO. 27-43-0187-89  
MINNESOTA MINING AND MANUFACTURING COMPANY  
TWIN CITIES ARMY AMMUNITION PLANT  
NEW BRIGHTON, MINNESOTA  
19-23 SEPTEMBER 1988**

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**CONTROL NO. 87 43 0**



DEPARTMENT OF THE ARMY  
U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY  
ABERDEEN PROVING GROUND, MARYLAND 21010-5422



REPLY TO  
ATTENTION OF

HSHB-MR-HI (40)

10 April 1989

MEMORANDUM FOR Commander, U.S. Army Materiel Command, ATTN:  
AMCSG, 5001 Eisenhower Avenue, Alexandria,  
VA 22333-0001

SUBJECT: Radiation Protection Study No. 27-43-0187-89, Minnesota  
Mining and Manufacturing Company, Twin Cities Army Ammunition  
Plant, New Brighton, Minnesota, 19-23 September 1988

EXECUTIVE SUMMARY

The purpose and recommendations of the enclosed report follow:

a. Purpose. This study was performed to:

(1) Alert you to any previous unknown health hazards or areas of noncompliance with regulatory requirements associated with the use of radioactive materials at Minnesota Mining and Manufacturing (3M Company) at Twin Cities Army Ammunition Plant (TCAAP), Minnesota.

(2) Perform a Close-Out Study for five previously radiological contaminated sump pits at TCAAP. The sump pits were contaminated during 3M Company operations.

b. Recommendations.

(1) Continue to persist in your efforts to renew your DA Permit Number P22-57-01.

(2) Proceed with efforts to return the five sump pits to unrestricted use.

FOR THE COMMANDER:

Encl

MICHAEL W. MUELLER  
MAJ, MS

Chief, Health Physics Division

CF:

HQDA(SGPS-PSP) (wo/encl)

Cdr, AMCCOM, ATTN: AMSMC-SG (w/encl)

Comdt, AHS, ATTN: HSHA-IPM (w/encl)

Cdr, TCAAP (2 cy) (w/encl)



DEPARTMENT OF THE ARMY  
U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY  
ABERDEEN PROVING GROUND, MARYLAND 21010-5422



REPLY TO  
ATTENTION OF

HSHB-MR-HI

RADIATION PROTECTION STUDY NO. 27-43-0187-89  
MINNESOTA MINING AND MANUFACTURING COMPANY  
TWIN CITIES ARMY AMMUNITION PLANT  
NEW BRIGHTON, MINNESOTA  
19-23 SEPTEMBER 1988

1. REFERENCES. Appendix A contains a list of references.
2. AUTHORITY.
  - a. Memorandum, HQ AMC, AMCSG-R, 8 July 1987, subject: Field Mission Services, FY 88, Program 27.
  - b. Telephone conversation between Mr. Edge, USAEHA, and Mr. Paul Lin, AMCEN-A, 14 January 1988, subject: Request Radiation Protection Survey of Promethium-147 Contaminated Area at Twin Cities Army Ammunition Plant for 3M Company.
3. PURPOSE.
  - a. Alert you any previous unknown health hazards or areas of noncompliance with regulatory requirements associated with the use of radioactive material by the Minnesota Mining and Manufacturing Company (3M Company), Twin Cities Army Ammunition Plant (TCAAP), Minnesota.
  - b. Provide recommendations to correct health hazards, ensure regulatory compliance, and improve your radiation protection program at TCAAP.
  - c. Perform a Close-Out Study for five previously radiological contaminated sump pits at TCAAP.
4. GENERAL.
  - a. An entrance interview was held with Mr. Clarence Oster, Department of the Army Civilian (DAC), Chief Engineer, TCAAP, and Mr. Fred Entwistle, Health Physics Specialist, 3M Company.
  - b. This survey was performed by Mr. Harris Edge, DAC, and 2LT Gary Matcek, MS, Health Physics Division, the U.S. Army Environmental Hygiene Agency (USAEHA).
  - c. The most recent overview of the radiation protection program at 3M Company, TCAAP, by USAEHA was conducted 8-9 August 1985 (Radiation Protection Study No. 28-43-0028-86).

CONTROL NO 87430

Radn Prot Study No. 27-43-0187-89, TCAAP, New Brighton, MN,  
19-23 Sep 88

5. FINDINGS.

a. General.

(1) The 3M Company activities were authorized through a lease permit granted by the Secretary of the Army as arranged by the Corps of Engineers and the service agreement with Federal Cartridge Corporation (FCC). The FCC was the contracted plant manager for TCAAP.

(2) The 3M Company Nuclear Regulatory Commission (NRC) License Number BML 22-00057-06, expiration date 31 May 1992, authorized 3M Company to develop, manufacture, and distribute radioactive sources used in various industrial and medical applications.

