APPLICATION FOR RENEWAL OF NRC LICENSE

CONTENTS

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NRC FORM 313 U. S. NUCLEAR REGULATORY COMMISSION

(8-1999)
10 CFR 30, 32, 33
34, 35, 36, 39 and 40

APPLICATION FOR MATERIAL LICENSE

APPROVED BY OMB: NO. 3150-0120 EXPIRES:08/31/2002

Estimated burden per response to comply with this mandatory information collection request: 7.4 hours. Submittal of the application is necessary to determine that the applicant is qualified and that adequate procedures exist to protect the public health and safety. Send comments regarding burden estimate to the Records Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to bjs1@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0120), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

INSTRUCTIONS: SEE THE APPROPRIATE LICENSE APPLICATION GUIDE FOR DETAILED INSTRUCTIONS FOR COMPLETING APPLICATION. SEND TWO COPIES OF THE ENTIRE COMPLETED APPLICATION TO THE NRC OFFICE SPECIFIED BELOW.

APPLICATION FOR DISTRIBUTION OF EXEMPT PRODUCTS FILE APPLICATIONS WITH:

DIVISION OF INDUSTRIAL AND MEDICAL NUCLEAR SAFETY
OFFICE OF NUCLEAR MATERIALS SAFETY AND SAFEGUARDS
U.S. NUCLEAR REGULATORY COMMISSION
WASHINGTON, DC 20555-0001

ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS:

IF YOU ARE LOCATED IN:

CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, MAINE, MARYLAND, MASSACHUSETTS, NEW HAMPSHIRE, NEW JERSEY, NEW YORK, PENNSYLVANIA, RHODE ISLAND, OR VERMONT, SEND APPLICATIONS TO:

LICENSING ASSISTANT SECTION
NUCLEAR MATERIALS SAFETY BRANCH
U.S. NUCLEAR REGULATORY COMMISSION, REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PA 19406-1415

ALABAMA, FLORIDA, GEORGIA, KENTUCKY, MISSISSIPPI, NORTH CAROLINA, PUERTO RICO, SOUTH CAROLINA, TENNESSEE, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA, SEND APPLICATIONS TO:

SAM NUNN ATLANTA FEDERAL CENTER
U. S. NUCLEAR REGULATORY COMMISSION, REGION II
61 FORSYTH STREET, S.W., SUITE 23T85
ATLANTA, GEORGIA 30303-8931

IF YOU ARE LOCATED IN:

ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND APPLICATIONS TO:

MATERIALS LICENSING SECTION
U.S. NUCLEAR REGULATORY COMMISSION, REGION III
801 WARRENVILLE RD.
LISLE, IL 60532-4351

ALASKA, ARIZONA, ARKANSAS, CALIFORNIA, COLORADO, HAWAII, IDAHO, KANSAS, LOUISIANA, MONTANA, NEBRASKA, NEVADA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, OREGON, PACIFIC TRUST TERRITORIES, SOUTH DAKOTA, TEXAS, UTAH, WASHINGTON, OR WYOMING, SEND APPLICATIONS TO:

NUCLEAR MATERIALS LICENSING SECTION
U.S. NUCLEAR REGULATORY COMMISSION, REGION IV
611 RYAN PLAZA DRIVE, SUITE 400
ARLINGTON, TX 76011-8064

PERSONS LOCATED IN AGREEMENT STATES SEND APPLICATIONS TO THE U.S. NUCLEAR REGULATORY COMMISSION ONLY IF THEY WISH TO POSSESS AND USE LICENSED MATERIAL IN STATES SUBJECT TO U.S.NUCLEAR REGULATORY COMMISSION JURISDICTIONS.

1. THIS IS AN APPLICATION FOR *(Check appropriate item)*

- [ ] A. NEW LICENSE
- [ ] B. AMENDMENT TO LICENSE NUMBER _____
- [X] C. RENEWAL OF LICENSE NUMBER 01-02861-05

2. NAME AND MAILING ADDRESS OF APPLICANT *(Include Zip code)*

Commandant
U.S. Army Chemical School
401 MANSCEN Loop, Suite 1843
Fort Leonard Wood, MO 65473-8926

3. ADDRESS(ES) WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED

Located in the northwest corner of Pelham Range, National Guard Training Center.
Coordinates 593300 meters east, 3732500 meters west
in Universal Transverse Mercator (UTM) Grid Zone 16.
Pelham Range is located of US Highway 431, northwest of Anniston, Alabama.

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION

John W. May

TELEPHONE NUMBER

(573) 596-0131 ext. 3-6224

SUBMIT ITEMS 5 THROUGH 11 ON 8-1/2 X 11" PAPER. THE TYPE AND SCOPE OF INFORMATION TO BE PROVIDED IS DESCRIBED IN THE LICENSE APPLICATION GUIDE.

5. RADIOACTIVE MATERIAL.
a. Element and mass number; b. chemical and/or physical form; and c. maximum amount which will be possessed at any one time.

6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED.

7. INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING EXPERIENCE.

8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS.

9. FACILITIES AND EQUIPMENT.

10. RADIATION SAFETY PROGRAM.

11. WASTE MANAGEMENT.

12. LICENSEE FEES *(See 10 CFR 170 and Section 170.31)*

FEE CATEGORY | AMOUNT ENCLOSED $

13. CERTIFICATION. *(Must be completed by applicant)* THE APPLICANT UNDERSTANDS THAT ALL STATEMENTS AND REPRESENTATIONS MADE IN THIS APPLICATION ARE BINDING UPON THE APPLICANT.

THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATION ON BEHALF OF THE APPLICANT, NAMED IN ITEM 2, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PARTS 30, 32, 33, 34, 35, 36, 39 AND 40, AND THAT ALL INFORMATION CONTAINED HEREIN IS TRUE AND CORRECT TO THE BEST OF THEIR KNOWLEDGE AND BELIEF.

WARNING: 18 U.S.C. SECTION 1001 ACT OFJUNE 25, 1948 62 STAT. 749 MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION.

CERTIFYING OFFICER -- TYPED/PRINTED NAME AND TITLE	SIGNATURE	DATE
PATRICIA L. NILO, Brigadier General, U.S. Army, Commandant		18 Jan 02

FOR NRC USE ONLY

TYPE OF FEE	FEE LOG	FEE CATEGORY	AMOUNT RECEIVED	CHECK NUMBER	COMMENTS
			$		
APPROVED BY				DATE	

PRINTED ON RECYCLED PAPER

DEPARTMENT OF THE ARMY
US ARMY CHEMICAL SCHOOL
401 MANSCEN LOOP
FORT LEONARD WOOD, MISSOURI 65473-8926

REPLY TO
ATTENTION OF:

January 18, 2002

Health Physics Office

Mr. Douglas M. Collins, Director
U. S. Nuclear Regulatory Commission, Region II
Division of Nuclear Materials Safety
Sam Nunn Atlanta Federal Building
61 Forsyth Street SW Suite 23T85
Atlanta, GA 30303-8931

Dear Sir:

Request that NRC Materials License number 01-02861-05, docket number 030-17584, be renewed. The license is for possession and decommissioning. The major changes are to the decommissioning plan and schedule and can be found at Tab C. Also included are the work plan for groundwater investigation found at Tab J and the scope of work for the aerial survey at Tab K.

If you have any questions or require clarification, contact Mr. John May at (573) 596-0131 extension 3-6224.

Sincerely,

Patricia L. Nilo
Brigadier General, U.S. Army
Commandant

5. RADIOACTIVE MATERIAL.

a. Element & Mass Number	b. Chemical/Physical Form	c. Maximum amount
Cobalt 60	Residual Contamination	50 millicuries
Cesium 137	Residual Contamination	1 millicurie
Strontium/Yittrium 90	Residual Contamination	1 millicurie

6. PURPOSES FOR WHICH LICENSED MATERIAL WILL BE USED:

For possession of residual contamination and to perform decontamination and decommissioning activities.

Changes to the Decommissioning Plan and a revised schedule are attached.

See:
Tab I: Decommissioning Plan prepared by Allied Technology Group
Tab J: Work Plan for Groundwater Investigation prepared by IT Corporation.
Tab K: Scope of work for aerial survey.

The following are changes to the Decommissioning Plan (D Plan) for the Ft. McClellan Burial mound on Pelham Range.

In the period between the approval of the D Plan and commencing operations there have been several organizational changes at ATG, Inc. Additionally, after commencing work on Pelham Range it was determined that several of the operations proposed in the Decommissioning Plan were impractical or impossible to achieve. The following changes reflect the current status of the operation.

Operational Changes

1. All references to onsite gamma spectroscopy should be deleted. Unstable/dirty power supplied from portable generators and gain shifts caused buy temperature shifts in the site trailer made useful onsite gamma spectroscopy impossible to achieve. Offsite gamma spectroscopy is provided by ATG laboratories in WA and TN.
2. All schedules in the plan are invalid. The project is currently nearly completed. Barring major weather delays all operations will be completed by the end of February.
3. Section 2.4 states that there are no sub-contractors on the project. DNL Company of Oakland, CA is currently subcontracted to provide much of the current onsite work. This subcontract was initiated after ATG, Inc. entered bankruptcy on 3 Dec 2001. Subcontracting support allowed financial flexibility needed to continue and complete the project.
4. The plan refers to certain persons and companies by name as providing support, specifically Auxier and Assoc. and Dr. Jim Berger. Reviews will be performed by a CHP and CHP/MARSSIM support is available, although not necessarily by these persons or companies.
5. Section 2.1 refers to "systematic samples" to confirm effectiveness of the survey. This has been achieved by collection of daily soil samples from the scanned material.
6. Section 4.1 describes sloping the sides of the excavation for safety purposes. A professional engineer (PE) has inspected the site with regard to soil type and excavation safety. The PE determined that sloping is not required and has provided a memo to this effect for the project records.
7. Section 4.4 refers to stockpiling surveyed material in 6" lifts. This was a carryover from the text of a previous project of similar scope. This method was not necessary and was not used on this project.
8. Section 6.8.4 stated that USA CHPPM established the decision errors for the project when in fact the decision errors were established by HQ, OSC.
9. Section 6.10. The student T test from NUREG-5849 is unnecessary and will not be performed.
10. Drawings provided with the plan are inaccurate. The site configuration was changed for several reasons. Ft. McClellan personnel requested that we keep the operations south of the road on the north boundary of the controlled area and not impact the bivouac area to the north of the site. The Final Status Survey maps will represent the site as it is configured and will define the appropriate survey units. All survey units will continue to be treated as class 1 areas.
11. All references to instruments by company model number (e.g., Ludlum Model 3) are for example and instrumentation of equal or better detection capability and sensitivity may be substituted.
12. Excavations that are not related to the decontamination effort will not be treated as affected material and will not be screened or surveyed.
13. Reprofiling the material to reflect higher activity levels has caused delays in shipping to Envirocare.

Organizational Changes

1. With the exception of Fred Feizollahi, none of the personnel listed is involved in the project. Wade Fillingame is the PM and Broker, Steve Thompson is the Site H&S/HP supervisor. Angel James has provided UXO coverage.

20 December, 2001

Ft. McClellan, Pelham Range, Burial Mound
Proposed Schedule

- **17 Dec through 22 Dec** Re-mobilize equipment and personnel. Complete training and excavation of affected material. Will work Sat if necessary to complete.

- **23Dec through 25 Dec** Christmas Holiday

- **26 Dec through 29 Dec** Remob with 3 personel to perform site management operations. Excavated soil will have to be moved and staged for screening.

- **30 Dec through 1 Jan** New Years Holiday

- **2 Jan** Remobilize all personnel to site including Robert Doyan and Charles Cronister.

- **3 Jan through 5 Jan** prepare site to complete sloping of excavation. This will require moving all affected soils from the area used to store the soil from the slopes and performing a survey of the area that will become a part of the Final Status Survey.

- **7 Jan through 12 Jan** complete sloping and begin screening. UXO tech will not be required after the sloping excavations are completed. De-mob the excavator and return it to the rental company. Ship discreet sources to the DCF.

- **14 Jan through 19 Jan** continue screening operations. It is my expectation that screening operations will continue until the **end of February**. Sample the bottom of the excavation and split samples with the NRC. Once we and the NRC agree that the bottom of the excavation is clean we can stop staging clean material and begin backfilling the excavation. This is important to minimize the site footprint and will allow us to avoid a re-mobilization to grade and backfill the site.

- Around the week of **24 January** I expect to re-examine the contents of at least 4 and up to 8 intermodal boxes to look for material that does not comply with the requirements of the Envirocare WAC.

- Late February mobilize a small bulldozer to the site for a week to perform site grading.

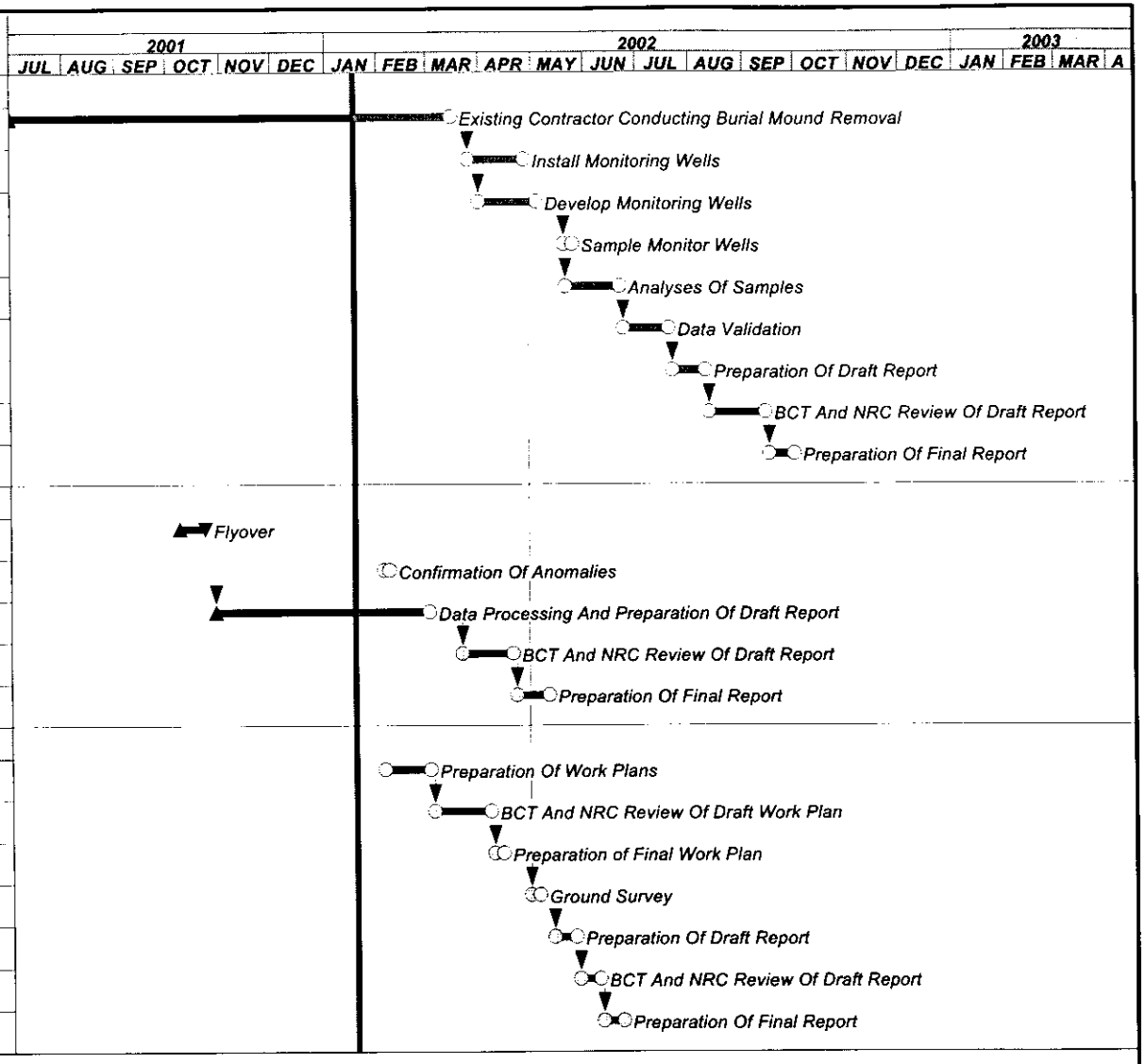
- Complete the onsite portion of the project and demobilize all personnel and equipment by 8 March.

It is my intention to work 10 hours per day, 6 days per week for the duration of the project.

BIG DISCLAIMER→ This schedule does not allow for major weather delays.

The period of time between now and 12 Jan requires the most coordination to meet the schedule.

Activity ID	Early Start	Early Finish	Orig Dur	Rem Dur
Monitoring Wells				
10	02JUL01A	15MAR02	185*	41*
12	25MAR02	26APR02	25	25
14	01APR02	03MAY02	25	25
16	20MAY02	24MAY02	5	5
18	21MAY02	21JUN02	24	24
20	24JUN02	19JUL02	20	20
22	22JUL02	09AUG02	15	15
24	12AUG02	13SEP02	25	25
26	16SEP02	30SEP02	11	11
Radiological Flyover				
28	08OCT01A	22OCT01A	11	0
30	04FEB02*	06FEB02	3	3
32	29OCT01A	01MAR02	90	31
34	21MAR02	19APR02	22	22
36	22APR02	10MAY02	15	15
Ground Survey Over Remediated Mound				
38	04FEB02*	01MAR02	20	20
40	04MAR02	05APR02	25	25
42	08APR02	12APR02	5	5
44	29APR02	03MAY02	5	5
46	13MAY02	24MAY02	10	10
48	27MAY02	07JUN02	10	10
50	10JUN02	21JUN02	10	10



Start Date	01OCT01
Finish Date	30SEP02
Data Date	18JAN02
Run Date	18JAN02 11:09

© Primavera Systems, Inc.

RAD1

Fort McClellan- CK10 WAD 13
Radiological/Rideout Field

Sheet 1 of 1

Early Bar
Progress Bar
Critical Activity

7. INDIVIDUALS RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING/ EXPERIENCE.

Primary - John W. May (resume attached)

PERSONAL INFORMATION WAS REMOVED
BY NRC.

JOHN W. MAY, JR., [redacted]

1. General Educational Background:

Thomas Edison State College, 1992, 59 Semester hours towards BS in Applied Science and Technology, concentration in Radiation Protection. Includes the following credits:

Nuclear Physics	3 sem hrs
Radiological Safety	3 sem hrs
Radiological Science: Bio/Chem	3 sem hrs
Radiation Protection & Control	8 sem hrs
Radiation Detection & Measurement	8 sem hrs
Applied Health Physics	8 sem hrs
Radiochemical Laboratory	1 sem hr
Chemistry	6 sem hrs
Analytical Chemistry	4 sem hrs
Applied Organic Chemistry	4 sem hrs
Chemical Laboratory Techniques	2 sem hrs
Chemical Safety	1 sem hr
Physical Science	3 sem hrs

2. Formal Training in Radiation Safety:

Categories:

A. Principles and Practices of Radiation Protection:
B. Radioactivity Measurement Standardization & Monitoring Techniques & Instruments
C. Mathematics and Calculations Basis to the Use and Measurement of Radioactivity
D. Biological Effects of Radiation

Training	Course, location, duration and date Completed
A, B, C, D	Radiological Laboratory Procedures and Radiation Physics, Chemical Laboratory rocedures Course, US Army Chemical School, Ft McClellan, AL, 13 weeks, 1980.
A, B, C, D	Radiological Safety Course, U.S. Army Chemical School, Ft McClellan, AL, 120 hours, 1980.
A, B, C, D	Operational Radiation Safety Course, U.S. Army Chemical School, Ft McClellan, AL, 40 hours, 1989.
A, D	Internal Dosimetry Course, given by Oak Ridge National Laboratories at Ft Belvoir RD&E Center, 32 hours (CEU), Jun 1991.
A, B, C	Radioactive Materials Training Course, Department of Energy, Atlanta, GA,40 hours, 1989.

PERSONAL INFORMATION WAS REMOVED
BY NRC.

