



DEPARTMENT OF THE ARMY  
U. S. ARMY CENTER FOR HEALTH PROMOTION AND PREVENTIVE MEDICINE  
5158 BLACKHAWK ROAD  
ABERDEEN PROVING GROUND, MARYLAND 21010-5403

REPLY TO  
ATTENTION OF

MCHB-TS-OHP

28 JUL 2003


MEMORANDUM FOR Commander, U.S. Army Materiel Command (AMCSG-R), 5001  
Eisenhower Avenue, Alexandria, VA 22304-6100

SUBJECT: Industrial and Environmental Radiation Survey No. 26-MF-8260-R2-03,  
U.S. Army Jefferson Proving Ground, Madison, Indiana, 21-23 April 2003

Copies of the subject report and Executive Summary are enclosed.

FOR THE COMMANDER:

Encl

  
MARK A. MELANSON  
LTC, MS  
Program Manager  
Health Physics Program

CF (w/encl):  
DIR, POPM-SA (MCPO-SA) (MCHO-CL-W/(EXSUM ONLY))  
CDR, SBCCOM (AMSSB-RCB-RS/MS KUYKENDALL)  
CDR, AMC (AMCSF-P)  
CDR, JPG  
CDR, NORTH ATLANTIC RMC

*Readiness thru Health*

# U.S. Army Center for Health Promotion and Preventive Medicine

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INDUSTRIAL AND ENVIRONMENTAL RADIATION SURVEY  
NO. 26-MF-8260-R2-03  
U.S. ARMY JEFFERSON PROVING GROUND  
MADISON, INDIANA  
21-23 APRIL 2003

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## Readiness Thru Health

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## **U.S. Army Center for Health Promotion and Preventive Medicine**

*The U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) lineage can be traced back over 50 years. This organization began as the Army Industrial Hygiene Laboratory, established during the industrial buildup for World War II, under the direct supervision of The Army Surgeon General. Its original location was at the Johns Hopkins School of Hygiene and Public Health. Its mission was to conduct occupational health surveys and investigations within the Department of Defense's (DOD's) industrial production base. It was staffed with three personnel and had a limited annual operating budget of \$3,000.*

*In 1960, the laboratory became internationally known as the U.S. Army Environmental Hygiene Agency or AEHA. Its mission expanded to support the worldwide preventive medicine programs of the Army, DOD, and other Federal agencies when directed by the Army Medical Command or the Office of The Surgeon General, through consultations, support services, investigations, on-site visits, and training.*

*On 1 August 1994, AEHA was redesignated the U.S. Army Center for Health Promotion and Preventive Medicine with a provisional status and a commanding general officer. On 1 October 1995, the nonprovisional status was approved with a mission for providing preventive medicine and health promotion leadership, direction, and services for America's Army.*

*The mission of USACHPPM is to provide health promotion and preventive medicine leadership and services to counter environmental, occupational, and disease threats to health, fitness, and readiness in support of the National Military Strategy. Its vision is to be the world class center of excellence for the systematic prevention of environmental, occupational, and disease threats to the health performance of individuals and populations.*

*The Center has been reorganized and reengineered to support the Army of the future. The USACHPPM now has three subordinate commands located in Fort Meade, Maryland; Fort McPherson, Georgia; and Fort Lewis, Washington; to provide responsive regional health promotion and preventive medicine support across the U.S. There are also two CHPPM overseas commands in Landstuhl, Germany and Camp Zama, Japan who contribute to the success of USACHPPM's increasing global mission.*

*The USACHPPM remains strong and at the forefront of prevention-based programs worldwide. The future will involve meeting multiple challenges, from demonstrating the effectiveness of health promotion and preventive medicine to integrating force health protection, health risk assessment, population health and injury prevention into the life-cycle model of the soldier. The USACHPPM will continue to work closely with sister services to support the continuum of military operations to be faced in the coming years.*



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U. S. ARMY CENTER FOR HEALTH PROMOTION AND PREVENTIVE MEDICINE  
5158 BLACKHAWK ROAD  
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REPLY TO  
ATTENTION OF

**EXECUTIVE SUMMARY  
INDUSTRIAL AND ENVIRONMENTAL RADIATION SURVEY  
NO. 26-MF-8260-R2-03  
U.S. ARMY JEFFERSON PROVING GROUND  
MADISON, INDIANA  
21-23 APRIL 2003**

**I. PURPOSE.** This survey was performed to assist in your efforts to implement the Nuclear Regulatory Commission (NRC) approved Environmental Radiation Monitoring (ERM) Program in accordance with (IAW) NRC License Number SUB-1435 and its amendments. It requires the examination of the fate and transport of depleted uranium (DU) from the DU impact area at Jefferson Proving Ground.