(3) The 3M Company was authorized to use radioactive material at TCAAP by DA Permit No. P22-57-01, expiration date 31 December 1984.

(4) Mr. Entwistle was designated as the onsite health physicist by 3M Company.

b. Personnel Dosimetry Program.

(1) The 3M Company had developed a personnel dosimetry program in accordance with 10 CFR 20.101.

(2) The dosimetry services were provided by TMA/Eberline Corporation.

(3) Records indicated that radiation exposures to individual workers were kept within the radiation dose standards outlined in 10 CFR 20.101.

c. Radioactive Material.

\* (1) The DA Permit No. P22-57-01 renewal application was submitted to the DA on 6 December 1985 by letter. The 3M Company had not received a response from the DA on the status of the application for renewal at the time of this survey.

(2) The primary isotopes used by 3M Company on TCAAP site include cesium-137, polonium-210, and iodine-125.

(3) Building 113 was used to produce static eliminator devices that contained polonium-210 in microsphere form and iodine-125 seeds which are used in medical implant procedures.

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19-23 Sep 88

(a) Procedures to control the spread of radiological contamination were implemented.

(b) Potential airborne contamination was monitored.

(c) Stack monitors were available to monitor for potential radioactive materials released into the environment.

(4) Building 575 was used to produce cesium-137 sealed sources for medical implant procedures and for calibrating RADIAC instruments. This building had several individual hot cells; all equipped with the latest state-of-the-art handling tools and devices.

(a) Standing operating procedures to control and manage the spread of radiological contamination were in place and enforced.

(b) Appropriate radiation warning signs were posted in all areas located inside a radiation control environment.

(5) Building 573 was used for storage of radioactive materials, and was located inside a designated radiation control area. The entrance to the radiation controlled area was posted with appropriate warning signs.

(6) Building 538D was demolished several years ago. However, there were five sumps in the building which had been used to control wastewater. When the operations were terminated, these sumps were found to be contaminated with promethium-147, in microsphere form. The 3M Company included all sumps in their lease agreement which was covered by DA Permit Number P22-57-01. The sumps were enclosed by a fence, and each sump was posted with a "Caution: Radioactive Material" sign. Recently, 3M Company decontaminated the sumps; declared each sump radiologically clean and requested that USAEHA perform a close-out survey on the sumps during the survey so that the area may be returned to unrestricted use (see paragraph 5f).

d. Environmental Monitoring Program.

(1) Stack effluent monitoring was performed by 3M Company. Results were provided to the Commander's Representative, TCAAP.

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(2) The 3M Company was disposing of radioactive materials by releasing the materials into the sanitary sewerage system. The disposal appeared to be in accordance with 10 CFR 20.303.

e. Records, Reports and Surveys.

(1) An inventory of ionizing radiation sources was available for review and appeared to be adequate for its intended purpose. The inventory was provided to the Commander's Representative, TCAAP.

(2) Documentation was available to show that radiation safety training was provided to FCC maintenance and engineering personnel, and to the emergency personnel entering 3M Company's radiation controlled areas.

(3) Radiation protection surveys were performed in all areas where radioactive materials were used and stored.

f. Sump Pits Close-Out Survey Results.

(1) Instrumentation Survey.

(a) The NRC limit for unrestricted use of facilities potentially contaminated with beta-gamma emitters is 5,000 disintegrations per minute per 100 square centimeters (dpm/100 cm<sup>2</sup>).

(b) The instrumentation survey was performed with an Eberline Smart Portable (ESP)-2 survey meter with a Model HP-210T detector. The results indicated that there were no beta-gamma radiation detected above 5,000 dpm/100 cm<sup>2</sup>. The average readings varied from a low of 185 dpm/100 cm<sup>2</sup> to a high of 657 dpm/100 cm<sup>2</sup>. Background radioactivity was subtracted from the reported results. Appendix B includes all instrumentation survey results.

(2) Wipe Test Survey.

(a) Wipe test surveys were performed to determine the removable contamination level on the surface of the walls of each sump pit. The NRC limit for unrestricted use of potentially contaminated facilities with removable radioactive material is 1000 dpm/100 cm<sup>2</sup> for beta-gamma emitters.

(b) The wipe test survey indicated that no removable surface contamination was detected above 1,000 dpm/100 cm<sup>2</sup>. Appendix B includes a table of wipe test results.

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(3) Water Sample Results.

(a) A water sample was collected from each sump pit that contained water. The water samples were analyzed for promethium-147 (Pm-147).