A, B, C, D	Radioactive Materials Shipping Regulatory Awareness Course, Chem-Nuclear Systems, Columbia, SC, 40 hours, 1986.
D	Laser Microwave Hazards Workshop, USA Environmental Hygiene Agency, APG, MD, 40 hours, Mar 1982.
D	Laser Radiation Hazards Course, USA Environmental Hygiene Agency, Redstone Arsenal, AL, 16 hours, Sep 1991.

3. Experience with Ionizing Radiation:

July 1999 to present: U.S. Army Chemical School, Fort Leonard Wood, MO 65473. Health Physics Manager and Primary Radiation Safety Officer for U.S. Army Chemical School.

Duties: Responsible for a broad health physics program. Manage two NRC Licenses, one of which is a broad scope license for R&D and educataion at the Chemical School and one is for decommissioning of an old radiological waste burial site at Fort McClellan, AL. License Numbers: 24-32221-01 and 01-02861-05.

February 1991 to July 1999: U.S. Army Chemical School, Fort McClellan, AL 36205. Health Physics Manager for US Army Chemical School and Radiological Protection Officer for Fort McClellan, AL.

Duties: Responsible for a broad health physics program. Managed three NRC Licenses, one of which is a broad scope license for R&D and educataion and one is for decommissioning of an old radiological laboratory facility and hot cell. License Numbers: 01-02861-04, 01-02861-05, and SNM 1877. Passed the examination for the National Registry of Radiation Protection Technologists (NRRPT) in 1991.

January 1986 to February 1991: Edwin R. Bradley Radiological Laboratory, U.S. Army Chemical School, Fort McClellan, AL 36205. Training Instructor in Radiation Safety. Alternate Radiation Protection Officer for Fort McClellan.

Duties: Taught aspects of basic atomic physics, health physics and radiological safety. Responsible for development of texts and training materials for the Radiological Safety course at Fort McClellan. Principle instructor for the Radiological Safety Course. Appointed as the principle radiation safety officer for the Radiological Training Division, U.S. Army Chemical School, and as a member of the Installation Ionizing Radiation Control Committee.

September 1980 to November 1982: Radiological Division, U.S. Army Chemical School, Fort McClellan, AL 36205. Radiological Laboratory Technician, Radiation Safety Officer, Principle Instructor for Radiological Laboratory Procedures, Instructor for Radiological Safety Course 7K-F3. Alternate Radiation Protection Officer for Fort McClellan and the Chemical School.

Duties: Performed radiological analysis of unidentified radioisotopes; ensure compliance with Health Physics Regulations and NRC licenses at the U.S. Army Chemical School; served as Senior Radiological Laboratory Technician at the U.S. Army Chemical School. Approved as the alternate Radiation Protection Officer on NRC Licenses, 01-02861-05, SNM-1877, and 01-02861-04 in 1982.

4. Radioisotopes used:

Most radioisotopes with atomic numbers 3 thru 83 inclusive in varying activities, plus the following:

Am-241, Th-234, H-3, U-235, Pu-239, U-238, Po-210, AmBe Source, Ra-226

Have worked with the following isotopes in multiCurie quantities:

Co-60, Cs-137, H-3, Ir-192, Cf-252

5. Memberships:

Member of the Alabama Chapter of the Health Physics Society since 1981.

National Registry of Radiation Protection Technologists (NRRPT) 1991.

8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREA.

Training will in accordance with 10 CFR 19.12 and will be commensurate with the type of source and hazard that the individual is expected to encounter.

9. FACILITIES AND EQUIPMENT.

No facilities are covered under this license. A map of Pelham Range is attached.

Equipment:
A list of monitoring and survey instruments at the U.S. Army Chemical School is attached.

Instruments used during decommissioning can be found in the appropriate decommissioning plan.

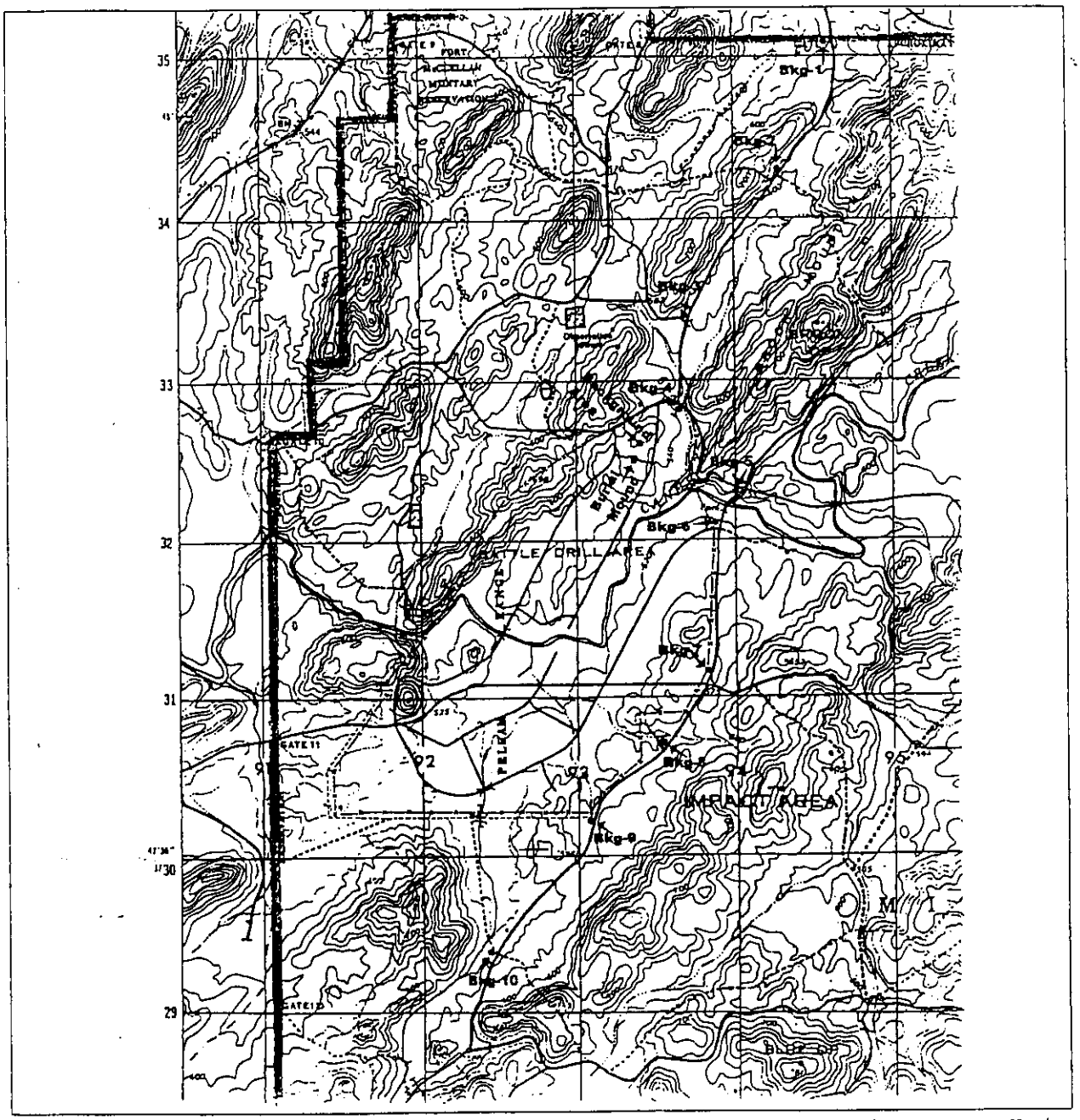
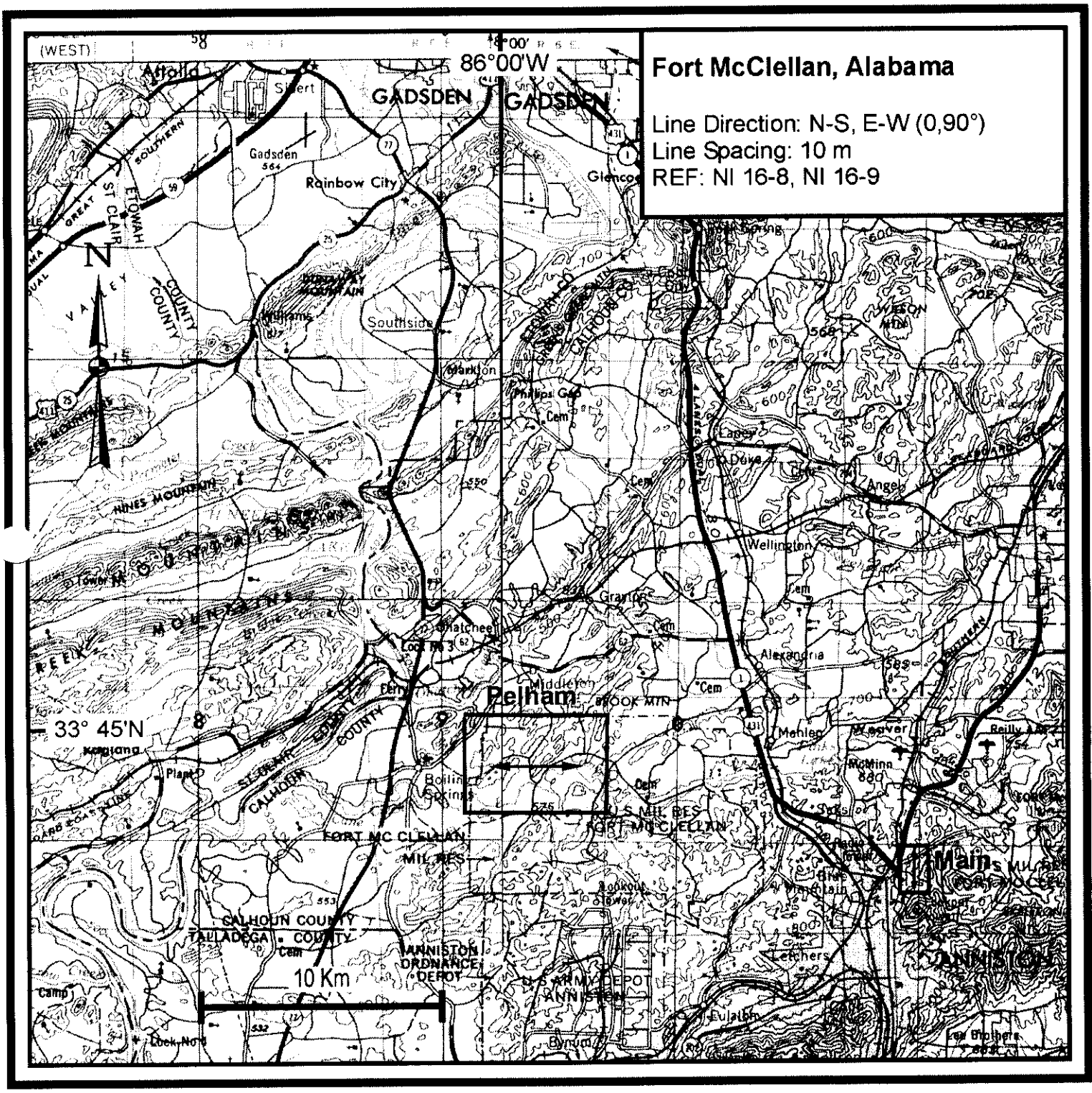


Figure H-3. Reconnaissance Backgrounds, Burial Mound Survey Unit and Troop Assembly Background Locations

25m x 25m
593300 East 3732500 No
(UTM Universal Transverse Mercato
Grid Zone 16


Fort McClellan, Alabama
Line Direction: N-S, E-W (0,90°)
Line Spacing: 10 m
REF: NI 16-8, NI 16-9
(WEST)
86°00'W
33° 45'N
GADSDEN
Rainbow City
Southside
Pelham
FORT MC CLELLAN
MIL RES
ANNISTON
ORDNANCE
DEPOT
CALHOUN COUNTY
TALLADEGA COUNTY
10 Km
N

INSTRUMENT TYPE	MAKE & MODEL	RADIATION DETECTED	SENSITIVITY	WINDOW THICKNESS	USE
Proportional Gas Flow	Tennelec Series 5 XLB	alpha, beta	to 999,999 counts	0.08 mg/cm^2	low level counting
Liquid Scintillation	Packard TriCarb 2500TR	Alpha, beta	to 999,999 counts	NA	low level counting
Geiger-Mueller	Eberline E-520	beta, gamma	0.01-200 mR/hr	30 mg/cm^2	survey & monitoring
Scintillation	Bicron MicroRem	gamma	0.1-2000 Urem	NA	survey & monitoring
Proportional Counter	Berthold Md LB1231	beta, gamma	0.001-500,000 cps	5 mg/cm^2	survey & monitoring
Scintillation, ZnS	AN/PDR-77	alpha, beta, gamma	to 999k cpm to 999k mR/hr	1.5 mg/cm^2 11 mg/cm^2	survey & monitoring survey & monitoring
Scintillation, NaI	Eberline SPA-3	gamma	to 3M cpm	NA	Survey
Scintillation, NaI	Rainbow MD 7010	gamma	999,999 counts	NA	multi channel analysis

10. RADIATION SAFETY PROGRAM

Army Regulation 11-9 The Army Radiation Safety Program (attached)

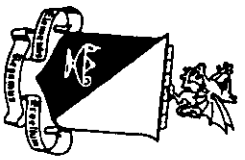
The health & safety plan of the attached Decommissioning plan.

Army Regulation 11-9

Army Programs

The Army Radiation Safety Program

Headquarters
Department of the Army
Washington, DC
28 May 1999



U.S. ARMY CHEMICAL SCHOOL

HEALTH PHYSICS OFFICE (ATSC-CMA-HP)
401 ENGINEER LOOP, SUITE 1843
FORT LEONARD WOOD, MISSOURI 65473-8926

JOHN W. MAY
HEALTH PHYSICIST
CHIEF, HEALTH PHYSICS OFFICE

E-mail: mayj@wood.army.mil

Voice: (573) 596-0131 Ext. 3-6224 / 3-6228 • DSN: 676-6224

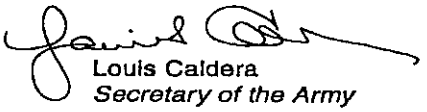
Headquarters
Department of the Army
Washington, DC
28 May 1999

*Army Regulation 11-9

Effective 29 June 1999

Army Programs

The Army Radiation Safety Program



Louis Caldera
Secretary of the Army

History. This is a new regulation.

Summary. This regulation prescribes Army radiation safety policy. It is a consolidation of several regulations that partially covered this policy. It implements DODI 6055.8 and DODI 6055.11. It includes Army policy for the use, licensing, disposal, transportation, dosimetry, accident reporting, safety design, and inventory control of and radiation exposure standards for ionizing and nonionizing radiation sources. This regulation updates policy to be consistent with current Federal radiation safety regulations; simplifies Army radiation authorization, Army radiation permit, and Nuclear Regulatory Commission license application procedures; requires Army radiation authorizations for the use of machine-produced ionizing radiation; and strengthens MACOM and installation radiation safety authority.

Applicability. This regulation applies to the Active Army, the Army National Guard of the United States, the Army Reserve, and Army contractors. This regulation does not apply to nuclear weapons (AR 50-5).

Proponent and exception authority. The proponent of this Army regulation is the Director of the Army Staff (DAS). The DAS has the authority to approve exceptions to this regulation that are consistent with controlling law and regulation. The DAS may delegate this authority, in writing, to a division chief within the proponent agency in the grade of colonel or civilian equivalent.

Army management control process. This regulation contains management control provisions and identifies key management controls that must be evaluated.

Supplementation. Supplementation of this regulation is prohibited without prior approval from HQDA (DACS-SF), WASH DC 20310-0200.

Suggested improvements. Users are invited to send comments and suggested improvements on DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to HQDA (DACS-SF), WASH DC 20310-0200.

Distribution. This publication is available in electronic media only and is intended for command level C for Active Army and D for Army National Guard of the United States.

*This regulation supersedes AR 40-14, 30 June 1995; AR 40-46, 15 November 1974; AR 385-9, 1 April 1982; and AR 385-11, dated 1 May 1980

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Summary of Change

AR 11-9
Army Programs
The Army Radiation Safety Program
This publication—

- Establishes radiation safety policies and procedures for all ionizing and nonionizing radiation sources used by Army personnel or on Army installations (located throughout).
- Establishes the position of Army Radiation Safety Officer (para 1-4).
- Establishes the Army Radiation Safety Council (para 1-5).
- Provides personnel radiation exposure standards (table 5-1).
- Provides radioactive contamination guidelines and radioactive waste disposal instructions (para 5-3).
- Provides radiation accident and incident reporting policies (chap 6).
- Provides instructions for applying for Nuclear Regulatory Commission licenses, Army radiation authorizations, and Army radiation permits (chap 2).
- Integrates risk management into the Army radiation safety program (chap 1).

Chapter 1
Introduction

1-1. Purpose
This regulation establishes policies and procedures for the use of, licensing, disposal, transportation, safety design, and inventory control of ionizing and nonionizing radiation sources. It also provides radiation exposure standards and dosimetry and accident reporting instructions. Its objective is to assure safe use of radiation sources and compliance with all applicable Federal and DOD rules and regulations.

1-2. References
Required and related publications are listed in appendix A.

1-3. Explanation of terms
Abbreviations and special terms used in this regulation are explained in the glossary.

1-4. Responsibilities
a. The Assistant Secretary of the Army (Installations and Environment) (ASA(I&E)) establishes overall Army environment, safety, and occupational health policy and maintains general oversight of and serves as advocate for the Army Radiation Safety Program.

b. The Assistant Secretary of the Army (Manpower and Reserve Affairs) establishes overall Army health and preventive medicine policy and maintains oversight of medical and health aspects of the Army Radiation Safety Program.

c. The Director of Army Safety (DASAF), Office of the Chief of Staff, Army, will-
   (1) Provide Army Staff oversight of the Army Radiation Safety Program.
   (2) Administer, direct, and integrate Army Force Protection risk management (AR 385-10).
   (3) Chair the Army Radiation Safety Council (ARSC).
   (4) In coordination with the ASA (I&E), designate, in writing, a qualified nuclear medical science officer (SSI 72A67C) colonel to serve as Army Radiation Safety Officer (Army RSO).

d. The Commanding General, Army Materiel Command (AMC) will—
   (1) Control NRC (Nuclear Regulatory Commission) licenses and Army radiation authorizations for Army radioactive commodities.
   (2) Provide ionizing radiation dosimetry services (at the Army Ionizing Radiation Dosimetry Center (AIRDC)) that meet the requirements of 10 CFR 20.1501(c). The Chief, AIRDC, will—
      (a) Publish instructions for starting, maintaining, and ending personnel dosimetry services (SB 11-206).
      (b) Maintain the Army's Central Dosimetry Records Repository (CDRR). The CDRR will archive comprehensive dosimetry records for all Army personnel and for other personnel who use Army dosimetry services. Records will meet the requirements of 10 CFR 20.2106 and 20.2110. Records will include results of bioassays, administrative dose assignments (including copies of documents that make the assignments), and supplementary occupational dose equivalent information (for example, dosimetry information resulting from off-duty employment, "moonlighting") that any radiation safety officer (RSO) reports. In particular, the AIRDC will meet the requirements of 10 CFR 20.2106(f) for long-term retention of these records.
      (c) Provide quarterly personnel dosimetry reports (automated dosimetry record (ADR)) to RSOs for all personnel who received dosimetry services during the previous calendar quarter. These reports will enable supported RSOs to meet all recordkeeping requirements in 10 CFR 20.2106.

(d) Provide reporting services that enable RSOs to meet all requirements of 10 CFR 19.13, 29 CFR 1910.1096(n) and (o), and 29 CFR 1926.53(p) and (q).

(e) Provide reporting services that meet the requirements of 10 CFR 20.2206.

(f) Notify immediately (by telephone or message) the RSO, The Surgeon General (TSG), the major Army command (MACOM) radiation safety staff officer (RSSO), and the Army RSO when AIRDC records indicate that any Army personnel ionizing radiation exposure standard (table 5-1) may have been exceeded.