**II. CONCLUSION.** A review of the ERM Program sampling results for April 2003 indicated the following:

A. There were no levels of uranium detected above the established action levels in any of the environmental samples collected.

B. The overall ERM Program was sound and was being conducted IAW current regulatory requirements for radiation protection.

**III. RECOMMENDATIONS.** Environmental monitoring should be continued IAW the ERM Program or as required by the license.

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**DEPARTMENT OF THE ARMY**  
**U. S. ARMY CENTER FOR HEALTH PROMOTION AND PREVENTIVE MEDICINE**  
**5158 BLACKHAWK ROAD**  
**ABERDEEN PROVING GROUND, MARYLAND 21010-5403**

REPLY TO  
ATTENTION OF

**25 JUL 2003**

**MCHB-TS-OHP**

**INDUSTRIAL AND ENVIRONMENTAL RADIATION SURVEY**  
**NO. 26-MF-8260-R2-03**  
**U.S. ARMY JEFFERSON PROVING GROUND**  
**MADISON, INDIANA**  
**21-23 APRIL 2003**

**I. REFERENCES.** See Appendix A for a list of references.

**II. AUTHORITY.** Meeting among Mr. Clifford Wendel, Risk Management, Soldier and Biological Chemical Command (SBCCOM) and Mr. Patrick Mark Moscato, Mr. James Mullikin, and Mr. David Collins, Health Physics Program (HPP), to establish requested U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) support for the Environmental Radiation Monitoring (ERM) Program.

**III. PURPOSE.** This survey was performed to assist in your efforts to implement the Nuclear Regulatory Commission (NRC) approved ERM Program in accordance with (IAW) NRC License Number SUB-1435 and amendments thereto. The NRC license requires the examination of the fate and transport of depleted uranium (DU) from the DU impact area at Jefferson Proving Ground (JPG).

**IV. GENERAL.**

**A.** Initial and onsite coordination for survey assistance was conducted with Mr. Kenneth Knouf, Department of the Army Civilian (DAC), Site Manager, and Mr. Phil Mann, DAC, Site Staff Member.

**B.** An exit briefing, to include a discussion of initial sample results and concerns, was held with Mr. Knouf on 23 April 2003.

**C.** Mr. Lorus Miller, Health Physics Technician, Henry M. Jackson Foundation (HMJF) Participant, HPP, USACHPPM, and Mr. Patrick Mark Moscato, DAC, Health Physicist, Health Physics Program (HPP), USACHPPM, performed this survey and are qualified Health Physics Personnel with varied expertise in radiological health issues and environmental sampling

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techniques. They have had occupational health and safety training, to include 40-hour hazardous waste operations and emergency response training.

D. Abbreviations used in this report can be found in Appendix B.

## V. FINDINGS.

### A. General.

1. Ms. Joyce Kuykendall, DAC, SBCCOM Radiation Safety Staff Officer (RSSO), is the point of contact for the JPG ERM.

2. Mr. Knouf and his staff provided onsite support to include admission into the JPG restricted areas. There were no onsite unexploded ordnance personnel to provide escort.

3. The USACHPPM standing operating procedure (SOP) for the DU Sampling Program at JPG, effective 10 March 2000, was followed for this project (Reference 6).

4. The ERM Program requires biannual sampling.

B. Personnel Dosimetry Program. None required.

### C. Radioactive Materials.

1. The NRC license authorized possession of DU only for decommissioning of DU metal and alloy located at the JPG site.

a. The NRC approved ERM Program required biannual environmental sampling which included soil, sediment, surface water, and ground water sampling and evaluation.

b. Radioactive material warning signs were posted IAW regulatory requirements. Signs were present on all barriers controlling access into the restricted areas.

c. An Abbreviated Site Safety and Health Plan (ASSHP) for entering restricted areas of JPG was established and implemented.

