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DEPARTMENT OF THE ARMY
HEADQUARTERS, U.S. ARMY TEST AND EVALUATION COMMAND
314 LONGS CORNER ROAD
ABERDEEN PROVING GROUND MD 21005-5055

REPLY TO ATTENTION OF

August 10, 1999

Safety Division

Mr. Larry W. Camper
Chief, Decommissioning Branch
Division of Waste Management
Office of Nuclear Material Safety and Safeguards
United States Nuclear Regulatory Commission
Washington, DC 20555-0001

Dear Mr. Camper:

A revised Environmental Radiation Monitoring (ERM) Plan for Jefferson Proving Ground (JPG) is attached for your review and approval. The only change requested is in paragraph 5a, Periodic Sampling Program, where the number of soil sample locations is changed from six to four. Two soil sampling locations have been removed. These locations were near the center of the impact area along the firing line for depleted uranium (DU) testing. Four other soil sampling locations located at the corners of the DU impact area remain unchanged.

This change is requested for the following reasons: (1) The two sampling locations are in an area which has been well documented as an area contaminated by DU, so no new information is gained by sampling in this area; (2) the area is heavily contaminated by unexploded ordnance, so personnel performing sampling are exposed to a significant personal risk; and (3) the ERM Plan is not degraded by the removal of the two soil sampling locations.

Please contact Mr. Robert A. Aaserude at (410) 278-1308 for additional information regarding this action.

Sincerely,

for Dal M. Nett
Chief, Safety Division
Directorate for Support Mission

Enclosure

Copies furnished:
Docket, U.S. Nuclear Regulatory Commission
Commander, U.S. Army Materiel Command, ATTN: AMCSF-P/AMCSG-R

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U.S. ARMY TEST AND EVALUATION COMMAND

ENVIRONMENTAL RADIATION MONITORING (ERM) PLAN FOR JEFFERSON PROVING GROUND (JPG)

1. Purpose. An ERM plan is established at JPG to define the potential for transport of radioactive material resulting from test and test-related activities through the environment to man. Primary emphasis will be placed on the potential radiation exposure to man, but concern also exists regarding potential impact on plants and animals.

2. Scope. Evaluation of the potential environmental impact of radioactive materials is required for programs regulated by the Nuclear Regulatory Commission (NRC). Previous tank penetrator tests involved firing depleted uranium (DU) projectiles through "soft" targets (usually wood or canvas). These tests were nondestructive (aerosolization did not occur), although the round may have fragmented upon striking the earth and other obstacles.

3. Responsibilities.

a. Radiation Protection Officer (RPO). The RPO will:

(1) Prepare all ERM plans and keep them current.

(2) Use the ERM to define the potential population at JPG that may be at risk of radiation exposure.

(3) Act as the Contracting Officer's Representative (COR) for contracts let to sample/analyze radioactive material in the environment.

(4) Assure that appropriate quality assurance procedures are being implemented according to the general format in NRC Regulatory Guide 4.15.

(5) Present sampling data and conclusions to the TECOM Radiation Control Committee (RCC) on a regular basis for review and concurrence by the RCC.

b. Environmental Quality Coordinator (EQC). The EQC will:

(1) Provide, as input to the ERM, definitions of potential pathways for movement of radioactive and/or toxic materials, specifically including any pathways known as food chains.

(2) Assist the RPO in defining and establishing sampling locations based on known or suspected pathways.

(3) Review sampling data to determine the presence and potential exposure of plants, animals, and the general public (i.e., off post) to radioactive materials.

c. Radiation Control Committee (RCC). As related to the ERM, the committee is to review data collected for the ERM and to provide guidance to the RPO on program management.

ENCLOSURE

4. Criteria for Establishing a Sampling Program.

a. Pathway analysis.

(1) Radioactive material released in the environment has the potential of affecting man, plants, and animals. Determination of important pathways is based on the method of radioactive material release, environmental transport considerations, and man's use of the environment. Any pathway that has the potential of increasing the risk of human exposure to radioactive material is considered to be critical, with second priority established for pathways that are highly visible and are perceived by the general public to be significant relative to their health, income, or recreation. Ecological significance is based on increased risk to endangered or protected plants and animals or gradual but perceptible changes in the distribution of plant species and their associated animal assemblages. Pathways of potential DU transport to man are analyzed in accordance with NUREG-0475, Radiological Environmental Monitoring by NRC Licensees for Routine Operations of Nuclear Facilities; the National Council on Radiation Protection and Measurement (NCRP) Report No. 50, Environmental Radiation Measurements; and the NRC Regulatory Guide 4.15.

(2) Pathways are evaluated for significance based on the following criteria:

(a) The radioactive material release will exceed limits on radiation levels in unrestricted areas given in 10 CFR 20.

(b) Proposed operations are an "important" pathway (appreciable radiation exposure potential for man) or of significant public interest (NUREG-0475).

(c) Proposed operation could alter existing ecological relationships.