(3) Provide Army low-level radioactive waste disposal services (TM 3-261) (at the Army Low-Level Radioactive Waste Disposal Division, U.S. Army Industrial Operations Command, ATTN: AMSIO-DMW, Rock Island, IL 61299-6000). In addition:

(a) Establish procedures for implementing the Army's responsibility as DOD Executive Agent for Low-Level Radioactive Waste Disposal.

(b) Maintain records of all Army radioactive waste disposal by burial.

(4) Provide the Army radiation test, measurement, and diagnostic equipment (TMDE) program and accredited radiation instrument calibration services (AR 750-43 and TB 750-25).

(5) In coordination with CG, U.S. Army Medical Command (MEDCOM), maintain capability to provide on-site radiation safety support following radioactive material contamination accidents and incidents.

(6) Assure that foreign military sales of radioactive material (RAM) and items that contain RAM comply with applicable United States regulations and DOD directives.

e. The Surgeon General will—

(1) Establish Army radiation safety personnel exposure standards as necessary and provide them to the Army RSO for promulgation (para1-4l(3)).

(2) Approve all radiation dose limits in excess of limits promulgated in this regulation (chap 5) and provide these limits to the Army RSO for promulgation as necessary (para 1-4l(3)).

(3) Establish and promulgate Army radiological health guidelines for deployment operations as necessary.

(4) Provide Army Staff supervision on the medical and health aspects of exposure to ionizing radiation associated with doses that AIRDC documents.

f. The Commanding General, Training and Doctrine Command (CG, TRADOC), will—

(1) Include appropriate radiation safety training in MOS/SSI-producing courses and in unit mission-essential task list (METL) profiles for personnel in MOS/SSIs (military occupational specialty/specialty skill identifier) and TOE units that use radiation and radioactive commodities.

(2) Prepare training modules [in coordination with CG, AMC and CG, Army Medical Department Center and School (CG, AMEDDC&S), about protection from U.S. and foreign ionizing and nonionizing radiation sources that may expose Army personnel to radiation during deployment. These modules will be available for radiation safety training of deploying and deployed personnel as necessary.

g. The Commanding General, U.S. Army Medical Command will—

(1) Prepare training modules (at AMEDDC&S), in coordination with CG, TRADOC and CG, AMC about health hazards of, protection from, and medical treatment of injuries caused by U.S. and foreign radiation sources that may expose Army personnel during deployment. These modules will be available for radiation safety training of deploying and deployed personnel as necessary.

(2) In coordination with CG, AMC, maintain capability to provide on-site medical advice and support following radioactive contamination accidents or incidents (AR 40-13).

(3) Survey each installation and each NRC license, Army reactor permit, or Army radiation authorization (ARA) holder at least once every three years for compliance with applicable radiation safety and health regulations and guidance (AR 40-5).

(4) Establish appropriate occupational health surveillance for personnel occupationally exposed to radiation (AR 40-5).

(5) Perform health hazards assessments (HHAs) of commodities and systems that emit radiation or contain RAM as early as practical in development and before fielding (AR 40-10).

(6) Provide radiation bioassay services (AR 40-5) that comply with criteria of the American National Standards Institute (ANSI) (see ANSI N13.30). Such services are available from the U.S. Army Center for Health Promotion and Preventive Medicine (CHPPM) on a cost-reimbursable basis.

(7) Provide medical support for investigations of alleged excessive radiation exposures (DODI 6055.11 and DA PAM 40-18).

h. The Assistant Chief of Staff for Installation Management (ACSIM) will provide oversight for all radioactive contamination surveys conducted in support of base closure or installation restoration activities.

i. Each MACOM commanding general will—

(1) Assure installation and subordinate command compliance with conditions of AMC-held radioactive commodity NRC licenses and ARAs. (See para 2-1b.)

(2) Designate, in writing, a person to be the MACOM RSSO.

(3) Issue ARAs as necessary (para 2-3).

(4) As necessary, establish and employ procedures to assure that captured, purchased, borrowed, or otherwise obtained foreign equipment and materiel are surveyed for RAM and that appropriate actions are taken following discovery of any RAM in those items.

(5) Concerning the MACOM radiation safety program:

(a) Establish review and approval procedures for conducting risk management in accordance with established doctrine (DODI 6055.1).

(b) Maintain a central register of risk decisions regarding deviations from the Army standards of this regulation and DA PAM 40-18 within the command.

(c) Assure that the complete risk management process is executed before the conduct of all operations.

(6) Report excess military-exempt lasers to the Defense Reutilization and Marketing Service for utilization screening within DOD (DOD 4160.21-M-1). (See para 3-2c.)

(a) Maintain accountability during the screening period.

(b) Losing and gaining organizations will transfer excess directly between themselves.

(c) After utilization screening is completed, identify supply system requirements for usable parts. Return required parts to the supply system.

j. Each installation commander—

(1) Will designate, in writing, a qualified individual to be Installation RSO.

(2) May establish an Installation Radiation Safety Committee (RSC). (See para 1-6.)

(3) Will prepare and maintain historical records of location of use or storage of RAM on the installation and the responsible activity for that use or storage (para 2-5).

(4) Will maintain documentation listing locations categorized as "RF controlled" and "RF uncontrolled" environments as necessary (DODI 6055.11).

(5) Issue Army radiation permits as necessary (para 2-4).

k. Each commander will—

(1) Designate, in writing, a person to be the RSO when any of the following is true.

(a) When a NRC license, Army reactor permit, ARA, or applicable technical publication requires it.

(b) When para 5-2b requires any personnel in the command to wear AIRDC-issued dosimetry.

(c) When para 5-2c requires any personnel in the command to participate in a bioassay program.

(d) When the activity operates, maintains, or services a class IIIb or class IV laser system (section 1.3, ANSI Z136.1) that is not type-classified. The title of the person so designated may be "laser safety officer" (LSO).

(2) When paragraph (1) above requires the designation of an RSO (or LSO)—

(a) Establish written policies and procedures to assure compliance with applicable Federal, DOD, and Army radiation safety regulations and directives. These documents will include emergency reaction plans as necessary and procedures for investigating and reporting radiation accidents, incidents, and overexposures (chap 6).

(b) Assure that an internal (for example, the RSO or local acting IG (Inspector General)) or external (for example, the TSG (para 1-4g(3)) or an RSO from another command) agent or agency audits the radiation safety program annually.

(3) Assure that all personnel occupationally exposed to radiation receive appropriate radiation safety training commensurate with potential hazards from radiation sources they may encounter.

(4) Maintain an inventory of radiation sources as higher headquarters directs and in accordance with requirements of NRC licenses, Army reactor permits, ARAs, and technical publications.

(5) For radioactive commodities in the command, establish written policies and procedures as necessary to assure compliance with radiation safety requirements in applicable technical publications. (See para 2-1b(1).)

l. The Army Radiation Safety Officer will—

(1) On behalf of the DASAF, direct the Army Radiation Safety Program.

(2) On behalf of the DASAF, develop, manage, and promulgate Army radiation safety policy and guidance.

(3) On behalf of TSG, promulgate Federal and Army radiation safety personnel exposure standards within the Army.

(4) On behalf of the ASA (I&E), provide HQDA oversight of the DOD Executive Agency for Low-Level Radioactive Waste, to include matters concerning depleted uranium.

(5) Resolve radiation safety issues between MACOMs as necessary.

(6) Promote good radiation safety practices throughout the Army.

(7) Provide radiation safety consultation to the DA staff and MACOM commanders and staffs.

(8) Serve as HQDA radiation safety point-of-contact with other DOD and Federal agencies.

(9) Represent HQDA on DOD radiation safety committees, working groups, and panels.

(10) Coordinate HQDA-level radiation safety plans and responses to radiation emergencies, accidents, and incidents.

(11) Integrate risk management into the Army Radiation Safety Program.

m. Major Army command RSSOs will—

(1) Assure MACOM implementation of Army radiation safety policy.

(2) Direct the MACOM radiation safety program.

(3) Establish MACOM radiation safety policy.

(4) Provide radiation safety consultation to the MACOM commanding general and staff and to subordinate commanders and staffs.

(5) Serve as MACOM radiation safety point-of-contact.

n. Each Installation RSO will—

(1) Direct the installation radiation safety program.

(2) Assist TOE (Table of Organization and Equipment) units on the installation to meet requirements of NRC licenses and ARAs for radioactive commodities. In particular, the installation RSO will—

(a) Assure that TOE unit personnel receive appropriate radiation safety training as necessary.

(b) Meet all reporting requirements for accidents or incidents (para 6-2).

(c) Assure appropriate inventory control per applicable technical publications and logistics regulations.

(3) Notify the AMC RSSO when a building or area that currently or formerly contained radioactive commodities is scheduled for demolition or will no longer contain radioactive commodities. This is to provide AMC radioactive commodity license holders appropriate notice so that they can take decommissioning actions as necessary.

o. Each RSO (or LSO), including the installation RSO, will—

(1) Perform or be responsible for the performance of all radiation safety functions that applicable Federal, DOD, and Army regulations and NRC license, Army reactor permit, and ARA conditions require.

(2) Establish plans and procedures for handling credible emergencies involving radiation and radioactive materials. This includes coordination with civilian and military emergency response organizations as necessary.

(3) Coordinate with supporting medical personnel to help assure that personnel receive appropriate occupational health surveillance (AR 40-5).

(4) For an RSO with laser safety responsibilities, assume the responsibilities of an LSO as listed in section 1.3.2, ANSI Z136.1, except for occupational health responsibilities. (The RSO or LSO will assist the occupational health physician as necessary in meeting laser occupational health responsibilities.)

1-5. Army Radiation Safety Council

a. The ARSC is the Chief of Staff, Army's advisory body to provide recommendations for Army radiation safety directives and to gather and disseminate information about the status of the Army radiation safety program.

b. Membership includes the DASAF as chair (para 1-4c(3)), the Army RSO as recorder, the Radiological Hygiene Consultant to TSG, a representative of the ACSIM (Assistant Chief of Staff for Installation Management), a representative of the Army Reactor Office (AR 50-7), and the RSSO from each MACOM, the National Guard Bureau, and the Office, Chief Army Reserve.

c. The ARSC will meet at least once each 6 month period and at the call of the chair.

1-6. Installation Radiation Safety Committee

a. The installation RSC is the installation commander's advisory body to gather and disseminate information about the status of the installation radiation safety program.

b. Membership includes a chair that the commander designates, the installation RSO (recorder), and all tenant RSOs. Installations with large numbers of TOE unit personnel that use radioactive commodities will include military representatives knowledgeable about the TOE units' radiation safety programs.

c. Each installation RSC will meet at least once each calendar year and at the call of the chair.

1-7. Radiation Safety Committee

When a technical publication or conditions of a NRC license, Army reactor permit, or ARA require an RSC, it will meet the following requirements in addition to any other requirements of applicable directives.

a. The RSC will meet at least once in each six-month period and at the call of the chair.

b. A representative of the commander (that is, the commander or someone at the executive level in the organization who is not a radiation user) should chair the RSC. The RSO should be recorder and will be a voting member. The installation RSO may be a non-voting member.

c. The RSO will provide a copy of the minutes of each RSC meeting to the installation RSO.

1-8. General

a. Although a commander may assign radiation safety functions and the organizational location of the RSO (or LSO) to anywhere in the organization, the RSO and LSO will have direct access to the commander for radiation safety purposes as necessary.

b. Keep personnel exposure to ionizing radiation at a level as low as is reasonably achievable (ALARA).

c. Organizations involved in research, development, testing, and evaluation (RDTE), and in acquisition of equipment that emits radiation or contains RAM will-

(1) Identify hazards and controls and incorporate protection measures or identify operational restrictions before fielding.

(2) Process residual risks for acceptance per AR 70-1 and AR 385-16 before fielding materiel.

d. Proponents of technical publications will include radiation safety requirements about siting, operation, and maintenance of commodities and systems that contain RAM or emit radiation, as appropriate.

e. Army overseas controls of radiation sources will be at least as protective as are Army domestic controls.

f. Use risk management to identify the options and residual risk for decision by the decision authority. See FM 25-101 and FM 101-5 for a detailed discussion of steps for performing the risk management process.

1-9. Deviations

a. Limit deviations to only those from Army radiation safety standards and procedures. Deviations from Federal and DOD regulations and standards and from NRC license, Army reactor permit, and ARA conditions, including those implemented in technical publications, are not authorized.

b. The following personnel may authorize deviations from Army standards and procedures (para a above). (Deviations from personnel radiation exposure standards require TSG's approval.)

(1) Each MACOM commanding general.

(2) The Superintendent, U.S. Military Academy.

(3) The Chief, National Guard Bureau (NGB). (The Chief, NGB may sub-delegate deviation authority to the State Adjutant Generals.)

c. Only personnel listed in paragraph b above may approve residual risk levels deemed to be high or extremely high. Authority to accept residual risk will be per FM 101-5. For the purpose of this paragraph, the personnel listed in paragraph b above are considered MACOM commanding generals.

d. Grant deviations for 1 year or less. The respective approval authority may approve deviation renewals provided conditions cited in the original deviation remain the same.

e. Any accident or mishap occurring under an approved deviation will cause automatic termination of the approval until the respective approving authority completes an investigation and revalidates the deviation.

f. Forward requests through command channels to HQDA (DACS-SF), WASH DC 20310-0200, for waivers and exceptions to Federal or DOD radiation safety regulations. Prior approval from HQDA (DACS-SF), WASH DC 20310-0200, is required before such requests are sent to a Federal agency or to DOD. Prior approval of TSG is also required before requests for waivers or exceptions to Federal or DOD personnel radiation exposure standards are sent to a Federal agency or to DOD.

Chapter 2
Ionizing Radiation Sources

2-1. General

a. Materiel. AR 70-1 applies to developmental and non-developmental materiel containing radiation sources.

b. Compliance with NRC regulations and NRC license, Army reactor permit, and ARA conditions.

(1) All Army personnel using RAM will comply with all applicable NRC regulations and conditions of NRC licenses, Army reactor permits, and ARAs held by their own or by another command (paras 2-2a(2) and 2-3b(2)).

(2) Holders of NRC licenses, Army reactor permits, and ARAs will assure that all personnel using RAM are aware of applicable regulations and conditions as appropriate.

c. Shielding and control designs. A qualified expert will design, review, and test shielding of and controls for access to radiation areas, high radiation areas, and very high radiation areas. Perform these procedures per applicable regulations and guidelines before routinely using radiation sources within the area. Each design for high radiation and very high radiation areas will receive an additional independent review by a qualified expert that the MACOM RSSO designates.

d. Environmental requirements. See 10 CFR 51, 40 CFR, AR 200-1, and AR 200-2 for RAM environmental requirements.

2-2. Nuclear Regulatory Commission licenses

The NRC licenses special, source, and byproduct material in the U.S. and its possessions.

a. Send applications for new licenses, license renewals, and license amendments through command channels to the MACOM headquarters for forwarding to the NRC.

(1) The MACOM commanding general may allow subordinate commanders to forward applications directly to the NRC without MACOM review.

(2) When compliance with conditions proposed in the application requires efforts of personnel of another command, obtain a letter of agreement from an authorized representative of that command (paras 1-4l(5) and 2-1b).

(3) The applicant or MACOM RSSO will provide a copy of all correspondence relating to applications to Commander, CHPPM, Aberdeen Proving Ground, MD 21010-5422.

(4) Tenant commanders will provide a copy of each NRC license, including all amendments, to the installation commander.

b. Except as specified in paragraphs 1-9f and 2-2a, all Army personnel may communicate directly with the NRC without restriction. However, a person considering such communication should also consider whether information to be requested is obtainable from Army sources and whether information provided or obtained is of interest to the chain of command or other Army organizations.

2-3. Army radiation authorizations

a. The Army uses ARAs to control specific Army ionizing radiation sources (including machines that emit ionizing radiation) that the NRC does not license. An ARA is required for all such sources except

(1) Byproduct, source, or special material that the NRC has declared to be license-exempt (10 CFR 30, sections 30.14 through 30.20; 10 CFR 40, sections 40.13 and 40.14; and 10 CFR 70, section 70.14) or generally licenses (10 CFR 31; 10 CFR 40, sections 40.20 through 40.28; and 10 CFR 70, section 70.19).

(2) Less than 0.1 microcurie (μCi) [3.7 kilobecquerels (kBq)] of radium.

(3) Less than 1 (μCi (37 kBq) of any naturally occurring or accelerator produced RAM (NARM) other than radium. See paragraph c(2) for other NARM exemptions.

(4) For electron tubes containing less than 10 (μCi (370 kBq) of any NARM radioisotope.

(5) For machine-produced ionizing radiation sources not capable of producing a high radiation area or very high radiation area. (For example, medical and dental diagnostic x-ray systems do not require an ARA.) However, commanders will establish policies and procedures to assure that design and use of these excepted sources are in compliance with applicable radiation safety regulations and guidelines and that only appropriately trained and authorized personnel operate them.

(6) For Army nuclear reactors and Army reactor-produced RAM that remains at the reactor site. The Army Reactor Office issues Army reactor permits for these sources (AR 50-7).

b. Forward applications for new ARAs, ARA renewals, and ARA amendments through command channels to MACOM headquarters for approval.

(1) Use DA Form 3337, Application for Army Radiation Authorization (appendix B) for new ARAs. Use either DA Form 3337 or a memorandum that refers to the original DA Form 3337 for ARA renewals and amendments.

(2) When compliance with conditions proposed in the application requires efforts of personnel of another command, obtain a letter of agreement from an authorized representative of that command (paras 1-4l(5) and 2-1b).

(3) The MACOM RSSO will assure that applications meet appropriate regulatory and advisory guidelines before sending approval through command channels to the applicant.

(4) Tenant commanders will provide a copy of each ARA, including all amendments, to the installation commander.

c. The Army's ARA program will be similar to the NRC's licensing program. The Army will apply NRC regulations and guidance, modified as necessary, in its control of ARA ionizing radiation sources. Most ARA conditions will be similar to standard NRC license conditions.

(1) When an ARA applicant possesses or is applying for a NRC license to which ARA RAM use can be linked the application need only reference the NRC license. The issued ARA may reference the NRC license and incorporate the expiration date and all conditions of the NRC license.

(2) The NRC's regulations regarding license-exempt concentrations (10 CFR 30.14) and quantities (10 CFR 30.18) will be applied similarly to NARM with respect to ARA exemption upon HQDA approval. Applicants for such exemptions will send supporting documents through command channels to HQDA (DACS-SF), WASH DC 20310-0200.

d. The MACOM RSSO will provide a copy of all correspondence relating to ARA applications to Commander, CHPPM, Aberdeen Proving Ground, MD 21010-5422.

e. A sample ARA is in figure 2-1.

2-4. Army radiation permits

Non-Army agencies (including civilian contractors) require an Army radiation permits (ARP) to use, store, or possess ionizing radiation sources on an Army installation (32 CFR 655.10). (For the purpose of this paragraph, ionizing radiation source means any source that, if held or owned by an Army organization, would require a specific NRC license or ARA.)

a. The non-Army applicant will apply by letter with supporting documentation (para b below) through the appropriate tenant commander to the installation commander. Submit the letter so that the installation commander receives the application at least 30 days before the requested start date of the permit.

b. The ARP application will specify start and stop dates for the ARP and describe for what purposes the applicant needs the ARP. The installation commander will approve the application only if the applicant provides evidence to show that one of the following is true.

(1) The applicant possesses a valid NRC license or Department of Energy (DOE) radiological work permit that allows the applicant to use the source as specified in the ARP application.

(2) The applicant possesses a valid Agreement State license that allows the applicant to use RAM as specified in the ARP application, and the applicant has filed NRC Form-241, Report of Proposed Activities in Non-Agreement States, with the NRC in accordance with 10 CFR 150.20. An ARP issued under this circumstance will be valid for no more than 180 days in any calendar year.

(3) For NARM and machine-produced ionizing radiation sources, the applicant has an appropriate State authorization that allows the applicant to use the source as specified in the ARP application or has in place a radiation safety program that complies with Army regulations.