2. Action Levels. The following criteria for the restricted area will be used to limit DU exposure as stated in the ERM Program. The NRC in a letter dated 22 July 1996 approved the ERM Program.

a. Soil and Sediment:

**Perimeter and background samples:**

$\leq 35$  picocuries per gram (pCi/g) – no corrective action required.

$> 35$  pCi/g – collect 5 additional samples in a 1 meter square grid.

If average activity was verified to exceed 35 pCi/g decontamination to below 35 pCi/g.

**Sample locations along the firing line:**

$< 100$  pCi/g – no corrective action required.

100 – 300 pCi/g collect 5 additional samples in a 1 meter square grid.

If average is  $> 100$  pCi/g, investigate to determine reason for high level.

$> 300$  pCi/g was verified, investigate to determine reason for high level and contact the NRC.

**b. Surface and Ground Water:**

DU [Note: Title 10, Code of Federal Regulations (10 CFR), Part 20, Appendix B (effluent concentrations for water) limit is  $3.0 \times 10^{-1}$  picocuries per milliliter (pCi/ml)].

$< 1.5 \times 10^{-1}$  pCi/ml – no corrective action.

$> 1.5 \times 10^{-1}$  pCi/ml – resample and if activity is verified, investigate to determine reason for the high level and notify the NRC.

3. Basis for Action. When action levels are exceeded, an evaluation of cause will be performed by the SBCCOM Radiation Protection Officer (RPO). A report of the findings will be provided to the licensee's Radiation Control Committee. Based on their determination, recommendations to the Commander on corrective action will be made.

**D. Records and Reports.**

1. Records were available to show previous locations sampled as part of the ERM Program.

2. Instrumentation used for the administration of this project was evaluated and found to be adequate for their intended purpose.

**E. Survey Results.**

1. Soil and Sediment Samples. Soil and sediment samples were analyzed by gamma spectroscopy for thorium-234, the progeny of uranium-238.

a. Soil Samples. All soil sample locations and exposure results are presented in Appendix C. Analysis of the soil samples resulted in no levels of activity above the action level being detected. Laboratory analyses of soil sample results are summarized in Appendix D.

b. Sediment Samples. All sediment locations and exposure results are presented in Appendix C. Analysis of the sediment samples resulted in no levels of activity above the action level being detected. Laboratory analyses of sediment sample results are summarized in Appendix D.

2. Water samples were analyzed fluorometrically for dissolved total uranium.

a. Surface Water Samples. All surface water sample collection locations are presented in Appendix C. Analysis of the surface water samples resulted in no levels of activity above the action level being detected. Laboratory analyses of surface water sample results are summarized in Appendix D.

b. Ground Water (Monitoring Wells) Samples. All ground water sample locations are presented in Appendix C. Analysis of the ground water samples resulted in no levels of activity above the action level being detected. Laboratory analyses of the ground water sample results are summarized in Appendix D.

c. External Radiation Monitoring Results. Radiation exposure measurements were taken at each area where soil samples were collected and near areas where sediment, surface water, and ground water samples were collected. All radiation exposure results and monitoring equipment used are presented in Appendix C. The radiation exposure measurements ranged from 4.94 to 8.68 microrentgen per hour ( $\mu\text{R/hr}$ ).

## VI. DISCUSSION.

A. The USACHPPM survey team would like to thank the JPG site team for their continued assistance with coordination and execution of the sampling program.

B. Additional coordination is required for site access through the National Fish and Wildlife Service personnel.

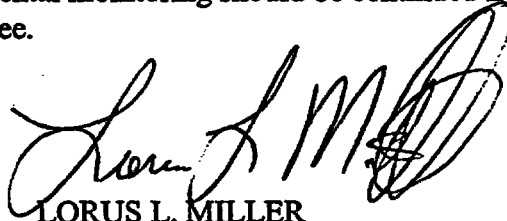
VII. CONCLUSION. An evaluation of the sampling results for April 2003 indicated the following:



A. There were no levels of uranium detected above the established action levels in any of the environmental samples collected.

B. The overall ERM Program was sound and was being conducted IAW current regulatory requirements for radiation protection.