(3) Evaluation of water transport pathways.

(a) Source (uranium oxides formed by weathering of solid metallic particles; i.e., from tank penetrator fragments).

Soil → Water (storm runoff) → Big Creek → Muscatatuck River→

→ White River → Wabash River → Ohio River

Potential contamination of the waterways outside JPG is considered highly unlikely. The Muscatatuck River is 30-40 miles away from the test site, so even without additional dilution occurring during runoff and without losses due to deposition on soil during runoff, water contamination is considered unlikely. The ground surface is at 800 feet above MSL. The area has approximately 44 inches of rainfall per year, ranging from a low of 1.75 inches in October to a high of 6.98 inches in March. Although a waterborne pathway to man cannot be postulated, neither can it be denied, since the ability of runoff to move material may cause the migration of some test residues from the impact area into drainage watershed. The monitoring program will evaluate the movement of this material.

(b) Source (uranium oxides formed by weathering of solid metallic particles; i.e., tank penetrator fragments).

Soil → Rain/Runoff → Vegetation → Animals → Predators

Soil → Rain/Runoff → Vegetation → Animals → Man

Natural uranium affects plant metabolism in a variety of ways, depending primarily on the concentration in the soil. Uranium absorption in plants occurs primarily in roots and seeds rather than leaves, and is affected by a variety of soil factors. However, since only about 1 percent of the ingested material is absorbed in the intestine (reference 7), the likelihood of this becoming a significant pathway to man is very remote.

(c) Source (uranium oxides formed by weathering of solid metallic particles; i.e., tank penetrator fragments).

Soil → Ground Water → Man

The soil in the impact area is primarily Clermont and Avonburg in the high, level areas and Cincinnati and Rossmoyne in the creek valleys. The following extracts are taken from the description of these soil types by the Soil Conservation Service, U.S. Department of Agriculture.

"The Clermont series consists of deep, nearly level, poorly drained soils that have very firm and brittle layers beginning at a depth of 30 to 48 inches. These soils of the uplands are on high, broad ridges. They formed in loess and the underlying loamy glacial till. Permeability is very slow below a depth of about 40 inches. The available water capacity is moderate. The organic matter content is low. Runoff is slow. Depth to the seasonal high water table is 0 to 1 foot. Wetness and the very slow permeability are the major limitations in the use and management of this poorly drained soil. The very slowly permeable layer restricts the downward movement of water and the absorption of effluent in septic tank absorption fields."

"The Avonburg series consists of deep, somewhat poorly drained soils that have a very firm and brittle fragipan beginning at a depth of about 20 to 36 inches. These soils of the uplands are nearly level on broad ridges and gently sloping on broad upland breaks. They formed in loess and the underlying loamy glacial till. Permeability is very slow in the fragipan. The available water capacity is moderate. The organic matter content generally is low. Depth to the seasonal high water table is 1 to 3 feet."

"The Cincinnati series consists of deep, well-drained soils that have a very firm and brittle fragipan beginning at a depth of 20 to 30 inches. These soils of the uplands are gently sloping to moderately sloping on narrow ridges and breaks, and they are moderately sloping and strongly sloping on hillsides. They formed in loess and the underlying loamy glacial till. Runoff and erosion are the major hazards, and the very slowly permeable fragipan is the major limitation in the use and management of this soil. The fragipan restricts root growth, the downward movement of water, and the absorption of effluent in septic tank absorption fields."

"The Rossmoyne series consists of deep, moderately well-drained soils that have a very firm and brittle fragipan beginning at a depth of about 20 to 30 inches. These soils of the uplands are nearly level and gently sloping on narrow ridges and gently sloping on short breaks. They formed in loess and the underlying loamy glacial till. Permeability is very slow in the fragipan, and the available water capacity is moderate. The organic matter content is low. Depth to the water table is 3 to 6 feet. Runoff and erosion are the major hazards, and the very slowly permeable fragipan is the major limitation in the use of management of this moderately well-drained soil. The fragipan restricts the penetration of roots, the downward movement of water, and the absorption of effluent in septic tank absorption fields."

SOIL CHART SUMMARY FOR JEFFERSON PROVING GROUND

Soil % Area	Type	Class	Slope	Drainage	Location
Clermont 32%	571	III	0-2%	Poor	Upland
Avonburg 20%	572	III	0-2%	Poor	Upland
Rossmoyne 14%	573	III	2-10%	Fair	Sloping Upland
Cincinnati 12%	574	IV	2-10%	Fair	Sloping Upland
Grayford 12%	594	IV	0-10%	Fair	2d Benches
Hayman 2%	74	I&II	0-10%	Good	Bottom
Stendil 6%	92	I&II	0-10%	Good	Bottom

Rock Outcrops, Cliffs, Mixed Alluvial Land

This soil has such low permeability that it effectively seals the surface water from the groundwater which is contained in layers of limestone. The major creeks have eroded the limestone to the extent that the surface water level is below the level of the groundwater. Occasionally, due to this phenomenon, a spring will feed groundwater into the surface water, but not vice versa. The only mechanism that would feed surface water into the groundwater would be the existence of a sinkhole, where the permeable limestone layers have collapsed and are exposed to surface waters. Since there are no sinkholes in the impact area, it can be concluded that there is no transport from surface water to groundwater. Therefore, intake by this route does not appear to be of significant concern.