(b) The water sample results indicated that Pm-147 activity in the water samples varied from a low of 90 dpm/ml to a high of 170 dpm/ml. The highest Pm-147 activity detected did not exceed the NRC Limit of  $6.0 \times 10^{-3}$  uCi/ml specified in 10 CFR 20, Appendix B, Table II, Col 2. Appendix B includes a table of the water sample results.

6. CONCLUSION. A review of the findings indicates the following:

a. There were no health hazards resulting from operations at TCAAP by 3M Company.

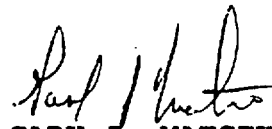
b. The overall radiation protection program was conducted in accordance with current regulatory requirements for radiation protection.

c. The Close-Out Study indicated that the five sump pits may be released for unrestricted use.

7. RECOMMENDATIONS. The following recommendations are provided to ensure regulatory compliance.

a. Continue to persist in your efforts renew your DA Permit Number P22-57-01 (32 CFR 655.10 and AR 385-11, paragraph 2-3). The USAEHA has contacted DA Licensing Authorities (AMC SF-P) on your behalf to communicate your concerns and to expedite the renewal of your DA Permit.

b. Proceed with efforts to return the five sump pits to unrestricted use (NRC Regulatory Guide 1.86 and NRC Regulatory Guide 8.21).



GARY J. MATCEK  
2LT, MS

Nuclear Medical Science Officer  
Health Physics Division

APPROVED:



HARRIS EDGE:  
Chief Industrial Health Physics  
Branch  
Health Physics Division



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## APPENDIX A

### REFERENCES

1. Title 10, Code of Federal Regulations (CFR), 1988 rev, Chapter I, Nuclear Regulatory Commission.
2. Title 32, CFR, 655.10, 1988 rev, Use of Radiation Sources by Non-Army Entities on Army Land (AR 385-11).
3. AR 385-11, 1 May 1980, Ionizing Radiation Protection (Licensing, Control, Transportation, Disposal, and Radiation Safety).
4. Nuclear Regulatory Commission Guide 1.86, Termination of Operating License for Nuclear Reactor.
5. Nuclear Regulatory Commission Guide 8.21, Recommend Action Levels for Removable Surface Contamination in Manufacturing Plants.
6. AR 40-5, 30 August 1986, Preventive Medicine.
7. AR 40-14, 15 March 1982, Control and Recording Procedures for Exposure to Ionizing Radiation and Radioactive Materials.
8. AR 200-2, 15 March 1985, Environmental Effects of Army Actions.

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APPENDIX B  
CLOSE-OUT SURVEY

#### CLOSE-OUT SURVEY PROCEDURES

1. INSTRUMENTATION SURVEY. The surface area of the walls of each sump pit was surveyed with an Eberline Model E-520 ratemeter with an HP-210 detector. The E-520 ratemeter was used to locate radioactive "hot spots" which were above background levels. Areas or spots identified as having readings above 100 dpm/100 cm<sup>2</sup> were resurveyed with the ESP-2 survey meter. The ESP-2 survey meter provided a more precise measurement of the contaminated area. Also the ESP-2 was used to quantitate the counts per minute over a selectable period of time and with a determined efficiency, which enables one to compute the activity detected.
2. WIPE TEST SURVEY. The surface area of each sump pit wall was wipe tested with cloth smears. Each cloth smear was moistened with distilled water before wiping the surface area. After each area (approximately 100 cm<sup>2</sup>) was wiped, the cloth smear was placed in an individual packet, surveyed with the ESP-2 survey meter and labelled. The wipe test samples were taken to USAEHA and analyzed by the Radiochemistry Analysis Branch.
3. WATER SAMPLES. A water sample was collected from each sump pit that contained water. The two small sump pits (Sump Pits No. 4 and 5) did not contain standing water; therefore, a water sample could not be collected. Each water sample was labelled and concentrated nitric acid added to preserve the suspected contaminants. Each sample was taken to USAEHA and analyzed by the Radiochemistry Analysis Branch.

## INSTRUMENTATION, CALIBRATION AND MEASUREMENT TECHNIQUES

### 1. INSTRUMENTATION.

a. Model Eberline Smart Portable ESP-2 Survey Meter with HP210T Geiger-Mueller probe; Mica Window Thickness of 1.4 to 2.0 milligram per square centimeter; Mica Window size of 1.75 inch diameter. Serial Number (SN) 936, Eberline Instrument Corporation, calibrated 17 August 1988.

b. Model E-520 Ratemeter with HP-210T Geiger-Mueller Probe, SN 633, Eberline Instrument Corporation, calibrated 24 August 1988.