VIII. RECOMMENDATION. Environmental monitoring should be continued IAW the ERM Program and SOP or as required by licensee.



LORUS L. MILLER

Health Physics Technician

Henry M. Jackson Foundation Participant

Health Physics Program



Patrick Mark Moscato

Health Physicist

Health Physics Program

APPROVED:

MARK A. MELANSON

LTC, MS

Program Manager

Health Physics

## APPENDIX A

### REFERENCES

1. NRC License Number SUB-1435, amendments and ERM Plan at JPG, 8 May 1988, TECOM, Aberdeen Proving Ground, Maryland.
2. 10 CFR, Part 19, 2003 rev., Notices, Instructions and Reports to Workers, Inspections.
3. 10 CFR, Part 20, 2003 rev., Standards for Protection Against Radiation.
4. 10 CFR, Part 21, 2003 rev., Reporting of Defects and Noncompliance.
5. 10 CFR, Part 40.42(c), 2001 rev., Expiration and termination of licenses and decommissioning of site and separate buildings or outdoor areas.
6. USACHPPM HPP SOP for DU Sampling Program at JPG, 10 March 2000.
7. ASSHP, 15 April 1998, JPG, Madison, IN.
8. ETL 385-1-2, 15 May 1995, Generic Scope of Work for Ordnance Avoidance Operations.
9. USAEHA Technical Guide 155, Environmental Sampling Guide, February 1993.
10. Letter, dated July 22, 1996, NRC, subject: Approval of the Environmental Radiation Plan and Security Plan.
11. USACHPPM Directorate of Laboratory Sciences, Radiologic, Classic and Clinical Chemistry Division, Final Analytical Reports, Program 26- Subjono 8260, Serial Numbers 146259 and 147081, DLS Profile #: 27705, Work Order #: 8057 and 8058, JPG, IN, 23 May and 16 July 2003.
12. 29 CFR, Part 1910.120, Hazardous Waste Operations and Emergency Response.

## APPENDIX B

### ABBREVIATIONS

ASSHP	Abbreviated Site Safety and Health Plan
CFR	Code of Federal Regulations
DAC	Department of the Army Civilian
DU	depleted uranium
ERM	Environmental Radiation Monitoring
HPP	Health Physics Program
IAW	in accordance with
JPG	Jefferson Proving Ground
MDC	Minimum Detectable Concentration
NRC	Nuclear Regulatory Commission
pCi/g	picocuries per gram
pCi/l	picocuries per Liter
pCi/ml	picocuries per milli liter
RSSO	Radiation Safety Staff Officer
SBCCOM	Soldier and Biological Chemical Command
SOP	standing operating procedure
USACHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
$\mu$ R/hr	microrentgen per hour

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## APPENDIX C

### SAMPLING LOCATIONS, SAMPLING PARAMETERS AND INSTRUMENTATION

<b>SOIL SAMPLES</b> (Refer to Appendix E for graphical representation)				
Sample ID	Sample Date	Exposure Reading ( $\mu\text{R/hr}$ )	Sample Locations	JPG ID Code
SOS1	23 Apr 03 @0915	8.32	Vicinity at Intersection of C-Road And Wonju Road	(S44)
SOS2	23 Apr 03 @1005	8.65	Vicinity at Intersection of E-Road And Morgan Road	(S48)
SOS3	23 Apr 03 @0945	8.31	0.5 miles east of Intersection at C-Road & East Recovery Road	(S43)
SOS4	23 Apr 03 @0855	7.95	Corner of Morgan Road And C-Road	(S47)
SOS5	16 Apr 03 @0915	7.91	Duplicate or Split Of SOS01	(S44)