(4) For overseas installations, the applicant has an appropriate host-nation authorization as necessary that allows the applicant to use the source as specified in the ARP application and has in place a radiation safety program that complies with Army regulations. (Applicants will comply with applicable status-of-forces agreements [SOFAs] and other international agreements.)

c. All ARPs will require applicants to remove all permitted sources from Army property by the end of the permitted time.

d. Disposal of RAM by non-Army agencies on Army property is prohibited. However, the installation commander may authorize radioactive releases to the atmosphere or to the sanitary sewerage system that are in compliance with all applicable Federal, DOD, and Army regulations. (The installation commander also will give appropriate consideration to State or local restrictions on such releases.)

e. A sample ARP is in figure 2-2.

2-5. Decommissioning records

a. Holders of NRC licenses will establish and maintain decommissioning records in accordance with 10 CFR 30.35(g), 40.36(f), and 70.25(g), as applicable.

b. Holders of ARAs will establish and maintain decommissioning records similar to those that the NRC requires.

c. Holders of NRC licenses and ARAs will provide information about the location of use and storage of RAM to the installation commander for the installation RAM history records (para 1-4j(3)).

2-6. Transfer and transport

a. Transfer radioactive material only to persons authorized to receive and possess it.

(1) The holder of the commodity license or ARA will in accordance with technical publications and applicable instructions establish transfer of Army radioactive commodities.

(2) For all other RAM, the shipper will obtain and retain appropriate evidence (for example, a copy of the recipient's ARA or NRC or Agreement State license) before shipping the RAM.

b. Domestic shipments of RAM will be in accordance with applicable NRC (10 CFR 71), Department of Transportation (DOT) (49 CFR), and U.S. Postal Service (39 CFR) regulations and per DOD 4500.9-R (Part II). International shipments of RAM will be per applicable U.S. and International Atomic Energy Agency (IAEA) transportation regulations.

c. Do not transfer radium and items containing radium to non-DOD agencies or activities (except for disposal as radioactive waste).

2-7. Radioactive waste disposition

a. Do not bury radioactive waste on Army property.

b. Coordinate with and obtain the approval of the Chief, Army Low-Level Radioactive Waste Disposal Division, U.S. Army Industrial Operations Command, ATTN: AMSIO-DMW, Rock Island, IL 61299-6000, for all disposal by burial on non-Army property of radioactive wastes.

(1) This includes approval for the off-site storage, packaging, shipment, treatment, and final disposition of such unwanted low-level RAM.

(2) Project managers of special projects, such as U.S. Army Corps of Engineers environmental restoration projects that generate unusually large amounts of radioactive waste may arrange for radioactive waste disposal as part of the project. However, they will coordinate such actions with the Chief, Army Low-Level Radioactive Waste Disposal Division (para 1-4d(3)(b)).

c. Release of RAM to the atmosphere or to the sanitary sewerage system will comply with all applicable NRC and EPA regulations. (Also, give appropriate consideration to State or local restrictions on such releases.)

d. If allowed by applicable regulations or by NRC license, Army reactor permit, or ARA conditions, RAM may be held for decay and subsequent disposal without regard to radioactivity. However, disposal of such material may still require special handling as hazardous waste (AR 40-5).

2-8. Survey instruments

Calibrate radiation survey instruments used for health or safety purposes at least annually using National Institute of Standards and Technology (NIST)-traceable radiation sources (AR 750-43 and TB 750-25).

a. Some instruments may require more frequent calibration. Consult applicable technical publications and with TMDE personnel for appropriate calibration intervals as necessary.

b. Calibration sources will be of a type and activity appropriate for the intended use of the instrument.

DEPARTMENT OF THE ARMY

HQ, MACOM

CITY, STATE, AND ZIP CODE

REPLY TO ATTENTION OF

XXXX-XX (11-XXm) 15 January 2000

MEMORANDUM FOR Commander, U.S. Army Activity, Installation, City, State XXXXX-XXXX

SUBJECT: Army Radiation Authorization (ARA) No. XXX-XX

1. Reference memorandum, HQ, U.S. Army Activity, XXXX-XX-X, 15 November 1999, subject: Application for Renewal of Army Radiation Authorization No. XXX-XX, and enclosures thereto.

2. In accordance with referenced memorandum ARA No. XXX-XX is amended in its entirety to read as follows:

a. Expiration date: 31 January 2002.

b. Description of machine-produced ionizing radiation source and of radioactive material, its chemical and/or physical form, and maximum amount at any one time authorized under this ARA: See enclosure.

c. Authorized use: See enclosure.

d. Radiation Safety Officer: CPT Dan Hamilton.

e. Conditions: See enclosure.

3. Except as specifically provided otherwise in this ARA, conduct your program in accordance with the statements, representations, and procedures in the documents, including any enclosures, listed: referenced memorandum.

4. Our point of contact is Mr. John A. Manfre, MACOM Radiation Safety Staff Officer, DSN XXX-XXXX.

FOR THE COMMANDER:

Encl RUPERT K. THORNE

as LTC, GS

Adjutant

Figure 2-1. Sample Army radiation authorization

DEPARTMENT OF THE ARMY INSTALLATION

CITY, STATE, AND ZIP CODE

October 7, 1999

Radiation Safety Office

Mr. Peter H. Myers

President, Myers and Associates, Inc.

19900 W. 49th Street

Austin, Texas 78799

Dear Mr. Myers:

This letter responds to your application dated September 20, 1999, for an Army radiation permit to use a lead-paint analyzer containing no more than 30 millicuries (1.11 gigabecquerels) of cadmium-109. Your application meets the requirements of Army Regulation 11-9 (The Army Radiation Safety Program) and of title 32, Code of Federal Regulations, part 655, section 655.10.

The (Installation) Commander hereby permits you to use the lead-paint analyzer on this installation during the period October 8 through November 22, 1999 in accordance with the terms specified in your application.

You must remove all radioactive material from the installation by the end of the permitted time and provide evidence to indicate that you have done so. We do not permit disposal of radioactive material on Army property. Reapply if you wish to use the lead-paint analyzer on this installation after November 22, 1999.

Sincerely,

John A. Manfre

Radiation Safety Officer

Figure 2-2. Sample Army radiation permit

Chapter 3
Lasers

3-1. General

a. The design of Army laser safety programs will follow applicable guidelines in ANSI Z136.1 and ANSI Z136.3. Military-exempt laser users will comply with laser safety requirements in applicable technical publications.

b. Army laser range safety guidance is in AR 385-63 and MIL-HBK 828.

c. Use a type-classified or commercial class IIIb or class IV laser on an Army range only if the DOD Laser Systems Safety Working Group or CHPPM has performed a prior laser hazard evaluation for that specific kind of laser.

(1) A list of approved lasers is in MIL-HDBK-828. Send requests for approval of an unlisted laser through command channels to Commander, CHPPM, ATTN: MCHB-DC-OLO, Aberdeen Proving Ground, MD 21010-5422.

(2) Use an unlisted class IIIb and class IV laser on an Army range for RDTE purposes only. Users of such lasers will comply with paragraph a.

d. Only a qualified expert will design, review, and test controls for access to a class IIIb or IV laser facility. Meet this requirement in accordance with applicable directives before routinely using class IIIb or IV lasers within such a facility. A qualified expert will design or review for adequacy all radiation safety SOPs (standing operating procedures) for each such facility.

e. Use only class I, class II, and class IIIa lasers indoors on Army installations as hand-held laser pointing devices. Do not use class IIIb or class IV lasers for such purposes.

3-2. Military-exempt lasers

a. Although exempt, military-exempt lasers will meet as many of the laser safety standards in 21 CFR 1040 as practical.

b. Proponents of military-exempt lasers will include laser safety requirements in technical publications about siting, operation, and maintenance of these lasers and laser systems.

c. Dispose of unwanted military-exempt lasers in accordance with DOD 4160.21-M-1. Do not dispose of potentially usable lasers or laser parts through utilization outside DOD, donation, or sale without the prior approval of the Deputy Undersecretary of Defense (Environmental Security) or designee. Send requests for such disposition through supply channels to the commanding general of the appropriate materiel readiness command.

d. Military-exempt lasers will not include lasers intended primarily for indoor classroom training and demonstration, industrial operations, scientific investigations, or medical applications.

e. Commanding General, USACHPPM, will maintain records for all military-exempt lasers that indicate types of laser products and manufacturers.

Chapter 4
Radiofrequency electromagnetic radiation

4-1. General

a. The Army will comply with RF (radiofrequency) radiation safety program elements in DODI 6055.11. Type-classified RF EMR (electromagnetic radiation) emitting system users will comply with radiation safety requirements in applicable technical publications.

b. Adopt no practice and conduct no operation involving planned exposure of personnel to RF levels in excess of the applicable maximum permissible exposures in DODI 6055.11.

c. Do not use radiofrequency protective clothing for routine use to protect personnel. Protective equipment, such as electrically insulated gloves and shoes for protection against RF shock and burn or for insulation from the ground plane is permissible where necessary for compliance with induced current limits in DODI 6055.11.

d. Identify, attenuate, or control potentially hazardous radiofrequency (RF) electromagnetic fields and other radiation hazards associated with Army electronic equipment by engineering design, protective equipment, administrative actions, or a combination thereof.

e. Proponents of RF electromagnetic radiation-emitting systems will include radiation safety requirements in technical publications about siting, operation, and maintenance of these systems.

4-2. Measurement and evaluation of RF fields

Use measurement procedures and techniques recommended in IEEE C95.3 as basic guidance for evaluating RF hazards.

a. Commanding General, CHPPM, will maintain records of surveys, reports, calculations, and control measures for each type-classified RF EMR emitter.

b. Where multiple RF EMR emitters are located in fixed arrangements, RF evaluation data will include a determination of weighted contributions from expected simultaneously operated emitters.

Chapter 5
Radiation safety standards, dosimetry, and recordkeeping

5-1. General

Personnel exposure limits in this chapter do not apply to doses or exposure due to background radiation, due to any medical administration the individual has received, or due to voluntary participation in medical research programs.

5-2. Ionizing radiation

a. Personnel exposure standards. Table 5-1 summarizes the Federal personnel radiation exposure standards that the Army follows.

(1) Unrestricted areas. The dose in any unrestricted area from external sources will not exceed 2 millirems (mrem) [0.02 millisievert (mSv)] in any one hour.

(2) Nuclear Regulatory Commission jurisdiction. Standards for exposure to ionizing radiation emitted from NRC-licensed RAM are in 10 CFR 20. The Army also applies these standards to Army reactors and to a combination of exposures to NRC-licensed RAM and other ionizing radiation sources.

(3) Occupational Safety and Health Administration (OSHA) jurisdiction. Federal standards for occupational exposure to all other ionizing radiation sources are in OSHA regulations (29 CFR 1910.1096 and 1926.53). However, adhere to NRC standards for all ionizing radiation sources when NRC standards are more protective than OSHA standards.

b. Dosimetry. All occupationally exposed personnel using AIRDC dosimetry services will wear a whole-body dosimeter (worn closest to the source of radiation exposure on the trunk between the shoulders and waist). Wear supplemental dosimeters as necessary to monitor exposures to specific organs or areas, such as the thyroid, finger, hand, lens of eye, and fetus or embryo.

(1) Monitor, using AIRDC-supplied dosimeters (see para(2)), occupational exposure of all personnel working in Army facilities or on Army projects (including Army Corps of Engineers civil works projects) for:

(a) Adults likely to receive, in 1 year from sources external to the body, a dose in excess of 10 percent of any of the occupational limits in table 5-1.

(b) Minors and declared pregnant women likely to receive, in 1 year from sources external to the body, a dose in excess of 10 percent of any of the applicable limits in table 5-1.

(c) Individuals entering a high or very high radiation area.

(2) Personnel at Army government-owned contractor-operated (GOCO) facilities and contractor personnel who are working in Army facilities and require dosimetry will use AIRDC-supplied dosimeters unless a written contract specifically exempts them. (Non-GOCO contractor personnel working under provisions of an ARP may use contractor-supplied dosimetry.)

(3) AIRDC dosimeters may be used to monitor the exposure of other personnel and for area monitoring. Evaluate requirements for continued use of AIRDC dosimetry for such purposes periodically (at least annually).

(4) DA PAM 40-18 contains instructions for wearing supplemental dosimeters.

c. Bioassay.

(1) Monitor occupational intake of RAM and, as necessary, assess the committed effective dose equivalent (CEDE) for:

(a) Adults likely to receive, in 1 year, an intake in excess of 10 percent of applicable annual limits of intake (ALI). The ALIs for NRC-licensed RAM are in table 1, columns 1 and 2, 10 CFR 20, appendix B. The Surgeon General will provide, as necessary, ALIs and related air and water concentrations for radioisotopes used under ARA authority and not listed in 10 CFR 20, appendix B to the Army RSO for promulgation.

(b) Minors and declared pregnant women likely to receive, in 1 year, a CEDE in excess of 0.05 rem (0.5 mSv).

(2) Intake of RAM may be monitored and the CEDE assessed for other individuals. Evaluate the requirement for continued intake monitoring periodically (at least annually).

(3) All Government- and contractor-provided bioassay will be in accordance with procedures in ANSI N13.30.

d. Dosimetry and bioassay records.

(1) All personnel will complete DD Form 1952, Dosimeter Application and Record of Occupational Radiation Exposure, before receiving AIRDC dosimetry or participating in a routine bioassay program.

(2) The RSO will provide a copy of determinations of administrative doses (para e), determinations of non-Army occupational dose histories (obtained from somewhere other than AIRDC), bioassay results, and results of assessing CEDE by bioassay or by determination of the time-weighted air concentrations to which an individual has been exposed [that is, derived air concentration (DAC)-hours] to the AIRDC for archiving.

(3) The RSO will provide a copy of each DD Form 1952 and calendar year ADR for routinely monitored personnel to the supporting medical treatment facility or occupational health clinic (AR 40-66). (Examples: A visitor monitored only during a short-term visit of a few days is not routinely monitored. A student or intern monitored over a period of a few months is routinely monitored.)

e. Administrative doses.

(1) Only TSG may approve assigning an administrative dose in place of any AIRDC-recorded occupational dose equivalent that exceeds a value in table 5-1.

(2) RSOs will estimate TEDE (total effective dose equivalent) or CEDE when they cannot determine it from dosimetry or bioassay (for example, if a dosimeter was lost, damaged, or believed to be deliberately exposed). The estimate of the administrative dose may be based on any of the following.

(a) Occupancy or workload information and radiation dose levels at the radiation source operator location.

(b) Data supplied by a supplemental dosimeter.

(c) Average of the individual's previous occupational dose for the preceding 6 to 12 months if conditions prevailed similar to those during the period for which the dose is being estimated.

(d) Recorded doses accrued by coworkers performing similar duties under similar circumstances.

(3) The RSO will document the reason for the administrative dose assignment and the method used to estimate it.

(a) For alleged overexposures, the RSO will forward request for approval of the administrative dose, with supporting documentation, through command channels to TSG.

(b) For all other administrative dose assignments, the RSO will provide a report to Chief, AIRDC, to be included with the person's records in the CDRR.

f. Other requirements. Federal requirements for security of RAM; control of access to radiation areas, high radiation areas, and very high radiation areas; caution signs; posting and labeling requirements; radioactive material shipping and receiving; and so on are in 10 CFR, 29 CFR 1910.1096 and 1926.53, 49 CFR, and other applicable documents listed in the References section (app A).

5-3. Radioactive contamination

In the absence of other regulatory or advisory guidance, a surface is contaminated if either the removable or total radioactivity is above the levels in table 5-2.

a. If a surface cannot be decontaminated promptly to levels below those in table 5-2, control, mark, designate, or post it per applicable regulations.

b. Always reduce radioactive contamination to levels ALARA.

c. Local commanders may use contamination standards more strict than those in table 5-2 but will not use standards less strict without applying risk management principles (para 1-9).

5-4. Nonionizing radiation

See table 5-3 for a description of the electromagnetic radiation spectrum. Refer to the following indicated references for personnel radiation exposure standards for the following types of nonionizing radiation.

a. Lasers: ANSI Z136.1 and ANSI Z136.3.

b. Ultraviolet, visible, infrared, and extremely low frequency electromagnetic radiation and static electric fields: (latest edition of) American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVsTM) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIsTM).

c. Radiofrequency electromagnetic radiation: DODI 6055.11.

d. Static magnetic fields: International Commission on Non-Ionizing Radiation Protection (ICNIRP), "Guidelines on Limits of Exposure to Static Magnetic Fields," *Health Physics*, vol. 66, January, 1994, pp. 100-106.

Table 5-1.
Army Personnel Ionizing Radiation Exposure Standards.

Category	Maximum[1,2,3]
Member of the general public	100 mrem (1 mSv) (TEDE) in calendar year[4]
Fetus/embryo of occupationally exposed declared pregnant woman	500 mrem (5 mSv) (DDE of mother + ED due to radionuclides in fetus/embryo) for entire pregnancy
Occupational exposure of adults	5 rem (0.05 Sv) (TEDE) in calendar year
Lens of the eye	15 rem (0.15 Sv) (EDE) in calendar year[3]
Individual organ	50 rem (0.5 Sv) (DDE + CDE) in calendar year
Skin or extremity	50 rem (0.5 Sv) (SDE) in calendar year
Occupational exposure of minors	10% of limits for adults

1. From 10 CFR 20. Refer to 10 CFR 20 for detailed standards.
2. Abbreviations: TEDE = total effective dose equivalent; DDE = deep dose equivalent; ED = effective dose; EDE = effective dose equivalent; CDE = committed dose equivalent; SDE = shallow dose equivalent.
3. OSHA standard for occupational exposure of adults and for the lens of the eye is 1¼ rem in calendar quarter. OSHA standard for skin of whole body is 7½ rem in calendar quarter. OSHA standard for hands and forearms; feet and ankles is 18¾ rem in calendar quarter.
4. The dose in any unrestricted area from external sources, exclusive of the dose contributions from patients administered radioactive material and released in accordance with applicable regulations, will not exceed 2 mrem (0.02 mSv) in any one hour.

Table 5-2.
Surface Radioactivity Values in dpm/100 cm^2

Nuclide[a]	Removable[b, c]	Total (Fixed + Removable[b, d]
^{nat}U, ^{235}U, ^{238}U, and associated decay products	1,000	5,000
Transuranics, ^{226}Ra, ^{228}Ra, ^{230}Th, ^{228}Th, ^{231}Pa, ^{227}Ac, ^{125}I, ^{129}I	20	500
^{nat}Th, ^{232}Th, ^{90}Sr, ^{223}Ra, ^{224}Ra, ^{232}U, ^{126}I, ^{131}I, ^{133}I	200	1,000
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except ^{90}Sr and others noted above[e]	1,000	5,000
Tritium and tritiated compounds[f]	10,000	NA

a. See para 5-3 for applicability of this table. This table is extracted from 10 CFR 835, appendix D. The values in this table apply to radioactive contamination deposited on, but not incorporated into the interior of, the contaminated item. Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, apply the limits established for alpha- and beta-gamma-emitting nuclides independently.

b. As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

c. The amount of removable radioactive material per 100 cm^2 of surface area should be determined by swiping the area with dry filter or soft absorbent paper, applying moderate pressure, and then assessing the amount of radioactive material on the swipe with an appropriate instrument of known efficiency. (Note: The use of dry material may not be appropriate for tritium.) When removable contamination on objects of surface area less than 100 cm^2 is determined, the activity per unit area should be based on the actual area and the entire surface should be wiped. Except for transuranics and ^{228}Ra, ^{227}Ac, ^{228}Th, ^{230}Th, ^{231}Pa and alpha emitters, it is not necessary to use swiping techniques to measure removable contamination levels if direct scan surveys indicate that the total residual surface contamination levels are within the limits for removable contamination.

d. The levels may be averaged over one square meter provided the maximum surface activity in any area of 100 cm^2 is less than three times the value specified. For purposes of averaging, any square meter of surface shall be considered to be above the activity guide G if: (1) From measurements of a representative number n of sections it is determined that $\frac{1}{n}\sum_{i=1}^{n} S_i \geq 3G$, where $S_i \geq G$ is the dpm/100 cm^2 determined from measurement of section i; or (2) it is determined that the sum of the activity of all isolated spots or particles in any 100 cm^2 area exceeds $3G$.

e. This category of radionuclides includes mixed fission products, including the ^{90}Sr which is present in them. It does not apply to ^{90}Sr which has been separated from the other fission products or mixtures where the ^{90}Sr has been enriched.

f. Tritium contamination may diffuse into the volume or matrix of materials. Evaluation of surface contamination shall consider the extent to which such contamination may migrate to the surface in order to ensure the surface radioactivity value provided in this table is not exceeded. Once this contamination migrates to the surface, it may be removable, not fixed; therefore a "Total" value does not apply.