### 2. CALIBRATION TECHNIQUES.

a. Model ESP-2 with 210T Probe. This instrument was calibrated to respond to 100 percent efficiency for pulse rate from the Model MP-1, Minipulser, Eberline Instrument Corporation, calibrated 7 July 1988, traceable to the National Institute of Standards and Technology (NIST). An efficiency of approximately 25 percent was measured with technetium-99 plated sources [0.09 megaelectron volts (MeV) average beta energy]. The calculated efficiency was 20 percent for carbon-14 (0.52 MeV averaged beta energies). The efficiencies are listed as a percentage of the  $2\pi$  emission rate from a one-inch diameter source.

b. Model E-520 with HP210T Probe. Same as above except that the calculated efficiency was 10 percent for carbon-14.

### 3. MEASUREMENT TECHNIQUES.

a. Model ESP-2 with HP-210T Probe. The ESP-2 was set-up in the scaler fixed precision mode, which automatically adjusts count time so that the measurements have a selected fixed 10 percent precision at the 2 sigma confidence level. The high voltage, dead time and calibration constant were preselected. Surface areas of the sump pits which showed radiological readings above 100 dpm/cm<sup>2</sup> were measured with the ESP-2 survey meter to measure the surface contamination.

b. Model E-520 with HP-210T Probe. The entire surface of the five sumps was surveyed with the E-520 survey meter. All readings detected above 100 dpm/cm<sup>2</sup> were measured with the ESP-2. The survey instrument operational parameters were checked and verified after each sump was surveyed. The calibration constant was verified with a one uCi carbon-14 check source, traceable to NIST.

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TABLE B-1. INSTRUMENTATION SURVEY RESULTS

Location	Sample Number	Beta Contamination $\pm 2$ Standard Deviations	
		Average Results (dpm/100 cm <sup>2</sup> )	Maximum Results (dpm/100 cm <sup>2</sup> )
Sump Pit #1	Wall-a	320	657
	Wall-b	296	520
	Wall-c	302	420
	Wall-d	287	406
Sump Pit #2	Wall-a	180	265
	Wall-b	220	340
	Wall-c	257	402
	Wall-d	242	400
Sump Pit #3	Wall-a	360	460
	Wall-b	378	475
	Wall-c	355	445
	Wall-d	296	436
Sump Pit #4	Wall-a	375	580
	Wall-b	356	565
Sump Pit #5	Wall-a	350	570
	Wall-b	330	456

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TABLE B-2. WIPE TEST SAMPLE RESULTS

Location	Sample Number	Removable Pm-147 (dpm/100 cm <sup>2</sup> ± 2 S.D)	Location	Sample Number	Removable Pm-147 (dpm/100 cm <sup>2</sup> ± 2 S.D)
Sump Pit #1	Wall-a-1	16	Sump Pit #1	Wall-c-1	16
	Wall-a-2	13		Wall-c-2	23
	Wall-a-3	16		Wall-c-3	15
	Wall-a-4	22		Wall-c-4	23
	Wall-a-5	47		Wall-c-5	25
	Wall-a-6	55		Wall-c-6	34
	Wall-a-7	65		Wall-c-7	42
	Wall-a-8	36		Wall-c-8	25
	Wall-a-9	27		Wall-c-9	32
	Wall-a-10	22		Wall-c-10	20
	Wall-b-1	15		Wall-d-1	18
	Wall-b-2	13		Wall-d-2	19
	Wall-b-3	15		Wall-d-3	32
	Wall-b-4	24		Wall-d-4	40
	Wall-b-5	22		Wall-d-5	20
	Wall-b-6	46		Wall-d-6	25
	Wall-b-7	52		Wall-d-7	24
	Wall-b-8	27		Wall-d-8	23
	Wall-b-9	36		Wall-d-9	22
	Wall-b-10	22		Wall-d-10	21
Sump Pit #2	Wall-a-1	42	Sump Pit #2	Wall-c-1	47
	Wall-a-2	35		Wall-c-2	45
	Wall-a-3	43		Wall-c-3	42
	Wall-a-4	25		Wall-c-4	31
	Wall-a-5	26		Wall-c-5	30
	Wall-a-6	39		Wall-c-6	42
	Wall-a-7	38		Wall-c-7	50
	Wall-a-8	41		Wall-c-8	47
	Wall-a-9	40		Wall-c-9	40
	Wall-a-10	41		Wall-c-10	42
	Wall-b-1	43		Wall-d-1	45
	Wall-b-2	34		Wall-d-2	50
	Wall-b-3	35		Wall-d-3	57
	Wall-b-4	30		Wall-d-4	54
	Wall-b-5	32		Wall-d-5	35
	Wall-b-6	36		Wall-d-6	25
	Wall-b-7	34		Wall-d-7	32
	Wall-b-8	25		Wall-d-8	40
	Wall-b-9	27		Wall-d-9	45
	Wall-b-10	28		Wall-d-10	42

Radn Prot Study No. 27-43-0187-89, TCAAP, New Brighton, MN,  
19-23 Sep 88

TABLE B-3. WATER SAMPLE RESULTS

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Sample Number	Gross Beta Activity (MicroCurie per milliliter +/-2 Standard Deviations)
Sump Pit #1	$5.0 \times 10^{-8}$
Sump Pit #2	$4.9 \times 10^{-8}$
Sump Pit #3	$1.4 \times 10^{-8}$
Rice Creek (Background)	$9.0 \times 10^{-9}$
Tap Water, Bldg 105	$< 1.98 \times 10^{-9}$ *

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\*Minimum Detectable Activity =  $1.98 \times 10^{-9}$  uCi/ml.