SEDIMENT SAMPLES (Refer to Appendix E for graphical representation)				
Sample ID	Sample Date	Exposure Reading ( $\mu$ R/hr)	Sample Locations	JPG ID Code
SES1	22 Apr 03 @1325	5.69	West Perimeter Road Middle Fork Creek (Exits JPG property)	M1
SES2	22 Apr 03 @1305	5.21	Big Creek (Exits JPG property)	M2
SES3	22 Apr 03 @0935	5.20	Wonju Road Middle Fork Creek (Enters DU impact area)	M3
SES4	22 Apr 03 @1005	5.85	Big Creek (Enters DU impact area)	M4
SES5	22 Apr 03 @1200	6.20	Bridge No. 22 Big Creek	M5
SES6	22 Apr 03 @1040	4.94	Line of Fire Middle Fork Creek	M6
SES7	22 Apr 03 @0830	6.79	Bridge No. 12 @ Morgan Road Middle Fork Creek	M7
SES8	22 Apr 03 @0914	5.61	Bridge No. 13 @ Morgan Road Middle Fork Creek	M8
SES9	22 Apr 03 @1200	5.90	Duplicate or Split Of SES5	(M5)

<p align="center"><b>SURFACE WATER SAMPLES</b>                      (Refer to Appendix E for graphical representation)</p>				
<b>Sample ID</b>	<b>Sample Date</b>	<b>Exposure Reading (<math>\mu</math>R/hr)</b>	<b>Sample Locations</b>	<b>JPG ID Code</b>
SWS1	22 Apr 03 @1325	5.73	West Perimeter Road Middle Fork Creek (Exits JPG property)	SWBS
SWS2	22 Apr 03 @1305	5.78	Big Creek (Exits JPG property)	SWBN
SWS3	22 Apr 03 @0935	6.20	Wonju Road Middle Fork Creek (Enters DU impact area)	SWSE
SWS4	22 Apr 03 @1005	6.26	Big Creek (Enters DU impact area)	SWNE
SWS5	22 Apr 03 @1200	6.30	Bride No. 22 Big Creek	SWNB
SWS6	22 Apr 03 @1040	4.96	Line of Fire Middle Fork Creek	SWS
SWS7	22 Apr 03 @0830	7.25	Bridge No. 12 @ Morgan Road Middle Fork Creek	SWSW
SWS8	22 Apr 03 @0914	5.54	Bridge No. 13 @ Morgan Road Middle Fork Creek	SWNW
SWS9	22 Apr 03 @1200	6.10	Duplicate or Split Of SWS5	SWNB

GROUND WATER SAMPLE (Refer to Appendix E for graphical representation)						
Sample ID	Sample Date	Exposure Reading ( $\mu\text{R/hr}$ )	Sample Locations	Comments		
				pH	Temp ( $^{\circ}\text{C}$ )	Conductivity ( $\mu\text{mho}$ )
MW01	22 Apr 03 @0945	6.69	Well @ D Road and Wonju Road (perimeter DU impact area)	7.56	9.9	524.5
MW02	22 Apr 03 @1020	5.90	Well between C Road & Wonju Road (perimeter DU impact area)	7.23	11.2	634.5
MW03	22 Apr 03 @1055	5.24	Well between A Road and gate on Wonju Road (Perimeter DU impact area)	7.18	11.0	653.4
MW04	22 Apr 03 @1405	6.13	Well on South Perimeter Road (Along south border of JPG)	7.14	13.1	548.6
MW05	22 Apr 03 @0935	5.88	Well on D Road & Morgan Road (across Bridge No. 13) [perimeter of DU impact area]	7.25	9.9	382.4
MW06	22 Apr 03 @0840	7.34	Well @ C Road and Morgan Road (Perimeter of DU impact area)	7.44	11.7	572.4
MW07	22 Apr 03 @0812	7.42	Well @ Oakdale School House on Morgan Road (Perimeter DU impact area)	6.81	11.2	754.2
MW08	22 Apr 03 @1345	6.82	Well @ Southwest Corner of JPG (Along south border of JPG)	7.27	12.2	494.7
MW09	22 Apr 03 @1220	8.68	Well @ D Road and Bridge No.22 (Inside DU impact area)	7.42	12.8	6887
MW10	22 Apr 03 @1235	6.46	Well on Center Recovery Road (Inside DU impact area)	7.38	12.2	725.1
MW11	22 Apr 03 @1245	7.11	Well on D Road between Morgan and C Recovery Road (inside DU impact area)	7.59	9.8	359.2
MW12	22 Apr 03 @0950	5.73	Duplicate or Split of Sample MW2	7.37	11.1	529.2



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The following field instruments were used during the sample collection process of the monitoring program:

**Radiation Detection Instrument:**

Ludlum Model 2350 Data Logging Scaler/Ratemeter  
Serial Number: 120612  
Calibrated: 05 March 2003  
Calibration Due: 01 September 2003

Ludlum Model 44-10; 2"x2" Sodium Iodide (NaI) Scintillation Detector Serial Number:  
PR120486

**Water Quality Instrument:**

**PH, Temperature and Conductivity Meter:**

Myron L Company  
Serial Number: 608721

Operation verified using Myron L Company, NIST Traceable pH and Conductivity/TDS  
Standard Solutions.