Table 5—3.
Electromagnetic Radiation.

REGION	*WAVELENGTH*	*FREQUENCY*	*AUTHORITY*
Ionizing (gamma and x rays)	< 100 nm	> 3 PHz (E > 12.4 eV)	NRC and OSHA
Ultraviolet (UV)	100 to 380-400 nm	0.75-0.79 to 3 PHz	ACGIH
Visible (light)	380-400 to 760-780 nm	380-390 to 750-790 THz	ACGIH
Infrared (IR)	760-780 nm to 1 mm	300 GHz to 380-390 THz	ACGIH
Radiofrequency	1 mm to 100 km	3 kHz to 300 GHz	DOD
Extremely low frequency	> 100 km	< 3 kHz	ACGIH
Static electric fields	NA	NA	ACGIH
Static magnetic fields	NA	NA	ICNIRP

Notes.
1. Unit abbreviations: nm = nanometer (10^{-9} m); mm = millimeter (10^{-3} m); km = kilometer (10^{3} m); PHz = petahertz (10^{15} Hz); THz = terahertz (10^{12} Hz); GHz = gigahertz (10^{9} Hz); kHz = kilohertz (10^{3} Hz); and eV = electron volt (1 eV = 1.6 □10 $^{-19}$ J).
2. Wavelength x frequency = speed of light = 3 x 10^{8} m s^{-1}.
3. Authority = The regulating authority for personnel exposure for the purposes of this regulation (para 5-4).

Chapter 6
Special reporting requirements

6-1. General

a. Reporting requirements of AR 40-5, AR 385-40, and DA PAM 40-18 apply for radiation accidents, incidents, and over-exposures. Additional requirements are in paras b and 6-2.

b. IMMEDIATELY EVACUATE PERSONNEL SUSPECTED OF EXPERIENCING POTENTIALLY DAMAGING EYE EXPOSURE FROM LASER RADIATION TO THE NEAREST MEDICAL FACILITY FOR AN EYE EXAMINATION (See FM 8-50). LASER EYE INJURIES REQUIRE IMMEDIATE SPECIALIZED OPHTHALMOLOGIC CARE TO MINIMIZE LONG-TERM VISUAL ACUITY LOSS. MEDICAL PERSONNEL SHOULD OBTAIN MEDICAL GUIDANCE FOR SUCH EMERGENCIES FROM THE WALTER REED ARMY INSTITUTE OF RESEARCH DETACHMENT AT BROOKS AFB (Commercial [800] 473-3549).

c. Notify the installation or activity public affairs officer at the onset of the accident or incident in order to activate public affairs contingency measures (AR 360-5). Radiation accidents or incidents attract the attention of local and national media quickly. Early disclosure of accurate information is vital to maintaining the confidence of both the internal and external public.

6-2. Ionizing radiation

Federal reporting requirements for accidents, incidents, and over-exposures are in 10 CFR 20, subpart M and in 29 CFR 1910.1096(m) and 1926.53(o).

a. Send information copies of all reports required by 10 CFR 20.2201 through 20.2205, 29 CFR 1910.1096(m), or 29 CFR 1926.53(o) and of any other accident or incident report to the NRC or OSHA through command channels to HQDA (DACS-SF), WASH DC 20310-0200.

b. Reports through command channels will meet the same time requirements, as do required reports to the NRC and OSHA. For example, if the NRC requires immediate telephonic notification, follow it with immediate telephonic notification through the chain of command to HQDA (DACS-SF), WASH DC 20310-0200.

Appendix A
Publications

Section I
Required Publications

ANSI N13.30
American National Standards Institute, Performance Criteria for Radiobioassay. (Cited in para 1-4e(6).) (This publication may be obtained from American National Standards Institute, 1430 Broadway, New York, NY 10018.)

ANSI Z136.1
American National Standards Institute, American National Standard for Safe Use of Lasers. (Cited in paras 1-4k(e), 1-4n(5), 3-1a, and 5-4a.) (This publication may be obtained from the Laser Institute of America, Suite 125, 2424 Research Parkway, Orlando, FL 32826.)

ANSI Z136.3
American National Standards Institute, American National Standard for the Safe Use of Lasers in Health Care Facilities. (Cited in paras 3-1a, and 5-4a.) (This publication may be obtained from the Laser Institute of America, Suite 125, 2424 Research Parkway, Orlando, FL 32826.)

AR 40-5
Preventive Medicine. (Cited in paras 1-4g(3), (4), and (6); 1-4n(4); 2-7d; and 6-1a.)

AR 40-10
Health Hazard Assessment Program (HHA) in Support of the Army Materiel Acquisition Decision Process. (Cited in para 1-4g(5).)

AR 40-13
Medical Support-Nuclear/Chemical Accidents and Incidents. (Cited in para 1-4g(2).)

AR 40-66
Medical Record Administration. (Cited in para 5-2d(3).)

AR 50-7
Army Reactor Program. (Cited in paras 1-5b and 2-3a(6).)

AR 70-1
Systems Acquisition Policy and Procedure. (Cited in paras 1-8c and 2-1a.)

AR 200-1
Environmental Protection and Enhancement (Cited in para 2-1d.)

AR 200-2
Environmental Effects of Army Actions. (Cited in para 2-1d.)

AR 360-5
Public Information. (Cited in para 6-1c.)

AR 385-10
Army Safety Program. (Cited in para 1-4c(2).)

AR 385-40
Accident Reporting and Records. (Cited in para 6-1a.)

AR 385-63
Policies and Procedures for Firing Ammunition for Training, Target Practice and Combat. (Cited in para 3-1b.)

AR 750-43
Army Test, Measurement and Diagnostic Equipment Program. (Cited in paras 1-4d(4) and 2-8.)

DA PAM 40-18
Personnel Dosimetry Guidance and Dose Recording Procedures for Personnel Occupationally Exposed to Ionizing Radiation. (Cited in paras 1-4g(7), 1-4i(5)(b), 5-2b(4), and 6-1a.)

DOD 4160.21-M-1
Defense Demilitarization Manual. (Cited in para 3-2c.)

DOD 4500.9-R (Part II)
Defense Transportation Regulation - Cargo Movement. (Cited in para 2-6b.)

DODI 6055.1
DOD Occupational Safety and Health Program (Cited in para 1-4i(5)(a).)

DODI 6055.11
Protection of DOD Personnel from Exposure to Radiofrequency Radiation and Military Exempt Lasers. (Cited in paras 4-1a through c, 1-4g(7), 1-4j(4), and 5-4c.)

FM 8-50
Prevention and Medical Management of Laser Injuries. (Cited in para 6-1b.)

FM 25-101
Battle Focused Training. (Cited in para 1-8f.)

FM 101-5
Staff Organization and Operations. (Cited in paras 1-8f and 1-9c.)

IEEE C95.3
Institute of Electrical and Electronics Engineers, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields RF and Microwave. (Cited in para 4-2.) (This publication may be obtained from the Institute of Electrical and Electronics Engineers, Inc., 345 East 47th St., New York, NY 10017.)

MIL-HDBK-828
Laser Range Safety. (Cited in paras 3-1b and 3-1c(1).) (This publication may be obtained from the Standardization Documents Order Desk, Building 4D, 700 Robbins Ave., Philadelphia, PA 19111-5094.)

SB 11-206
Personnel Dosimetry Supply and Service for Technical Ionizing Radiation Exposure Control. (Cited in para 1-4d(2)(a).)

TB 750-43
Army Test, Measurement, and Diagnostic Equipment (TMDE) Calibration and Repair Support Program. (Cited in paras 1-4d(4) and 2-8.)

Title 10, CFR, Chapter I
Nuclear Regulatory Commission. (Cited in paras 1-4d(2), 1-4d(2)(b) through (e); 2-1d; 2-3a(1) and (4); 2-3c(2); 2-4b(2); 2-5a; 5-2a(1), c(1)(a), and f; 6-2; and 6-2a.)

Title 21, CFR, Subchapter J
Radiological Health. (Cited in paras 3-2a.)

Title 29, CFR, Part 1910
Occupational Safety and Health Standards. (Cited in paras 1-4d(2)(d), 5-2a(2) and f, 6-2, and 6-2a.)

Title 32, CFR, Part 655
Radiation Sources on Army Land. (Cited in para 2-4.)

Title 39, CFR
U.S. Postal Service. (Cited in para 2-6b.)

Title 40, CFR
Environmental Protection Agency. (Cited in para 2-1d.)

Title 49, CFR
Department of Transportation. (Cited in paras 2-6b and 5-2f.)

TM 3-261
Handling and Disposal of Unwanted Radioactive Material. (Cited in para 1-4d(3).)

Unnumbered Publication
ACGIH Threshold Limit Values (TLVs™) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs™). (Cited in para 5-4b.) (This publication may be obtained from the American Conference of Governmental Industrial Hygienists, Technical Affairs Office, 1330 Kemper Meadow Dr., Cincinnati, OH 45240.)

Unnumbered publication
International Commission on Non-Ionizing Radiation Protection (ICNIRP), Guidelines on Limits of Exposure to Static Magnetic Fields, *Health Physics*, vol. 66, pp. 100-106. (Cited in para 5-4d.)

Section II
Related Publications
A related publication is merely a source of additional information. The user does not have to read it to understand this regulation.

AR 11-2
Management Control

AR 11-34
The Army Respiratory Protection Program

AR 25-400-2
The Modern Army Recordkeeping System (MARKS)

AR 50-5
Nuclear Surety

AR 55-38
Reporting of Transportation Discrepancies in Shipments

AR 70-6
Type Classification of Army Materiel

AR 190-54
Nuclear Reactor Security Program

AR 210-10
Installations—Administration

AR 385-16
System Safety Engineering and Management

AR 700-64/DLAM 4145.8/NAVSUPINST 4000.34/AFR 67-8/MCO P4400.105
Radioactive Commodities in the DOD Supply Systems

AR 700-93
Processing and Shipping DOD Sponsored Retrograde Materiel Destined for Shipment to the United States, Its Territories, Trusts, and Possessions

AR 725-50
Requisitioning, Receipt, and Issue System

AST-1500Z-100-93
Identification Guide for Radioactive Sources in Foreign Materiel (This publication is available from Commander, U.S. Army Foreign Science and Technology Center, ATTN: IAFSTC-PO, 220 Seventh St. NE, Charlottesville, VA 22901-5396.)

DODI 6055.8
Occupational Radiation Protection Program

IEEE C95.1
Institute of Electrical and Electronics Engineers, IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz (This publication may be obtained from the Institute of Electrical and Electronics Engineers, Inc., 345 East 47th St., New York, NY 10017.)

NBS Handbook 107
Radiological Safety in the Design and Operation of Particle Accelerators (The National Bureau of Standards is now known as the National Institute of Standards and Technology) (This publication may be obtained from the U.S. Government Printing Office, P.O. Box 37082, Washington, DC 20013-7082, or from the National Technical Information Service, 5258 Port Royal Rd., Springfield, VA 22161.)

NBS Handbook 111
Radiation Safety for x-ray Diffraction and Fluorescence Analysis Equipment (This publication may be obtained from the U.S. Government Printing Office, P.O. Box 37082, Washington, DC 20013-7082, or from the National Technical Information Service, 5258 Port Royal Rd., Springfield, VA 22161.)

NBS Handbook 114
General Safety Standards for Installations Using Non-Medical X-Ray and Sealed Gamma-Ray Sources, Energies up to 10 MeV (This publication may be obtained from the U.S. Government Printing Office, P.O. Box 37082, Washington, DC 20013-7082, or from the National Technical Information Service, 5258 Port Royal Rd., Springfield, VA 22161.)

NCRP Reports
Approximately 100 numbered reports on a variety of radiation safety topics (These publications may be obtained from the National Council on Radiation Protection and Measurements, 7910 Woodmont Ave., Suite 1016, Bethesda, MD 20814.)

NRC Regulatory Guide 8.13
Instruction Concerning Prenatal Radiation Exposure (This publication may be obtained from the U.S. Government Printing Office, P.O. Box 37082, Washington, DC 20013-7082, or from the National Technical Information Service, 5258 Port Royal Rd., Springfield, VA 22161.)

NRC Regulatory Guide 8.29
Instruction Concerning Risks from Occupational Radiation Exposure (This publication may be obtained from the U.S. Government Printing Office, P.O. Box 37082, Washington, DC 20013-7082, or from the National Technical Information Service, 5258 Port Royal Rd., Springfield, VA 22161.)

TB 43-0116
Identification of Radioactive Items in the Army

TB 43-0121
Inspection and Certification of RADIAC Meters (Dosimeters)

TB 43-0122
Instructions for the Safe Handling and Identification of U.S. Army Communications-Electronics Command-Managed Radioactive Items in the Army Inventory

TB 43-0216
Safety and Hazard Warnings for Operation and Maintenance of TACOM Equipment

TB 43-0133
Hazard Criteria for CECOM Radiofrequency and Optical Radiation Producing Equipment

TB 43-0137
Transportation Information for CECOM Radioactive Commodities (Use this bulletin for general guidance only; refer to 10 CFR 71 and 49 CFR for current NRC and DOT regulations.)

TB 43-0141
Safe Handling, Maintenance, Storage, and Disposal of Radioactive Commodities Managed by the U.S. Army Troop Support and Aviation Material Readiness Command

TB 43-180
Calibration and Repair Requirements for the Maintenance of Army Materiel

TB 385-4
Safety Requirements for Maintenance of Electrical and Electronic Equipment

TB MED 502
Respiratory Protection Program

TB MED 506
Occupational Vision

TB MED 521
Management and Control of Diagnostic X-Ray, Therapeutic X-Ray, and Gamma-Beam Equipment

TB MED 522
Control of Health Hazards from Protective Material Used in Self-Luminous Devices

TB MED 523
Control of Hazards to Health from Microwave and Radio Frequency Radiation and Ultrasound

TB MED 524
Control of Hazards to Health from Laser Radiation

TB MED 525
Control of Hazards to Health from Ionizing Radiation Used by the Army Medical Department

Title 10, CFR, Part 835
Occupational Radiation Protection

TM 5-315
Transportability Guidance for Safe Transport of Radioactive Materials (Use this manual for general guidance only; refer to 10 CFR 71 and 49 CFR for current NRC and DOT regulations.)

TM 55-315
Transportability Guidance for Safe Transport of Radioactive Materials (Use this manual for general guidance only; refer to 10 CFR 71 and 49 CFR for current NRC and DOT regulations.)

TM 55-4470-400-12-1
Transportability Guidance for Nuclear Reactor Irradiated Fuel Elements (Use this manual for general guidance only; refer to 10 CFR 71 and 49 CFR for current NRC and DOT regulations.)

Section III
Prescribed Forms

DA Form 3337
Application for Army Radiation Authorization. (Cited in para 2-3b(1).)

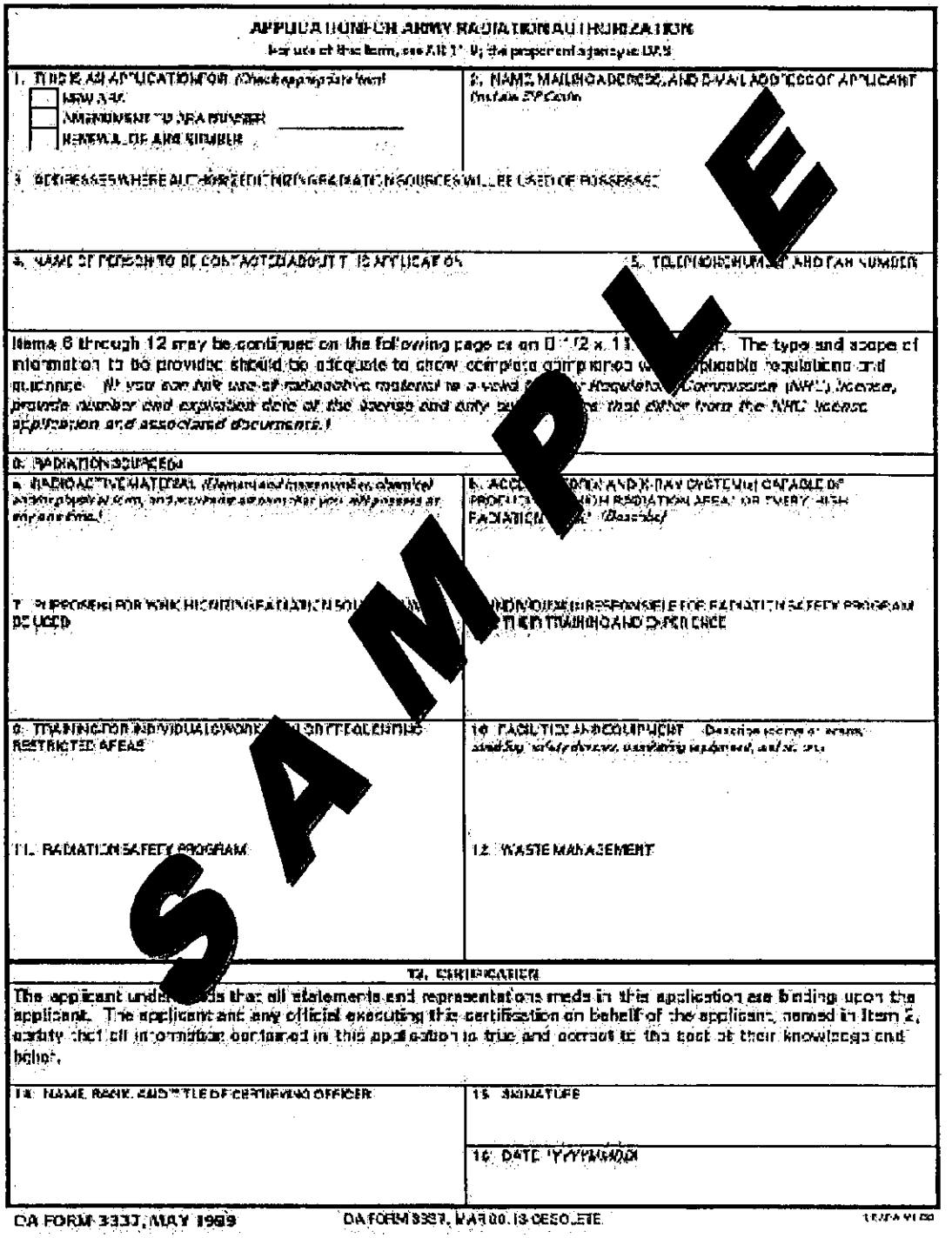
Section IV
Referenced Forms

DA Form 11-2-R
Management Control Evaluation Certification Statement

DD Form 1952
Dosimeter Application and Record of Occupational Radiation Exposure

NRC Form 241
Report of Proposed Activities in Non-Agreement States

Appendix B
Sample application for Army Radiation Authorization (DA Form 3337)



APPLICATION FOR ARMY RADIATION AUTHORIZATION

For use of this form, see AR 11-9; the proponent agency is DAIM

1. TYPE OF APPLICATION (Check appropriate box)
- [ ] NEW ARA
- [ ] AMENDMENT TO ARA NUMBER _____
- [ ] RENEWAL OF ARA NUMBER

2. NAME, MAILING ADDRESS, AND DoDAAD CODE OF APPLICANT (Include ZIP Code)

3. ADDRESSES WHERE ALL RADIOACTIVE MATERIAL OR RADIATION SOURCES WILL BE USED OR POSSESSED

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION

5. TELEPHONE NUMBER AND DSN NUMBER

Items 6 through 12 may be continued on the following page or on 8 1/2 x 11 inch paper. The type and scope of information to be provided should be adequate to show complete compliance with applicable regulations and guidance. (If your activity will use radioactive material in a way that requires Nuclear Regulatory Commission (NRC) license, provide number and expiration date of the license and any supplementary documents that differ from the NRC license application and associated documents.)