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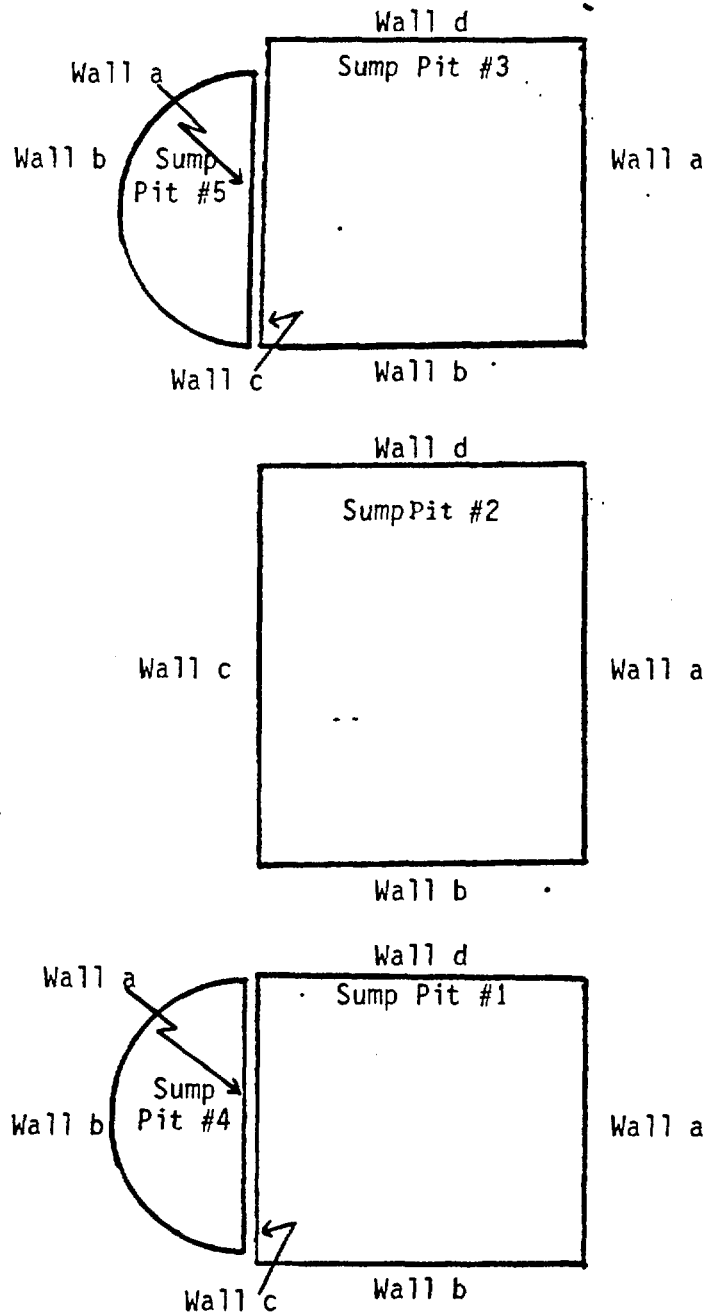
Radn Prot Study No. 27-43-0187-89, TCAAP, New Brighton, MN,  
19-23 Sep 88