Unit tested using solutions of pH=4, pH=7, and pH=10. For TDS/Conductivity, the solutions  
used were 442-1500 and KCI 1500

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#### **APPENDIX D**

##### **LABORATORY RESULTS OF ENVIRONMENTAL SAMPLES JEFFERSON PROVING GROUND APRIL 2003**

The following tables are summaries of the laboratory analyses. The complete results are reported in the USACHPPM Directorate of Laboratory Sciences, Radiologic, Classic and Clinical Chemistry Division, Final Analytical Report, Program 26-Subjono 8260, Serial Numbers 147081 and 146259, DLS Profile #: 27705, Work Order#s: 8057 and 8088, JPG, IN 23 May and 16 July 2003.

Water Samples  
(Established Action Level 150 pCi/l)

Monitoring Well Samples		
Field Sample Number	Total Uranium (pCi/l)	MDC* (pCi/l)
MW01	.311	.00667
MW02	.900	.00667
MW03	.629	.00667
MW04	.740	.00667
MW05	.280	.00667
MW06	2.44	.00667
MW07	1.47	.00667
MW08	.460	.00667
MW09	.583	.00667
MW10	1.44	.00667
MW11	.125	.00667
MW12	.318	.00667

Surface Water Samples		
Field Sample Number	Total Uranium (pCi/l)	MDC* (pCi/l)
SWS01	.127	.00667
SWS02	.248	.00667
SWS03	.0592	.00667
SWS04	.105	.00667
SWS05	.214	.00667
SWS06	.0525	.00667
SWS07	.0697	.00667
SWS08	.310	.00667
SWS09	.226	.00667

\* MDC – Minimum Detectable Concentration

Sediment and Soil Samples  
(Established Action Level – 35 pCi/g)

Sediment Samples		
Field Sample Number	Thorium-234 (pCi/g)	MDC (pCi/g)
SES01	$7.40\text{E-}2 \pm 1.05\text{E-}1$	4.87E-1
SES02	$1.75\text{E-}1 \pm 1.05\text{E-}1$	5.70E-1
SES03	$2.12\text{E-}1 \pm 1.47\text{E-}1$	5.69E-1
SES04	$-1.76\text{E-}2 \pm 2.65\text{E-}1$	4.72E-1
SES05	$-1.46\text{E-}2 \pm 2.84\text{E-}1$	5.04E-1
SES06	$8.20\text{E-}2 \pm 9.06\text{E-}2$	5.22E-1
SES07	$1.36\text{E-}1 \pm 1.29\text{E-}1$	5.50E-1
SES08	$1.38\text{E-}1 \pm 1.31\text{E-}1$	4.87E-1
SES09	$1.84\text{E-}1 \pm 1.08\text{E-}1$	5.02E-1

Soil Samples		
Field Sample Number	Total Uranium (pCi/g)	MDC (pCi/g)
SOS01	$3.11\text{E-}1 \pm 1.67\text{E-}1$	5.98E-1
SOS02	$1.47\text{E-}1 \pm 1.30\text{E-}1$	5.84E-1
SOS03	$1.30\text{E-}1 \pm 1.11\text{E-}1$	5.47E-1
SOS04	$9.74\text{E-}2 \pm 1.37\text{E-}1$	5.35E-1
SOS05	$1.80\text{E-}1 \pm 1.12\text{E-}1$	6.05E-1