6. RADIATION SOURCES

a. RADIOACTIVE MATERIAL (Element and isotope or chemical compound, and maximum amount per source possessed at any one time)

b. ACCELERATORS AND X-RAY SYSTEMS (Type) CAPABLE OF PRODUCING HIGH RADIATION AREAS OR EVERY HIGH RADIATION AREA (Describe)

7. PURPOSES FOR WHICH RADIATION SOURCES WILL BE USED

8. INDIVIDUALS RESPONSIBLE FOR RADIATION SAFETY PROGRAM (Name, training and experience)

9. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS

10. FACILITIES AND EQUIPMENT (Describe rooms, shielding, survey instruments, monitoring equipment, and so on)

11. RADIATION SAFETY PROGRAM

12. WASTE MANAGEMENT

13. CERTIFICATION

The applicant understands that all statements and representations made in this application are binding upon the applicant. The applicant and any official executing this certification on behalf of the applicant, named in Item 2, certify that all information contained in this application is true and correct to the best of their knowledge and belief.

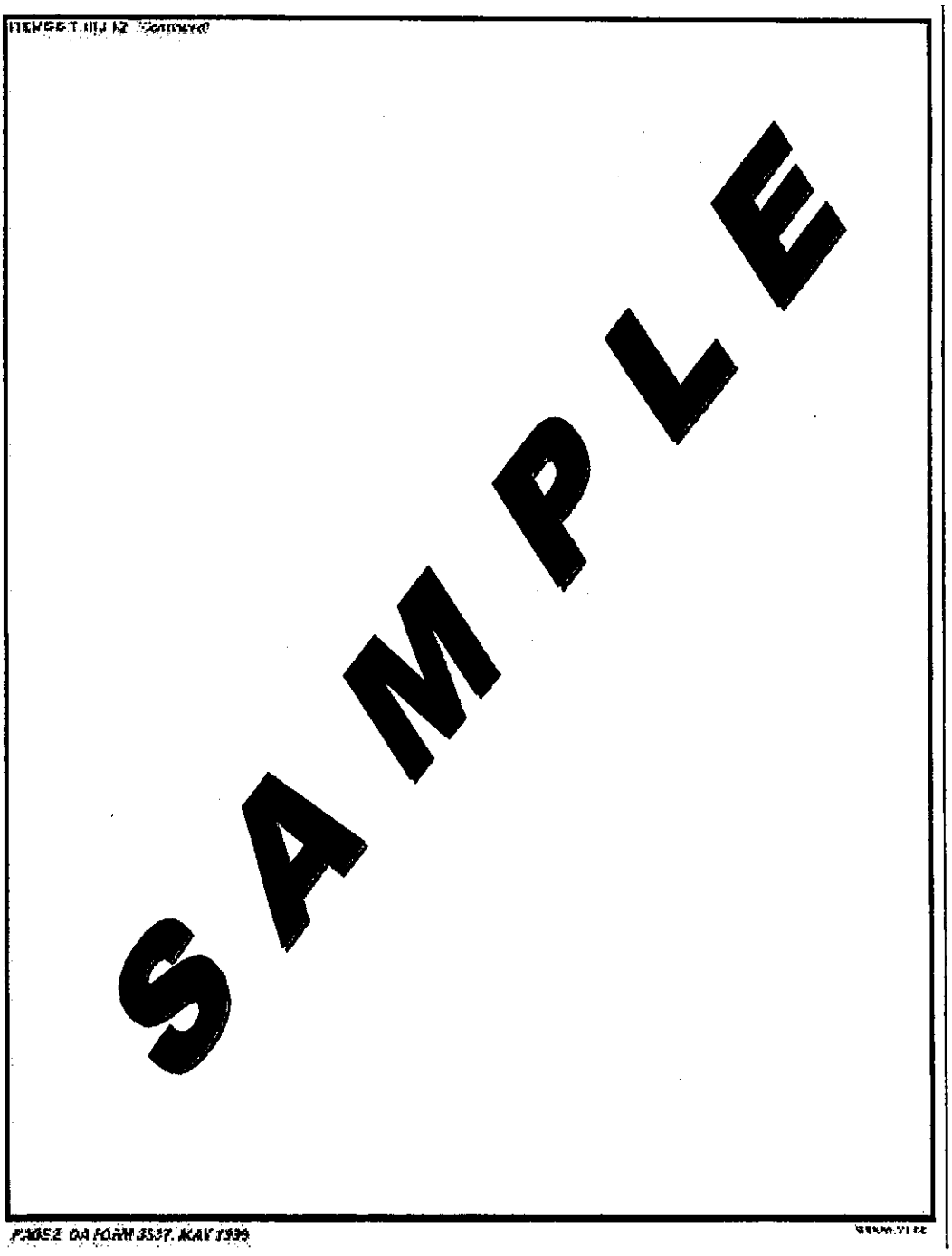
14. NAME, RANK, AND TITLE OF CERTIFYING OFFICER

15. SIGNATURE

16. DATE (YYYYMMDD)

DA FORM 3337, MAY 1999 DA FORM 3337, MAR 80, IS OBSOLETE

SAMPLE


SAMPLE

Appendix C
Management Control Evaluation Checklist

C-1. Function
The function covered by this checklist is radiation safety.

C-2. Purpose
The purpose of this checklist is to assist commanders and radiation safety officers in evaluating the key management controls listed below. It is not intended to cover all controls.

C-3. Instructions
Answers must be based on the actual testing of key management controls (for example, document analysis, direct observation, sampling, simulation, other). Answers that indicate deficiencies must be explained and corrective action indicated in supporting documentation. These management controls must be evaluated at least once every five years. Certification that this evaluation has been conducted must be accomplished on DA Form 11[illegible]R (Management Control Evaluation Certification Statement).

C-4. Test questions
a. If required (para 1-4k(1)), has a person been designated to be radiation safety officer?
b. If required (para 1-4k(2)), has a written radiation safety SOP been established?
c. Are all personnel occupationally exposed to radiation receiving appropriate radiation safety training?
d. Are all radiation sources secured against unauthorized use and removal?
e. If the unit possesses radioactive commodities, has a written SOP been established to assure compliance with radiation safety requirements of applicable technical publications?
f. Are all controllable quantities of radioactive material and radiation-producing sources held by the unit under appropriate authority (for example, a Nuclear Regulatory Commission license, an Army radiation authorization, or as part of a radioactive commodity)?
g. Is all radioactive waste disposed of properly?
h. Are all radiation survey instruments used for health and safety appropriately calibrated?
i. For Army laser ranges have all type-classified or commercial class IIIb or class IV lasers received appropriate evaluation before their use?
j. Are all unwanted military-exempt lasers disposed of properly?
k. Are all accidents and incidents involving excessive personnel radiation exposure or excessive radioactive contamination of facilities, equipment, or the environment promptly reported through appropriate channels?
l. Do all personnel occupationally exposed to ionizing radiation or radioactive material above applicable levels (paras 5-2b(1) and c(1)) participate in an appropriate dosimetry or bioassay program?
m. Is the dose in all unrestricted areas less than 2 millirems (0.02 millisieverts) in any one hour?

C-5. Supersession
This is a new checklist.

C-6. Comments
Help make this a better tool for evaluating management controls. Submit comments to HQDA (DACS-SF), WASH DC 20310-0200.

Glossary

Section I
Abbreviations

ACGIH
American Conference of Governmental Industrial Hygienists

ACSIM
Assistant Chief of Staff for Installation Management

ADR
automated dosimetry report

AFB
United States Air Force Base

AIRDC
Army Ionizing Radiation Dosimetry Center

ALARA
as low as is reasonably achievable

ALI
annual limit of intake

ANSI
American National Standards Institute

AR
Army Regulation

ARA
Army Radiation Authorization

ARP
Army Radiation Permit

ARSC
Army Radiation Safety Council

ASA(I&E)
Assistant Secretary of the Army (Installations and Environment)

BEI™
biological effectiveness index (ACGIH trademark)

Bkd
background

CDRR
Central Dosimetry Records Repository

CECOM
U.S. Army Communications-Electronics Command

CEDE
committed effective dose equivalent

CFR
Code of Federal Regulations

CG
Commanding General

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

cm
centimeter

DA
Department of the Army

DAC
derived air concentration

DASAF
Director of Army Safety

DOD
Department of Defense

DODI
Department of Defense Instruction

DOE
Department of Energy

dpm
disintegrations per minute

DOT
Department of Transportation

DSN
Defense Switching Network

EMR
electromagnetic radiation

EPA
U.S. Environmental Protection Agency

eV
electron volt

FY
fiscal year

GHz
gigahertz

GOCO
Government-owned contractor-operated

Gy
gray

h
hour

HHA
health hazard assessment

HQDA
Headquarters, Department of the Army

Hz
hertz

IAEA
International Atomic Energy Agency

ICNIRP
International Commission on Nonionizing Radiation Protection

IEEE
Institute of Electrical and Electronics Engineers

IR
infrared

kBq
kilobecquerel

kHz
kilohertz

km
kilometer

LSO
laser safety officer

m
meter

MACOM
major Army command

MARKS
Modern Army Recordkeeping System

METL
mission-essential task list

µCi
microcurie

mg
milligram

MIL-HDBK
military handbook

µm
micrometer

mm
millimeter

MOS
military occupational specialty

mrad
millirad

mSv
millisievert

MTF
medical treatment facility

NARM
naturally occurring or accelerated produced radioactive material

NBS
National Bureau of Standards (now named the National Institute of Standards and Technology)

NCRP
National Council on Radiation Protection and Measurements

NGB
National Guard Bureau

NIST
National Institute of Standards and Technology

nm
nanometer

NORM
naturally occurring radioactive material

NRC
U.S. Nuclear Regulatory Commission

NSN
National stock number

NVLAP
National Voluntary Laboratory Accreditation Program

OSHA
Occupational Safety and Health Administration

PHz
petahertz

RAM
radioactive material

RDTE
research, development, testing, and evaluation

RF
radiofrequency

RSC
radiation safety committee

RSO
radiation safety officer

RSSO
radiation safety staff officer

SB
supply bulletin

SI
Systemé Internationale (International System)

SOFA
status of forces agreement

SOP
standing operating procedure

SSI
specialty skill identifier

Sv
sievert

TACOM
U.S. Army Tank-Automotive and Armaments Command

TB
technical bulletin

TB MED
technical bulletin (medical)

TEDE
total effective dose equivalent

THz
terahertz

TLV™
threshold limit value (ACGIH trademark)

TM
technical manual

TMDE
test, measurement, and diagnostic equipment

TOE
table of organization and equipment

TSG
The Surgeon General

U.S.C.
United States Code

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

USAMC
U.S. Army Materiel Command

UV
ultraviolet

Section II
Terms

Absorbed dose
The energy imparted by ionizing radiation per unit mass of irradiated material. The units of absorbed dose are the rad and the gray (Gy).

Administrative dose
The total effective dose equivalent that a radiation safety officer assigns when dosimetry is inaccurate or has been misused or lost.

Agreement State
Any State with which the Atomic Energy Commission or the NRC has entered into an effective agreement in which the State assumes many of the NRC's functions.

ALARA
Acronym for "as low as is reasonably achievable" means making every reasonable effort to maintain exposures to radiation as far below applicable dose limits as is practical consistent with the purpose for which the activity is undertaken, taking into account the state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations and in relation to utilization of nuclear energy, radioactive materials, and ionizing radiation in the public interest.

Annual limit of intake (ALI)
The derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. ALI is the smaller value of intake of a given radionuclide in a year that would result in a committed effective dose equivalent of 5 rems (0.05 Sv) or a committed dose equivalent of 50 rems (0.5 Sv) to any organ or tissue.

Army regulation
A directive that sets forth missions, responsibilities, and policies, and establishes procedures to ensure uniform compliance with those policies.

Army Reserve facilities
Pertains to those facilities normally employed for the administration and training of Army Reserve units, in any entire structure or part thereof, including any interest in land, Army Reserve Center, and storage and other use areas.

Background radiation
Radiation from cosmic sources; naturally occurring radioactive material, including radon (except as a decay product of source or special nuclear material); and global fallout as it exists in the environment from the testing of nuclear explosive devices or from past nuclear accidents such as Chernobyl that contribute to background radiation. Background radiation does not include radiation from source, byproduct, or special nuclear materials that the NRC regulates or from NARM that the Army regulates.

Becquerel (Bq)
The SI unit of radioactivity equivalent to one nuclear transformation per second.

Bioassay (radiobioassay)
The determination of kinds, quantities or concentrations, and, in some cases, the locations of radioactive material in the human body, whether by direct measurement (*in vivo* counting) or by analysis and evaluation of materials excreted or removed from the human body (*in vitro* counting).

Byproduct material
Any radioactive material (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material.

Committed dose equivalent
The dose equivalent to organs or tissue of reference that will be received from an intake of radioactive material by an individual during the 50-year period following the intake.

Committed effective dose equivalent
The sum of the products of the weighting factors applicable to each of the body organs or tissues that are irradiated and the committed dose equivalent to these organs or tissues.

Commodity, radioactive
See Radioactive commodity

Condition
The status of personnel and equipment (readiness) as they interact with the operational environment during mission planning and execution.

Control
Action taken to eliminate hazards or reduce their risk.

Curie (Ci)
A unit of radioactivity equal to 37 billion becquerels.

Declared pregnant woman
A woman who has voluntarily informed her employer, in writing, of her pregnancy and the estimated date of conception.

Decommission
To remove (as a facility) safely from service and reduce residual radioactivity to a level that permits release of the property for unrestricted use and termination of the NRC license, Army reactor permit, or Army radiation authorization.

Deep-dose equivalent
Applies to external whole-body exposure and is the dose equivalent at a tissue depth of 1 centimeter (1000 mg/cm^{-2}).

Derived air concentration (DAC)
The concentration of a given radionuclide in air that, if breathed for a working year of 2,000 hours under conditions of light work (inhalation rate 1.2 cubic meters of air per hour), results in an inhalation of one ALI.

Develop the Force
One of the Army's four core capabilities. This capability includes the processes of developing doctrine; developing requirements; acquiring, training and sustaining people; and identifying and developing leaders. This core capability encompasses the various functions that must be accomplished to create tactical units that comprise the Operational Force.

Deviation
A departure from the requirements of this regulation.

Direct and Resource the Force
One of the Army's four core capabilities comprised of four core processes: planning and policy development; direction and assessment; financial management; and information management. These processes have six functions: Leadership; Human Resource Management; Force Management; Military Strategy; Acquisition and Logistics Management; and Installations & Facilities Management.

Dose equivalent
The product of absorbed dose in tissue, quality factor and all other necessary modifying factors at the location of interest in tissue. The units of dose equivalent are the rem and sievert (Sv).

Effective dose equivalent
The sum of the products of the dose equivalent to the organ or tissue and the weighting factors applicable to each of the body organs or tissues that are irradiated. The units of dose equivalent are the rem and sievert (Sv).

Electromagnetic radiation
Electric and magnetic fields that oscillate at right angles to each other and to their direction of propagation and that travel at the speed of light in a vacuum (300,000 kilometers per second). Electromagnetic radiation includes gamma rays, x rays, ultraviolet radiation, visible light, infrared radiation, radiofrequency radiation, and extremely low frequency electromagnetic radiation (see table 5-3).

Electron volt (eV)
A unit of energy equal to $1.6\ 10^{-19}$ joule.

Exposure
In risk management, the frequency and length of time subjected to a hazard.

Extremely low frequency (ELF) electromagnetic radiation
Electromagnetic radiation with a frequency less than 3 kHz.

Eye dose equivalent
Applies to the external exposure of the lens of the eye and is taken as the dose equivalent at a tissue depth of 0.3 centimeter (300 mg cm^{-2}).

Giga- (G)
An SI unit prefix indicating a factor of one billion (10^9).

Gray (Gy)
The SI unit of absorbed dose. One gray is equal to an absorbed dose of 1 joule/kilogram (100 rads).

Hazard
Any real or potential condition that can cause injury, illness, death of personnel, damage to or loss of equipment or property, or mission degradation.

Hertz (Hz)
The SI unit of frequency equivalent to one vibration (cycle) per second.

High radiation area
An area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.1 rem (1 mSv) in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates.

Infrared (IR) electromagnetic radiation
Electromagnetic radiation with a wavelength between 760-780 nm and 1 mm.

Installation
A grouping of facilities located in the same vicinity, which support particular functions. Installations may be elements of a base. Land and improvements permanently affixed thereto which are under the control of the Department of the Army and used by Army organizations. Where installations are located contiguously, the combined property is designated as one installation and the separate functions are designated as activities of that installation. In addition to those used primarily by troops, the term installation applies to real properties such as depots, arsenals, ammunition plants (both contractor and Government operated), hospitals, terminals, and other special mission installations. For the purposes of this regulation, United States Army Regional Support Commands are installations.

Ionizing radiation
Charged subatomic particles and ionized atoms with kinetic energies greater than 12.4 eV, electromagnetic radiation with photon energies greater than 12.4 eV, and all free neutrons and other uncharged subatomic particles (except neutrinos and antineutrinos).

Kilo- (k)
An SI unit prefix indicating a factor of 1000.

Laser
A device that produces an intense, coherent, directional beam of light by stimulating electronic or molecular transitions to lower energy levels. An acronym for light amplification by stimulated emission of radiation. Lasers are classified by degree of potential hazard (see 21 CFR 1040.10 and ANSI Z136.1 for comprehensive definitions of laser hazard classes).

a. Class I lasers emit at levels that are not hazardous under any viewing or maintenance conditions. They are exempt from control measures. (However, as a matter of good safety practice avoid intrabeam viewing in case the laser is mislabeled.)

b. Class II lasers (low-power) emit in the visible light portion of the electromagnetic spectrum. They are a potential eye hazard only for prolonged intrabeam viewing. Eye protection is normally afforded by the aversion response including the blink reflex.

c. Class III (medium-power) lasers emit in the infrared, visible, or ultraviolet portions of the electromagnetic spectrum. They are a hazard for direct intrabeam and specular reflection viewing. Diffuse reflection is not normally a hazard.

   (1) Class IIIa lasers, even though they emit at class III power levels, have special beam characteristics that make them eye-safe except when viewed through magnifying optics.

   (2) Class IIIb lasers are all other class III lasers.

d. Class IV (high-power) lasers emit in the infrared, visible, or ultraviolet portions of the electromagnetic spectrum. They are hazardous for direct intrabeam exposure and sometimes diffuse reflection exposure to the eyes or skin. They may also produce fire, material damage, laser-generated air contaminants, and hazardous plasma radiation.

Low-level radioactive waste
See Radioactive waste, low-level.

Materiel readiness command
A major subordinate command of the U.S. Army Materiel Command responsible for National Inventory Control Point (NICP) and National Maintenance Point (NMP) functions for assigned items (AR 725-50).

Member of the public
Any individual except when that individual is receiving an occupational dose.

Micro-(μ)
An SI unit prefix indicating a factor of one one-millionth (10^{-6}).

Military-exempt lasers
Those lasers and laser systems that the U.S. Food and Drug Administration has exempted from the provisions of 21 CFR 1040.10 and 1040.11 and of 21 CFR 1002 (except 21 CFR 1002.20) (exemption no. 76-EL-01 DOD). These laser products are used exclusively by DOD components and are designed for actual combat or combat training operations or are classified in the interest of national security.

Milli- (m)
An SI unit prefix indicating a factor of one one-thousandth (0.001).

Naturally occurring or accelerator produced radioactive material (NARM)
Radioactive material not classified as byproduct, special, or source material; NARM includes NORM (naturally occurring RAM).

Nonionizing radiation
Electromagnetic radiation with photon energies less than 12.4 eV

Occupational dose
The dose received by an individual in the course of employment in which the individual□assigned duties involve exposure to radiation or to radioactive material from regulated and unregulated sources of radiation, whether in the possession of the employer or other person. Occupational dose does not include dose received from background radiation; from any medical administration the individual has received; from exposure to patients administered radioactive material and released in accordance with applicable regulations; from voluntary participation in medical research programs; or as a member of the public.

Optical radiation
See Visible light.