Location	Sample Number	Removable Pm-147 (dpm/100 cm <sup>2</sup> ± 2 S.D)	Location	Sample Number	Removable Pm-147 (dpm/100 cm <sup>2</sup> ± 2 S.D)
Sump Pit #3	Wall-a-1	21	Sump Pit #3	Wall-c-1	30
	Wall-a-2	20		Wall-c-2	26
	Wall-a-3	25		Wall-c-3	24
	Wall-a-4	27		Wall-c-4	21
	Wall-a-5	25		Wall-c-5	33
	Wall-a-6	30		Wall-c-6	37
	Wall-a-7	37		Wall-c-7	39
	Wall-a-8	26		Wall-c-8	45
	Wall-a-9	25		Wall-c-9	26
	Wall-a-10	29		Wall-c-10	30
	Wall-b-1	26		Wall-d-1	27
	Wall-b-2	30		Wall-d-2	33
	Wall-b-3	35		Wall-d-3	34
	Wall-b-4	37		Wall-d-4	40
	Wall-b-5	39		Wall-d-5	45
	Wall-b-6	45		Wall-d-6	40
	Wall-b-7	57		Wall-d-7	45
	Wall-b-8	20		Wall-d-8	27
	Wall-b-9	26		Wall-d-9	33
	Wall-b-10	30		Wall-d-10	35
Sump Pit #4	Wall-a-1	26	Sump Pit #5	Wall-a-1	16
	Wall-a-2	24		Wall-a-2	24
	Wall-a-3	30		Wall-a-3	27
	Wall-a-4	35		Wall-a-4	29
	Wall-a-5	33		Wall-a-5	37
	Wall-a-6	37		Wall-a-6	40
	Wall-a-7	26		Wall-a-7	42
	Wall-a-8	27		Wall-a-8	41
	Wall-a-9	32		Wall-a-9	37
	Wall-a-10	35		Wall-a-10	32
	Wall-b-1	29		Wall-b-1	19
	Wall-b-2	33		Wall-b-2	28
	Wall-b-3	35		Wall-b-3	30
	Wall-b-4	29		Wall-b-4	33
	Wall-b-5	27		Wall-b-5	40
	Wall-b-6	21		Wall-b-6	47
	Wall-b-7	37		Wall-b-7	52
	Wall-b-8	28		Wall-b-8	58
	Wall-b-9	42		Wall-b-9	28
	Wall-b-10	37		Wall-b-10	36



GRAPHICAL ILLUSTRATION

For use of this form see AEHA Form 6 SOP; the proponent is HSE-AT.



Building 538D - Sump Pits  
Twin Cities Army Ammunition Plant, MN

**U.S. ARMY ENVIRONMENTAL HYGIENE AGENCY**  
**UNITED STATES ARMY MEDICAL DEPARTMENT**

DATE 7 Jan 89  
DRAWN HE  
APPROVED MWM  
SCALE NTS  
PLATE 1 of 8

GRAPHICAL ILLUSTRATION

For use of this form see AEHA Form 6 SOP; the proponent is HSE-AT.

TOP \* 287 dpm/100 cm<sup>2</sup>  
 \*\* 406 dpm/100 cm<sup>2</sup> Wall d

\* Averaged detected contamination over the wall surface

\*\* The maximum detected contamination

TOP \* 296 dpm/100 cm<sup>2</sup>  
 \*\* 520 dpm/100 cm<sup>2</sup> Wall b

TOP \* 302 dpm/100 cm<sup>2</sup>  
 \* 420 dpm/100 cm<sup>2</sup> Wall c

TOP \*320 dpm/100 cm<sup>2</sup>  
 \*\*657 dpm/100 cm<sup>2</sup> Wall a

Sump Pit #1-Walls a-d (Instrumentation Survey)  
 Twin Cities Army Ammunition Plant, MN

DATE 7 Jan 89  
 DRAWN HE  
 APPROVED MWM  
 SCALE NTS  
 PLATE 2 of 8

**U.S. ARMY ENVIRONMENTAL HYGIENE AGENCY**  
**UNITED STATES ARMY MEDICAL DEPARTMENT**

GRAPHICAL ILLUSTRATION

For use of this form see AEHA Form 6 SOP; the proponent is HSE-AT.

\* Averaged detected contamination over the wall surface

\*\* The maximum detected contamination

TOP \* 242 dpm/100 cm<sup>2</sup>  
\*\* 400 dpm/100 cm<sup>2</sup> Wall d

TOP \* 220 dpm/100 cm<sup>2</sup>  
\*\* 340 dpm/100 cm<sup>2</sup> Wall b

TOP \* 257 dpm/100 cm<sup>2</sup>  
\*\* 402 dpm/100 cm<sup>2</sup> Wall c

TOP \* 180 dpm/100 cm<sup>2</sup>  
\*\* 265 dpm/100 cm<sup>2</sup> Wall a

Sump Pit #2 - Walls a-d (Instrumentation Survey)  
Twin Cities Army Ammunition Plant, MN

DATE 7 Jan 89  
DRAWN HE  
APPROVED MWM  
SCALE NTS  
PLATE 3 of 8

**U.S. ARMY ENVIRONMENTAL HYGIENE AGENCY**  
**UNITED STATES ARMY MEDICAL DEPARTMENT**

GRAPHICAL ILLUSTRATION

For use of this form see AEHA Form 6 SOP; the proponent is HSE-AT.