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21-23 Apr 03

#### **APPENDIX E**

#### **JEFFERSON PROVING GROUND ENVIRONMENTAL MONITORING SAMPLE LOCATIONS**

*Jefferson Proving Ground: DU Sampling*  
**GROUNDWATER MONITORING WELLS**



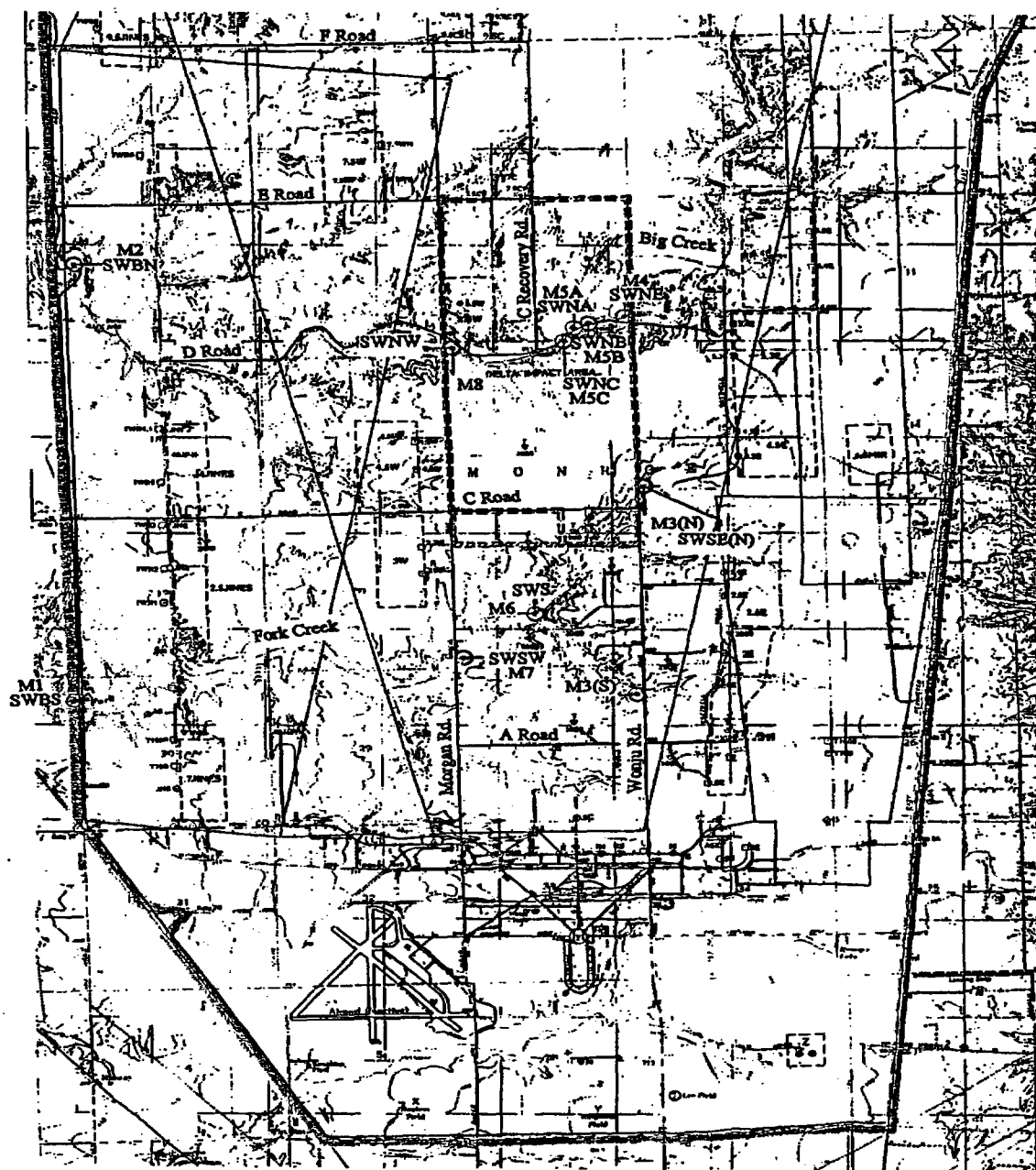
Figure 1: Groundwater samples (Sept. 1997)

**Jefferson Proving Ground: DU Sampling  
SOIL SAMPLES**



Figure 2: Soil Samples (Sept. 1997)

**Jefferson Proving Ground: DU Sampling  
SURFACEWATER & SEDIMENT SAMPLES**



**Figure 3: Surfacewater & Sediment Samples (Sept. 1997)**