Peta- (P)
An SI unit prefix indicating a factor of one million billion (10^{15}).

Probability
The likelihood that an event will occur.

Project the force
One of the Army's four core capabilities. This capability includes the processes of tailoring, mobilizing and projection of land power, and supporting organizational training. Recognized as the overriding capability by which the Army will be measured is the ability to rapidly deploy ready forces into a distant area of operations and keep them coming as dictated by the tempo of battle.

Qualified expert
A person who, by virtue of training and experience, can provide competent authoritative guidance about certain aspects of radiation safety. Being a qualified expert in one aspect of radiation safety does not necessarily mean that a person is a qualified expert in a different aspect. Forward requests for determination of whether a certain individual is a qualified expert through command channels to the MACOM RSSO as necessary. Forward these requests to HQDA (DACS-SF), WASH DC 20310-0200, for further evaluation as necessary.

Quality factor
The modifying factor [listed in 10 CFR 20.1004, tables 1004(b).1 and 1004(b).2] that is used to derive dose equivalent from absorbed dose.

Rad
A unit of absorbed dose. One rad is equal to an absorbed dose of 0.01 joule/kilogram (0.01 gray).

Radiation
For the purposes of this regulation, unless otherwise specified, radiation includes both ionizing and nonionizing radiation.

Radiation area
An area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.005 rem (0.05 mSv) in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates.

Radiation safety
For the purposes of this regulation, a scientific discipline whose objective is the protection of people and the environment from unnecessary exposure to radiation. Radiation safety is concerned with understanding, evaluating, and controlling the risks from radiation exposure relative to the benefits derived. Same as *health physics and radiation protection.*

Radiation safety committee
An advisory committee for the commander to assess the adequacy of the command's radiation safety program. Same as *radiation control committee and radiation protection committee.*

Radiation Safety Officer
The person that the commander designates, in writing, as the executive agent for the command's radiation safety program. Same as *radiation protection officer or health physics officer.*

Radiation safety program
A program to implement the objective of radiation safety.

a. The Army's radiation safety program includes all aspects of:
   (1) Measurement and evaluation of radiation and radioactive material pertaining to protection of personnel and the environment.
   (2) Army compliance with Federal and DOD radiation safety regulations.
   (3) The Army's radiation dosimetry, radiation bioassay, radioactive waste disposal, radiation safety training, and radiation instrument TMDE and calibration programs.

b. A command's radiation safety program includes all aspects of:
   (1) Measurement and evaluation of radiation and radioactive material within the command as they pertain to protection of personnel and the environment.
   (2) Compliance with Federal, DOD, and Army radiation safety regulations.

Radioactive commodity
An item of Government property made up in whole or in part of radioactive material. A national stock number (NSN) or part number is assigned to commodities containing radioactive material greater than 0.01 Ci.

Radioactive waste
Solid, liquid, or gaseous material that contains radionuclides regulated under the Atomic Energy Act, as amended, or is of sufficient quantity to require an Army radiation authorization, and is of negligible economic value considering the cost of recovery.

Radioactive waste, low-level
Material the NRC classifies as low-level radioactive waste (see 10 CFR 62.2); waste not classified as high-level radioactive waste (spent nuclear fuel), as transuranic waste, or as uranium or thorium tailings and waste; material acceptable for burial in a land disposal facility (10 CFR 61).

Radiobioassay
See bioassay.

Radiofrequency (RF) electromagnetic radiation
Electromagnetic radiation with frequencies between 3 kHz and 300 GHz.

Radiofrequency (RF) controlled environment
Locations where RF exposure may be incurred by persons who are aware of the potential for occupational exposure, by other cognizant persons, or as the incidental result of transient passage through areas where analysis shows the exposure levels may be above those shown in DODI 6055.1, table 6-2-1, but do not exceed those shown in DODI 6055.1, table 6-1-1. Existing physical arrangements or areas, such as fences, perimeters, or weather deck(s) of a ship may be used in establishing a controlled environment.

Radiofrequency (RF) uncontrolled environments
Locations where RF exposures do not exceed permissible exposure levels in DODI 6055.1, table 6-2-1. Such locations generally represent living quarters, workplaces, or public access areas where personnel would not expect to encounter higher levels of RF energy.

Recorder, RSC
The person directly responsible for the accuracy and completeness of the RSC minutes. The recorder may designate someone else to take notes at RSC meetings (for example, an assistant or secretary). The recorder should be the RSO to help assure that the minutes meet regulatory requirements.

Rem
A unit of any of the quantities expressed as dose equivalent. The dose equivalent in rems is equal to the absorbed dose in rads multiplied by the quality factor (1 rem = 0.01 sievert).

Residual Risk
The level of risk remaining after controls have been identified and selected for hazards that may result in loss of combat power. Controls are identified and selected until residual risk is at an acceptable level or until it cannot be practically reduced any further.

Risk
Chance of hazard or bad consequences; exposure of chance of injury or loss. Risk level is expressed in terms of hazard probability and severity.

Risk assessment
The identification and assessment of hazards (first two steps of the risk management process).

Risk decision
The decision to accept or not accept the risk(s) associated with an action; made by the commander, leader, or individual responsible for performing that action.

Risk management
A logical five step thought process, applicable to any situation or environment, for identifying and controlling hazards to protect the force.

Risk management integration
The process by which individuals or organizations develop plans to embed risk management into all that they do.

Severity
The expected consequence of an event in terms of degree of injury, property damage, or other mission impairing factors (loss of combat power, adverse publicity, and so on), that should occur.

Shallow dose equivalent
Applies to the external exposure of the skin or an extremity and is taken as the dose equivalent at a tissue depth of 0.007 centimeter (7 mg cm^{-2}) averaged over an area of 1 square centimeter.

Sievert (Sv)
The SI unit of any of the quantities expressed as dose equivalent. The dose equivalent in sieverts is equal to the absorbed dose in grays multiplied by the quality factor (1 Sv = 100 rem).

Source material
Uranium or thorium, or any combination thereof, in any physical or chemical form or ores that contain by weight one-twentieth of one percent (0.05%) or more of uranium, thorium, or any combination thereof. Source material does not include special nuclear material.

Special nuclear material
Plutonium, uranium-233, uranium enriched in the isotope 233 or in the isotope 235, or any material artificially enriched by any of the foregoing.

Sustain the Force
One of the Army's four core capabilities. This capability includes the processes of acquiring, maintaining and sustaining equipment; maintaining and sustaining land operations; acquiring and sustaining infrastructure and operating installations.

Tera- (T)
An SI unit prefix indicating a factor of one trillion (10^{12}).

Total effective dose equivalent
The sum of the deep-dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures).

Type classification
A designation the Army uses to indicate acceptability for service use (AR 70-61).

Ultraviolet (UV) electromagnetic radiation
Electromagnetic radiation with wavelengths between 100 nm and 380-400 nm.

United States Army Reserve Center
A home station facility, activity, or installation utilized for administration and training of United States Army Reserve units and personnel.

Unrestricted area
An area, access to which in neither limited nor controlled (for the purposes of ionizing radiation safety).

Very high radiation area
An area, accessible to individuals, in which radiation levels could result in an individual receiving an absorbed dose in excess of 500 rads (5 grays) in 1 hour at 1 meter from a radiation source or from any surface that the radiation penetrates.

Visible light
Electromagnetic radiation with wavelengths between 380-400 nm and 760-780 nm.

Weighting factor
For an organ or tissue, the proportion of the risk of stochastic effects resulting from irradiation of that organ or tissue to the total risk of stochastic effects when the whole body is irradiated uniformly.

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Assistant Secretary of the Army (Installations, Logistics, and Environment) [ASA(IL&E)], 1-4a
Assistant Secretary of the Army (Manpower and Reserve Affairs), 1-4b, 1-5b
Chief, Army Ionizing Radiation Dosimetry Center (AIRDC), 1-4d(2), 5-2d(2), 5-2e(3)(b)
Chief, Army Reserve, 1-5b
Chief, National Guard Bureau, 1-5b, 1-9b(3)
Commander, 1-4k, 2-2a(4), 2-2b(3)
Commanding General,
Center for Health Promotion and Preventive Medicine (CG, CHPPM), 1-4g(6), 2-2a(3), 2-3d, 3-1c, 3-2d, 4-2a
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11. WASTE MANAGEMENT

Radioactive waste will be disposed of in accordance with AR 11-9 and/or the decommissioning plan.

U.S. Army Fort McClellan
Fort McClellan, Alabama
HQ, IOC Project Number USA 98-046

PHASE II

'BURIAL MOUND'

DECOMMISSIONING PLAN

Prepared by:

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July 1999

U.S. ARMY FORT McCLELLAN

'BURIAL MOUND'

DECOMMISSIONING PLAN

APPROVAL PAGE

July 1999

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1.0 GENERAL INFORMATION

This Decommissioning Plan is intended to cover the scope and intent of actions necessary for the effective remediation and post-closure verification for unconditional release of the area known as the 'Burial Mound' at the Fort McClellan U.S. Army installation in Anniston, Alabama. Elements of the work are delineated in sufficient detail to ensure that the efforts are technically adequate and that adherence with requisite regulatory issues is maintained.

The present work is contracted to ATG, Inc. under Modification Number P00002 of Contract Number DAAA09-98-C-0039, by the Headquarters, U.S. Army Industrial Operations Command, Project Number USA 98-046. The internal ATG project number is 10036.01.

Fort McClellan is comprised of three parts, the Main Post, the Choccolocco Corridor, and the Pelham Range occupying 45,679 acres adjacent to Anniston, Alabama. The Main Post encompasses 19,000 acres and contains the majority of the facilities. The Choccolocco Corridor, approximately 4,500 acres, is leased from the State of Alabama and connects the Main Post with the Talladega National Forest to the east. Pelham Range consists of approximately 22,000 acres west of the Main Post.

The Army Base Closure and Realignment Committee (BRAC) has identified Fort McClellan as an installation for closure. There are several radiological issues the Army must resolve prior to closing the installation, and one of the most pressing items of concern is the 'Burial Mound' previously used as a low-level radioactive waste disposal cell. The mound is contaminated with Cs-137 and Co-60. Under the current tasking, ATG has determined acceptable site-specific concentrations for use as guideline values and has developed the comprehensive methodology to effect the removal and disposal of radiologically contaminated material in the 'Burial Mound' and perform a survey for the unconditional release of the area. Disposition of the primary and incidental secondary waste streams shall be at Envirocare of Utah, or other licensed/authorized recipient.

1.1 Origination of Contamination

The history of the base included training exercises for the Army Chemical Corp. for simulated large area radioactive contamination (fallout) from the surface detonation of a small yield (less than 0.5 kiloton) nuclear weapon. The training concept was to raise and lower sealed radioactive sources, and have students perform both ground and aerial surveys to map the radiological fallout pattern. The training facility was utilized to train Radiation Control Teams in support of nuclear weapons testing performed by the Atomic Energy Commission (AEC). There was an AEC license issued for use of the sealed sources.

There were two radiological training areas during the operational period of the mid 1950's through May of 1973, referred to as Rideout Field. The first field, referred to as "Old Rideout Field", contained approximately 600 source storage wells and was located north of Cane Creek, between West Perimeter Road and Centerline Road. The second field, referred to as "New Rideout Field", extended south of Cane Creek along Centerline Road.

The Old Rideout Field used locally fabricated Co-60 sources and higher activity commercially procured Cs-137 sources. While the Co-60 sources were used to simulate a uniform fallout pattern, the Cs-137 sources were used to simulate hot spots within the fallout pattern. The sources were raised and lowered manually from their shielded storage positions, located approximately 6' below the ground surface. An excessive number of leaking locally fabricated Co-60 sources contributed to the formation of the on-site 'Burial Mound' for use as an interim on-site disposal cell. The contaminated soil resulting from historically leaking sources was accumulated and transported to the location which is now designated as the 'Burial Mound'.

1.2 Characterization of the 'Burial Mound'

A recent radiological characterization of the 'Burial Mound' was performed by the U.S. Army Center for Health Promotion and Preventive Medicine (CHPPM), reference Industrial Radiation Study No. 27-MH-0987-R2-97, Pelham Range Burial Mound Site, Fort McClellan, Alabama, 29 August - 15 September 1995 and 14 - 28 January 1996. The survey followed much of the protocols of NUREG/CR-5849, including background determination, walkover surface scans, hole logging, and sample analysis. A total of 571 systematic random and select bias samples were analyzed for radiological parameters. Both elevated Co-60 and Cs-137 were observed in surface soil samples, but only elevated Co-60 was found in subsurface samples. The distribution of reported Co-60 concentrations ranges from undetectable levels up to 330 pCi/g, with an arithmetic mean concentration of 1.8 pCi/g. The distribution of Cs-137 concentrations range from background up to 179 pCi/g, with an arithmetic mean of 0.46 pCi/g.

There exists some concern regarding the observed heterogeneity of the 'Burial Mound' as depicted in the CHPPM report. First, an isolated speck of significant Co-60 radioactivity was discovered within one of the discrete surface soil samples. With some effort, an object approximating the "eye of a sewing needle" in size was isolated and determined to be 253,000 pCi / 0.0043 gram, which converts to a specific activity (SpA) of 58.8 uCi per gram. This SpA far exceeds the Envirocare Waste Acceptance Criteria (WAC), which for Co-60 is limited to $3.0E^4$ pCi/gm, and $6.0E^4$ pCi/gm for the Cs-137 limit.

The related concern is with the significant gamma readings recorded during hole logging when samples from the bore hole and nearby indicated only trace amounts of contamination. The trend leads toward a conclusion of significant heterogeneity within the pile. It may appear that both soluble and insoluble contamination exists, and depending on the location of any sample, an aliquot being analyzed may or may not be representative of the balance of the sample media. A remedy to ensure a comprehensive screening of the entire soil population and to serve as a rule-out to prohibit exceeding WAC limits for SpA is engineered into this Plan. (Section 2.1.1).

ATG reviewed the characterization data and developed a Sampling and Analysis Plan (SAP) to complete waste profiling of the 'Burial Mound' for acceptance for disposal at Envirocare of Utah in May 1998. On-site samples were collected by ATG during execution of the SAP, and the samples were subsequently analyzed by Mountain States Analytical, Inc. for the full suite of parameters. The original 10 meter x 10 meter grid was re-established, and 6 grids were discretely sampled to a depth of 6'. Samples were collected at 1' depth increments and field screened for gamma activity prior to shipping for laboratory analysis. The locations of sampling for waste profiling were recorded by their individual proximity within the original 10 m x 10 m grid pattern, as well as logging their respective GPS coordinates.

Preliminary acceptance of the 'Burial Mound' waste stream as LLRW (low-level radioactive waste) was received from Envirocare in October 1998. The requisite Pre-Shipment samples were subsequently forwarded to Envirocare for their footprint analysis in November 1998. Both the Waste Profile Record (EC-0230) and the Pre-Shipment Sample Record (EC-2000) provided a tentative waste delivery date of March 1999, and a tentative volume in the estimated range of 870 cubic yards. Note: Final release criteria had not been determined during waste profiling, which resulted in an estimated final volume being employed.

1.3 Summary of the Physical Description

The actual 'Burial Mound' is observed as a slight elevation standing secluded from adjacent woodlands and drainage areas by open land all around. The 'Burial Mound' is located at the northwest corner of Pelham Range, at the northern end of the Battle Drill Area of Range 24C. The mound is oblong in shape and is approximately 25 meters long by 15 meters wide at coordinates 593300 meters East, 3732500 meters North in Universal Transverse Mercator (UTM) Grid Zone 16. Ref: Industrial Radiation Study No. 27-MH-0987-R2-97, U.S. Army Center for Health Promotion and Preventive Medicine.

The mound is literally an irregular pile of soil to approximately 6' elevation above the surrounding grade, and covered with light vegetation. The footprint encompasses parts of six grids (10 m x 10 m), and contamination has been observed to a depth of 12' below grade.

The area surrounding the 'Burial Mound' is utilized as a training area for students at the U.S. Army Chemical and Military Police Schools, Active Duty Units, Reserve Units and Alabama National Guard Units. Subsequent to BRAC action, the area including the present 'Burial Mound' is to be remediated and turned over to the State for use by the National Guards in September 1999. Possible future occupancy may include bivouacking National Guards, hunters, and trespassers.

1.4 License Status

The first AEC license (BML 1-2861-1) was issued to the Chemical School in 1957. Although substantiating documents (shipping papers) have not been located, reference is made to the proper disposal of all locally fabricated Co-60 sources. Despite the reference to the proper disposal of all locally fabricated Co-60 sources, one such source was found, recovered, and properly disposed of in 1985 from the area referred to as the 'Burial Mound'. Ref: Industrial Radiation Study No. 27-MH-0987-R2-97, U.S. Army Center for Health Promotion and Preventive Medicine.

The radiological constituents of the 'Burial Mound' are presently accounted for under existing NRC license number 01-02861-05, docket number 030-17584, for possession and ultimate decontamination and decommissioning activities.Ref: U.S. Army Chemical School, Radiation Protection Officer, License 01-02861-05.

The pending remedial actions leading to the closure of the 'Burial Mound' as planned herein shall be performed under the current specific radioactive material license as implemented by the designated contractor. ATG, Inc. shall execute this Plan with oversight of the radiological protection program by the licensee. The Nuclear Regulatory Commission, Region II, is the responsible governing regulatory entity having jurisdiction over the licensed radiological health program.

An urgency exists in the need for a timely license termination immediately upon completion of the 'Burial Mound' site remediation. Other facility installations are to undergo characterization in parallel to the 'Burial Mound' activities, and are governed by the guidelines of a separate Plan. The base is to be closed under the BRAC by September 1, 1999.

2.0 DESCRIPTION OF PLANNED DECOMMISSIONING ACTIVITIES

2.1 Decommissioning Objectives, Activities, Tasks and Schedules

The principal elements necessary to facilitate removal and disposal of radiologically contaminated portions of the 'Burial Mound' are indicated in the following breakdown. The end-goal of this remedial action is the timely and economical extraction of known contaminated material from within the 'Burial Mound" and screening/sampling it to rule-out any isolated "hot spots" which may otherwise rival the disposal facility WAC. Subsequent to addressing the impacted material from the CHPPM characterization data, the balance of material in the impacted and immediately adjacent grids will be excavated to the maximum depth in which contamination has been found nearby, and the material will be direct surveyed for sorting by concentration limits. Material will be either rejected as LLRW and staged for disposal, or alternatively accepted for use as fill and staged for future replacement in the excavation.

The soil will be monitored on a conveyor system with NaI detectors and a determined sensitivity sufficient to meet the contaminant guidelines. Systematic samples will be collected after monitoring for on-site laboratory analysis by gamma spectroscopy to determine the correlation between scan instrument sensitivity and actual concentrations in soil. Quality control measures will additionally include splitting samples at a 10% frequency with a third party laboratory.

The waste will be loaded into Intermodal containers and shipped to Envirocare for disposal, with little latency between staging and shipping. The remediated excavation area and ultimately the grounds in the area of monitoring and material staging will be surveyed and sampled following the protocols of MARSSIM. The final status survey will be performed after the final waste shipment has been completed. All samples collected during the verification survey will be analyzed initially on-site to support early demobilization, and split with a third party laboratory for comparative analysis.

A project Final Report will be prepared detailing the events of the remedial action, referencing manifests and survey records, and including release surveys of equipment and areas. Data analysis/reduction will be performed off-site, and will ensure standardization of reporting units, statistical review for adequacy of data, and a comparison of actual residual levels of radioactivity in relation to the prescribed acceptable limits.

2.1.1 Decommissioning Objectives

The objectives of the decommissioning event governed by this Plan are:

2.1.1.1 Development and consensus adoption of site specific criteria for use as guideline values for residual concentrations of the contaminants of concern (i.e., Co-60 and Cs-137) in soil, with this task being completed herein; Ref: Development of Derived Cleanup Guidelines for the Pelham Range Burial Mound, Fort McClellan, Auxier & Associates, January 1999.