\* Averaged detected contamination over the wall surface

\*\* The maximum detected contamination

TOP \* 296 dpm/100 cm<sup>2</sup>  
 \*\* 436 dpm/100 cm<sup>2</sup> Wall d

TOP \* 378 dpm/100 cm<sup>2</sup>  
 \*\* 445 dpm/100 cm<sup>2</sup> Wall b

TOP \* 355 dpm/100 cm<sup>2</sup>  
 \*\* 445 dpm/100 cm<sup>2</sup> Wall c

TOP \* 360 dpm/100 cm<sup>2</sup>  
 \*\* 460 dpm/100 cm<sup>2</sup> Wall a

Sump Pit #3 - Walls a-d (Instrumentation Survey)  
 Twin Cities Army Ammunition Plant, MN

DATE 7 Jan 89

DRAWN HE

APPROVED MWM

SCALE NTS

PLATE 4 of 8

**U.S. ARMY ENVIRONMENTAL HYGIENE AGENCY**

**UNITED STATES ARMY MEDICAL DEPARTMENT**

AEHA Form 6, 1 Jun 80

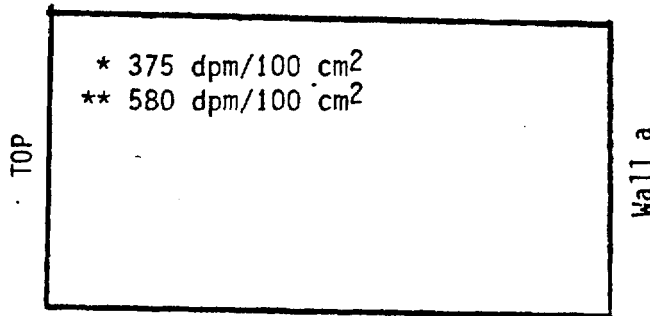
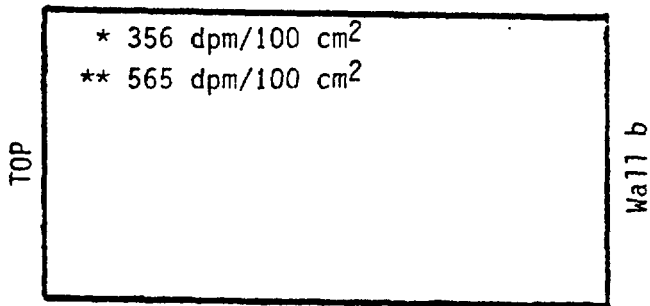
Replaces USAEHA Form 15, 12 Aug 74, which will be used.

GRAPHICAL ILLUSTRATION

For use of this form see AEHA Form 6 SOP; the proponent is HSE-AT.

\* Averaged detected contamination over the wall surface

\*\* The maximum detected contamination



Sump Pit #4 - Walls a-b (Instrumentation Survey)  
Twin Cities Army Ammunition Plant, MN

DATE 7 Jan 89

DRAWN HE

APPROVED MWM

SCALE NTS

PLATE 5 of 8

**U.S. ARMY ENVIRONMENTAL HYGIENE AGENCY**

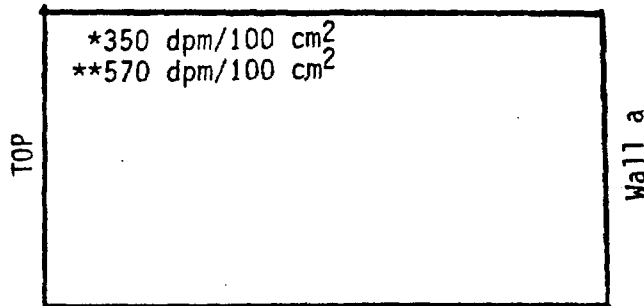
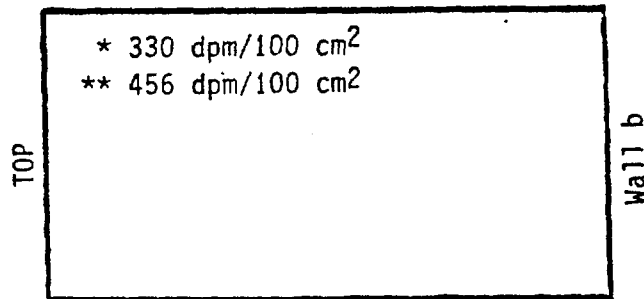
**UNITED STATES ARMY MEDICAL DEPARTMENT**

GRAPHICAL ILLUSTRATION

For use of this form see AEHA Form 6 SOP; the proponent is HSE-AT.