5. Periodic Sampling Program.

a. Soil Samples. Four sample locations, one at each corner of the DU impact area (Figure 1). These samples will be used to determine if DU is moving away from the center of the DU impact area. Samples will be taken semiannually, unless action level is exceeded, and quarterly as long as corrective action is required.

b. Sediment Samples. In each of the two streams, three sediment samples will be taken downstream and one upstream, as a control, from the impact area for the DU penetrator programs (Figure 2). These samples will be taken to determine if any DU particles have entered the stream. Samples will be taken from low spots or bends when possible. One sample will be at the point where drainage from an impact area initially enters the stream. One sample will be from a point located midway between the initial sample and the installation boundary. The final downstream sample will be taken at the installation boundary. Samples will be taken semiannually, unless the action level is exceeded, and quarterly as long as corrective action is required.

c. Water Samples.

(1) Surface Water. In each of the two streams, three water samples will be taken downstream and one upstream to serve as a control from the impact area for the DU penetrator programs to determine the migration of soluble uranium compounds (Figure 2). One sample will be taken at the point where the drainage area enters the stream. One sample will be taken from a point located midway between the initial sample and the installation boundary. The final downstream sample will be at the installation boundary. Samples will be taken semiannually, unless the action level is exceeded, and quarterly as long as corrective action is required.

(2) Ground Water. Eleven ground monitoring wells have been installed (Figure 2). Ground monitoring wells are approximately 40 feet deep. If DU migrates to the ground water, it is expected to be detected in the three wells in the impact area first. The two wells located near the south perimeter are considered to be background samples because they are upstream from the impact area. Samples are collected semiannually. If action levels are exceeded, quarterly sampling will be initiated as long as corrective action is required.

d. Sample Analysis. Analysis of all environmental samples will be performed by a recognized commercial laboratory in conformance with the standards established in references 1, 2, and 3. In particular, the analytical techniques using mass or alpha spectroscopy should be capable of a lower limit of detection that does not exceed 5% of the applicable action levels.

e. Action Levels.

(1) Every effort will be made to maintain radiation exposures and releases of radioactive and non-radioactive toxic metals to unrestricted areas as low as reasonably achievable (ALARA).

(2) The following criteria for the restricted area will be used to limit (DU) exposure.

Soil: DU (reference 8):

o Perimeter and background samples:

< 35 pCi/g - no corrective action

> 35 pCi/g - collect 5 additional samples in a 1-meter square grid

If average is still > 35 pCi/g, decontaminate to levels of 35 pCi/g.

Water: DU (Note: the 10 CFR 20, Appendix B limit is 3.0×10^{-1} pCi/ml):

< 1.5×10^{-1} pCi/ml - no corrective action

> 1.5×10^{-1} pCi/ml - resample; if results are > 1.5×10^{-1} pCi/ml, investigate to determine reason for the high level and notify the NRC.

(2) Basis for Action. If any of the action levels are exceeded, an evaluation of cause will be performed by the RPO. The RPO will provide a report of findings to the RCC. Based on their determination, recommendations to the commander on corrective action will be made.

REFERENCES

1. Radiological Environmental Monitoring by NRC Licensees for Routine Operations of Nuclear Facilities, NUREG-0475, Nuclear Regulatory Commission, September 1978.

2. Environmental Radiation Measurements, NCRP Report No. 50, National Council on Radiation Protection and Measurements, December 1976.

3. EML Procedures Manual, HASL-300, Environmental Measurements Laboratory, U.S. Department of Energy, 1972.

4. Ionizing Radiation Protection, JPGM 385-7, U.S. Army Jefferson Proving Ground, March 1983.

5. Soil Survey of Jefferson County, Indiana (to be published 1983), U.S. Department of Agriculture, Soil Conservation Service.

6. Letter, HSE-RH, QA, USAEHA, 14 March 1978, subject: Decontamination Criteria for Radioactive Materials at Weldon Spring Chemical Plant (WSCP).

7. Programmatic Life Cycle Environmental Assessment of Depleted Uranium (Draft), Chemical Systems Laboratory, APG, December 1982.

8. Review of the Environmental Quality Aspects of the TECOM DU Program at Jefferson Proving Ground, Indiana, 1984.

9. Ebinger, M. H., and Hansen, W. R., Jefferson Proving Ground Data Summary and Risk Assessment, LA-UR-96-835, Los Alamos National Laboratory, February 1996.

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To L. PITTIGLIO	From BOB AASERUDE
Dept./Agency US NRC	Phone # 410-278-1308
Fax # 301-415-5397	Fax #

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