\* Averaged detected contamination over the wall surface

\*\* The maximum detected contamination



Sump Pit #5 - Walls a-b (Instrumentation Survey)  
Twin Cities Army Ammunition Plant, MN

DATE 7 Jan 89

DRAWN HE

APPROVED MWM

SCALE NTS

PLATE 6 of 8

**U.S. ARMY ENVIRONMENTAL HYGIENE AGENCY**  
**UNITED STATES ARMY MEDICAL DEPARTMENT**

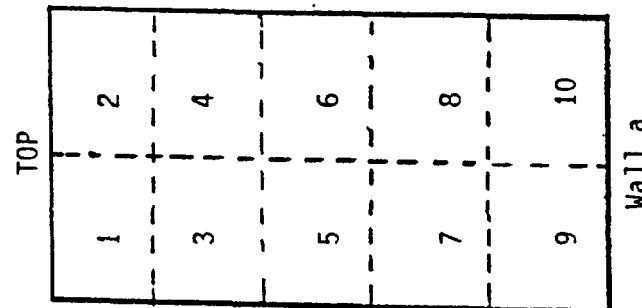
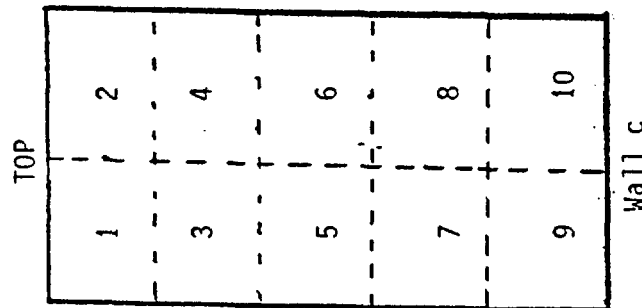
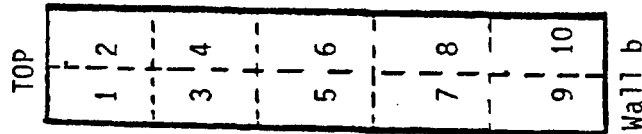
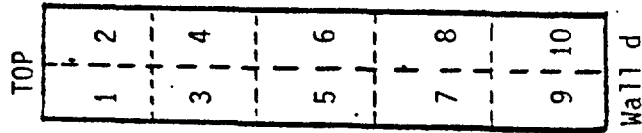
AEHA Form 6, 1 Jun 80

Replaces USAEHA Form 15, 12 Aug 74, which will be used.  
B-13

CONTROL NO. 87430

GRAPHICAL ILLUSTRATION

For use of this form see AEHA Form 6 SOP; the proponent is HSE-AT.



Wipe Test Locations for Sump Pits 1-3  
Twin Cities Army Ammunition Plant, MN

DATE 7 Jan 89  
DRAWN HE  
APPROVED MWM  
SCALE NTS  
PLATE 7 of 8

**U.S. ARMY ENVIRONMENTAL HYGIENE AGENCY**

**UNITED STATES ARMY MEDICAL DEPARTMENT**

AEHA Form 6, 1 Jun 80

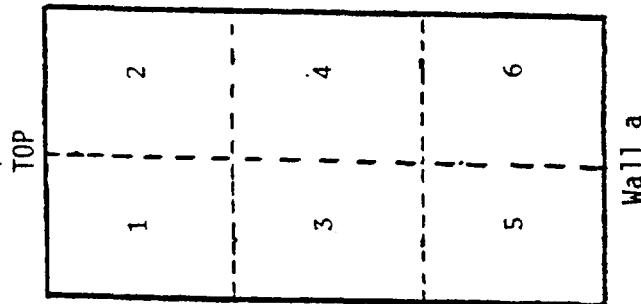
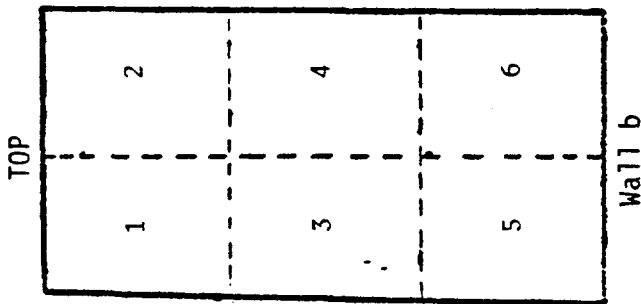
Replaces USAEHA Form 15, 12 Aug 74, which will be used.

B-14

CONTROL NO. 8743 0

GRAPHICAL ILLUSTRATION

For use of this form see AEHA Form 6 SOP; the proponent is HSE-AT.



Wipe Test Locations for Sump Pits 4 and 5  
Twin Cities Army Ammunition Plant, MN

DATE 7 Jan 89  
DRAWN HE  
APPROVED MWM  
SCALE NTS  
PLATE 8 of 8

**U.S. ARMY ENVIRONMENTAL HYGIENE AGENCY**  
**UNITED STATES ARMY MEDICAL DEPARTMENT**