2.1.1.2 The removal of the material in the vicinity of the 'Burial Mound' and immediately adjacent grounds;

Below Grade: 8 grids x 10 m x 10 m area x 3.65 m max depth	= 2,926 m^3
Slopes Sides: 14 x 10 m w. x 2.43 m depth x (4.88 m/2) l.	= 831 m^3
Above Grade: 6 grids x 10 m x 10 m area x 1.83 m max elev	= 1,098 m^3
In-Situ Volume:	4,855 m^3
Fluff Factor (Volume factor attributed to soil conditioning)	X 1.3
Removed and Processed Volume:	6,311 m^3

Ref. Attachments 1,2, and 5

2.1.1.3 In-line radiologically screening of soils via an automated conveyor / monitoring system and segregation of materials into 1)impacted (LLRW)[381 m^3]or [498 yd^3] estimated, or 2) non-impacted (backfill)[5930 m^3] with proven instrumentation sensitivity and QC verification by systematic sampling for laboratory analysis;

2.1.1.4 Shipment of LLRW to Envirocare for off-site disposal in a timely manner;

2.1.1.5 Employing results of the preceding survey and progress measurements for development of the verification survey following MARSSIM, and early implementation in the field;

2.1.1.6 Decontamination and release surveys of materials and equipment, and subsequent final waste shipment;

2.1.1.7 Submission of final report to ensure license termination prior to September 1, 1999.

2.1.1.8 Partial re-mobilization upon regulatory approval for backfill and closure of the excavation area.

TABLE 2.1.2 **Decommissioning Activities and Tasks**

Objective	Activity	Task	Description
2.1.1.1 Develop Site-Specific Criteria for Residual Contaminant Concentrations in Soil	1) Preliminary Planning Phase (completed)	1 Detailed Review of Existing Source Term	Identify key contaminants, physical area involved, and the range of existing concentrations.
		2 Preliminary Discussion w/Stakeholders to Reach Consensus	Ensure that scenarios for modeling and technical approach is mutually acceptable.
		3 Develop Concentration. Limits to Meet Dose/Risk Criteria	Apply reference data to conservative scenario for first cut at dose assessment.
		4 Resrad Code / Direct Gamma & Side Pathways	Apply reference computer code for determination of the site-specific dose based assessment
		5 Apply EPA Slope Factors / Risk Based Criteria	Cross-reference dose-based assessment to risk based criteria.
		6 Compare Designed Criteria to Pending Instrument Sensitivities	Perform reality check to ensure that the derived concentrations are within the sensitivity range of instrumentation to be employed.
		7 Submit Results of Site Specific Dose Assessment for Consensus Acceptance	Gain approval prior to adoption into the Decommissioning Plan.
			The development of site specific criteria provides technically defended concentration values with demonstrated minimal risk, while additionally achieving some economical advantage through ultimate waste volume reduction over alternative default values.

TABLE 2.1.2 **Decommissioning Activities and Tasks**

Objective	Activity	Task	Description
2.1.1.2 Remove Contents of the 'Burial Mound" and the Immediately Adjacent Grounds	1 Mobilization	1 Instrument Calibration	Ensure that all necessary instrumentation to be used in the field are in current calibration.
		2 Refresher Training	Provide necessary refresher training, i.e., 8-hr HAZWOPER, off-site.
		3 Entry Bioassays	All project personnel to submit base line bioassay (urine) samples for third party analysis by gamma spectroscopy.
		4 Travel	Ground travel to Fort McClellan, ~ one-half day's effort from Oak Ridge, TN, from which the primary crew originates.
		5 Site Specific Training	Documented site-specific training to the Decommissioning Plan, the QA Plan, and the HASP, as well as base requirements and logistical review.
		6 Preliminary Survey	A preliminary radiological survey of the general grounds to establish suitability for use as staging / lay-down areas, and to determine background levels for placement of the soil monitoring system.
		7 Implement OE Avoidance Plan	Perform OE survey of pile and immediately adjacent grounds surface to avoid the prospect of encountering ordnance and explosives on the base. Provide continued surveillance during excavation and soil monitoring phase.

TABLE 2.1.2 **Decommissioning Activities and Tasks**

Objective	Activity	Task	Description
2.1.1.2 Remove Contents of the "Burial Mound" and the Immediately Adjacent Grounds	1 Mobilization	8 Equipment Receipt / Set-up	Equipment will be received and set-up in locations correlating to the results of the preliminary survey. Equipment to include: Office / Lab / break area trailer, storage trailer, generators, Powerscreen modified with monitoring system, skid steer loader, and track-hoe.
		9 Install Security Fencing and Erosion Controls	Orange safety fencing (4') will be placed around the entirety of the controlled area during construction on-site. Silt fencing will be placed to prevent site erosion and/or cross-contamination into/out from the excavation area and the material staging location.
		10 Establish Control Points	A single access will be designated for equipment and vehicular traffic, and for personnel ingress/egress. Personnel frisking instrumentation will be maintained. Equipment and vehicles will require an exit survey if operated in the impacted area.
		11 Issue Radiation Work Permit (RWP)	An RWP will be issued for the remediation, re-characterization, and final survey of the Burial Mound and adjacent grounds. The RWP describes conditions and requirements for working in the area.

TABLE 2.1.2 **Decommissioning Activities and Tasks**

Objective	Activity	Task	Description
2.1.1.2 Remove Contents of the "Burial Mound" and the Immediately Adjacent Grounds	2 Burial Mound Remediation	1 Degrub Pile	The existing underbrush and small deciduous vegetation will be removed from the Burial Mound above grade pile prior to excavation.
		2 Process Vegetation	All vegetation will be shredded on-site and treated as LLRW for disposal.
		3 Extract Known Contaminated Soil	The above grade pile and the areas of known contamination per the CHPPM characterization report will be removed and monitored first. This permits early assurance of monitoring sensitivity and allows self-decontamination of the equipment by subsequent abrasive action of soil material of less probable contamination from distant areas.
2.1.1.3 In-Line Radiological Screening of Soils for Segregation of Impacted and Non-Impacted Material	1 Burial Mound Remediation	4 Remove Balance of Area Soil	The entirety of soil contents over the 8 grids will be excavated to the 12' depth, which is the deepest observed penetration of contamination observed at a single bore sample location in the CHPPM report. All removed material will undergo direct radiological screening.
		1 Prepare, Radiological Monitor, and Sort Monitored Material	Soil will be processed to break-up the hard clay into a dispersable material, and transfer it by an enclosed chute onto a 3' wide conveyor. The conveyor is curved on the sides to contain material, and has an active area for conveyance of 2' wide. to detect less than the site-specific concentration values prescribed.

TABLE 2.1.2 **Decommissioning Activities and Tasks**

Objective	Activity	Task	Description
2.1.1.3 In-Line Radiological Screening of Soils for Segregation of Impacted and Non-Impacted Material	1 Burial Mound Remediation	1 Prepare, Radiological Monitor, and Sort Monitored Material Contd.	An array of ten 2"x2" NaI detectors mated to alarming ratemeters and calibrated to the contaminants of concern make-up the stationary monitor under which the conveyor moves the soil. The speed is controlled along with the distance from the detectors, which results in an overall calibrated system with sufficient sensitivity.
		2 Material Sampling and Staging	An alarm of any detector will result in a manual system shut-down and rejection of the material as impacted, requiring containerization. Non-impacted soils will be segregated from impacted material and staged on clean ground cover. Systematic sampling will be performed and on-site analysis provided by gamma spectroscopy. QC samples at a 10% frequency will be split for third party analysis for verification. Impacted material will be packaged in 22 CY Intermodal containers with sliding rigid lids.
2.1.1.4 Shipment of LLRW to Envirocare for Disposal		1 Bulk Waste Packaging	Impacted soil will be placed into the container staged on the ground. Filling will be monitored for manually limiting to approximately 17 CY to maintain gross weight requirements (density of ~ 1.35 tons/CY).

TABLE 2.1.2 **Decommissioning Activities and Tasks**

Objective	Activity	Task	Description
2.1.1.4 Shipment of LLRW to Envirocare for Disposal		2 Waste Shipments	The expected (up to) 500 m^3 of impacted soil, vegetation, and PPE will be shipped in campaigns of approximately 4 loads/day, with 10 shipping campaigns stretched out over the soil monitoring period.
2.1.1.5 Verification Survey Following MARSSIM	1 Final Survey	1 Design Sampling Strategy	Employ recent remediation tasks and the earlier CHPPM survey data for development of the final status survey strategy. Area of approximately 7 Class 1 survey units of ~1000 to 2000 m^2, having been just remediated and/or used for handling and staging uncontainerized radioactive materials. No Class 2 or Class 3 areas designated. Determine the number of data points (random samples) following statistical recommendations of MARSSIM. Determine number of data points for target area and for background correlation. Establish data quality objectives. Integrate the survey strategy.
		2 Sample Collection	Tie-in the reference grid system, and install a square grid (10 m x 10 m). Install the triangular grid.

TABLE 2.1.2 **Decommissioning Activities and Tasks**

Objective	Activity	Task	Description
2.1.1.5 Verification Survey Following MARSSIM	1 Final Survey	2 Sample Collection Contd.	Cross-calibrate the 2" x 2" NaI field instrument to the true exposure response of a Pressurized Ionization Chamber. Perform the designed comprehensive scan survey coverage. Collect the designated number of randomly selected samples.
		3 Third Party Analysis	Provide necessary QA/QC. Complete chain-of-custody records and ship samples to third party laboratory. Have all samples comparably analyzed by gamma spectroscopy.
		4 Data Evaluation	Results will be converted to standardized units. Laboratory analysis and exposure rate measurement QC data will be evaluated for accuracy and precision. Any additional data needs will be identified. Annotate facility drawings to depict grid lay-out and sample locations. Graphically display concentrations on posting plots and histograms for survey units and reference area.

TABLE 2.1.2 **Decommissioning Activities and Tasks**

Objective	Activity	Task	Description
2.1.1.5 Verification Survey Following MARSSIM	1 Final Survey	5 Data Interpretation	Exposure data meeting acceptance criteria will be evaluated using the Wilcoxon Rank Sum test for each group of survey unit samples. Soil concentration data will be evaluated using the Student t-test. Any findings that are inconclusive or evidence leads to the criteria having not been met will be reported immediately to ensure early project closure. Results will be compared with DQOs established during the design phase.
		6 Report of Survey Findings	The final report will include survey procedures and results, and will follow the general guidance of MARSSIM.
2.1.1.6 Decontamination and Release Surveys of Equipment; and Final Waste Shipment	1 Demobilization	1 Decontaminate Major Equipment	Equipment will be decontaminated as soon as its use on the project has been completed, and decontamination/survey will be a parallel activity with site release survey preparations. The soil monitoring and handling equipment will be decontaminated primarily by passing large volumes of unaffected soil through it during the course of screening the balance of soil form the grids. The known affected material will be handled first. Ultimately, equipment will be freed of all clinging soil product by manual abrasives and supplemented by HEPA vacuum for debris pick up.

TABLE 2.1.2 **Decommissioning Activities and Tasks**

Objective	Activity	Task	Description
2.1.1.6 Decontamination and Release Surveys of Equipment; and Final Waste Shipment	1 Demobilization	2 Survey Major Equipment for Release	All areas susceptible to contact with contaminated material will be accessed and direct surveyed for release. Swipe samples will be collected and counted on-site. Survey data will be recorded on equipment diagrams to indicate the location of measurements.
		3 Final Equipment Decon / Survey	The remaining site equipment will be decon upon completion of the post-remediation walkover scan survey of the grounds. Decon will be performed on plastic lay-down areas. Radiological surveys will be performed to ensure effective decon efforts and to ultimately verify that levels of residual activity are acceptable for unconditional release.
		4 Final Waste Shipment	Secondary wastes, including spent filters, PPE, plastic, and deconned/removed residue from equipment, will be packaged along with impacted soil in the final Intermodal container. The final waste container will be scheduled for shipment in between the site remediation and the final verification survey.
		5 Site Clean-up	The work area will be restored to its condition prior to remediation activities. Solid waste will be removed, equipment containerized, and the grounds leveled (i.e., tracks smoothed), prior to performing the final verification survey. No site conditions will be altered after the verification survey has been completed.

TABLE 2.1.2 **Decommissioning Activities and Tasks**

Objective	Activity	Task	Description
2.1.1.6 Decontamination and Release Surveys of Equipment; and Final Waste Shipment	1 Demobilization	5 Site Clean-up Cont.	Equipment will be shipped and support utilities will be removed upon completion of the verification survey, also.
		6 Exit Bioassays	All site workers will submit a final bioassay (urine) sample for third party analysis to determine the extent of any uptake. Bioassay results will be used to indicate the effectiveness of the radiological controls program when the TEDE is calculated along with the contribution of external exposure. As warranted, internal exposure will be assigned and recorded for an individual.
		7 Return Travel	The balance of project personnel will demobilize upon completion of the final verification survey.
2.1.1.7 Submit Final Report	1 Final Report	1 Receive Third Party Analytical Results	10% of the final samples are to be shipped for third party analysis by gamma spectroscopy. The project budget assumes a routine TAT, expecting ~ 3 weeks for data receipt.
		2 Standardize and Compare Data	Survey and sample results will be reviewed and standardized, and the values will be compared to the release criteria. Statistical tests will be performed, and the acceptance or rejection of results in meeting the criteria will be determined. Data will be compared to the 25 mrem/y release criteria, assuming immediate occupancy by a resident family.

TABLE 2.1.2 Decommissioning Activities and Tasks

Objective	Activity	Task	Description
2.1.1.7 Submit Final Report	1 Final Report	3 Draft Narrative Report	A description of the overall project effort will be drafted to include major activities, waste volumes, manifest copies, and the extent of excavation and soil monitoring. The established governing criteria will be displayed along with the respective references. Emphasis will be placed on the final status survey (MARSSIM).
		4 Assemble Report & Supporting Data	The narrative report, field data, and analytical results will be compiled into a single submittal. The goal is to complete work activities and submit the report for contemplation of NRC license termination prior to September 1, 1999.
2.1.1.8 Closure	1 Remobilization	1 Return Travel	A partial crew re-mobilization to the site will occur upon notification of regulatory approval, indicating verification and acceptance of the site meeting conditions suitable for license termination.
	2 Site Closure	2 Property Restoration	The excavated area of the 'Burial Mound' will be backfilled with the stockpiled monitored soil and imported clean fill, as necessary. The area will be graded and contoured to match the adjacent area.

2.1.3 Procedures

Execution of this Decommissioning Plan will be performed in accordance with the project 'Health and Safety Plan', Appendix 1; the 'Quality Assurance Plan', Appendix 2; the 'OE Avoidance Plan', Appendix 3; and, internally approved ATG Field Operations Procedures submitted as Appendix 4. All Field Operations procedures employed on the project have been previously approved and implemented on earlier ATG / IOC projects of similar scope and work activities. Any changes, additions, or revisions to the procedures will be subject to a review process and require applicable internal approval, as well as acceptance by the U.S. Army IOC Project Manager prior to implementation.

Data and text should be updated, where relevant, by replacement of the existing pages with the latest revised pages. All pages submitted to update, revise, or add pages to the procedure(s) should show the date of change and the change or revision number. A guide page listing the pages to be inserted or revised, or pages to be removed, should accompany the revised pages. When major changes are made, a revised table of contents should be provided.

2.1.4 Schedule

The integrated schedule for the remediation of the Fort McClellan 'Burial Mound' follows in Gantt chart format as developed using Microsoft Project. Upon mobilization, the crew effort is assumed to be working five 10-hour days per week on average.

The actual on-site duration for field activities in the screening of soils, packaging and disposal of LLRW, and performing the final status survey encompasses six calendar weeks. The critical path is the throughput of the large volume of soil from the 'Burial Mound', subsequent depths, and immediately adjacent areas. The productivity of the soil monitor is identified in Section 4.0.

It is anticipated that project on-site activities will be performed during a single ten-hour weekday shift, working five days per week. However, due to the weather-related nature of the objective, the actual work may at times by on a flexible schedule to permit elongation of production during optimal conditions, and reduced site time when conditions jeopardize productivity, i.e., wet conditions. The plan of the day will be communicated with site representatives prior to schedule adjustments.

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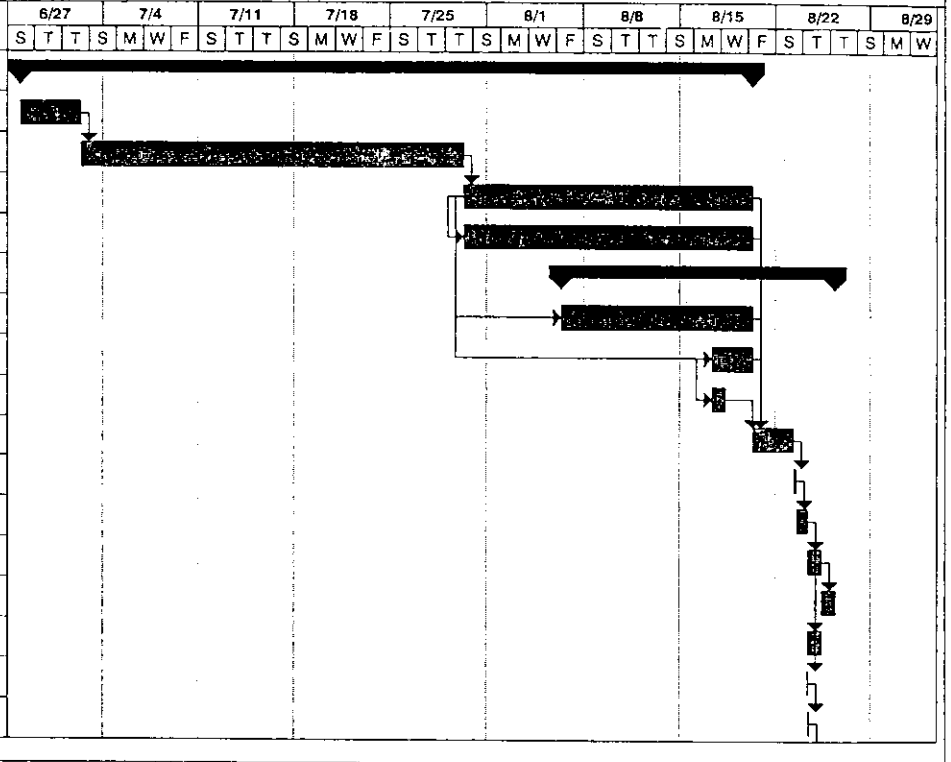
ID	WBS	Task Name	Duration	Start	Finish	Predecessors
1	1	Planning Phase	40 days	Mon 6/28/99	Fri 8/20/99	
2	1.1	Decommissioning Plan Submission	5 days	Mon 6/28/99	Fri 7/2/99	
3	1.2	Decommissioning Plan Approval	20 days	Fri 7/2/99	Fri 7/30/99	2
4	1.3	Procurement	15 days	Fri 7/30/99	Fri 8/20/99	3
5	1.4	Schedule Coordination	15 days	Fri 7/30/99	Fri 8/20/99	4SS
6	2	Mobilization	14 days	Fri 8/6/99	Thu 8/26/99	
7	2.1	Instrument Calibration	10 days	Fri 8/6/99	Fri 8/20/99	4SS+5 days
8	2.2	Refresher Training	3 days	Tue 8/17/99	Fri 8/20/99	5SS+12 days
9	2.3	Entry Bioassays	1 day	Tue 8/17/99	Wed 8/18/99	8SS
10	2.4	Travel	1 day	Fri 8/20/99	Mon 8/23/99	4,5,7,8,9
11	2.5	Site Specific Training	0.5 days	Mon 8/23/99	Mon 8/23/99	10
12	2.6	Preliminary Radiological Survey	0.5 days	Mon 8/23/99	Tue 8/24/99	11
13	2.7	Surface EO Survey	1 day	Tue 8/24/99	Wed 8/25/99	12
14	2.8	Equipment Set-up	1 day	Wed 8/25/99	Thu 8/26/99	13
15	2.9	Install Security / Sediment Fencing	1 day	Tue 8/24/99	Wed 8/25/99	12
16	2.10	Establish Control Points	0.2 days	Tue 8/24/99	Tue 8/24/99	12
17	2.11	Issue RWP	0.2 days	Tue 8/24/99	Tue 8/24/99	16



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Rolled Up Progress
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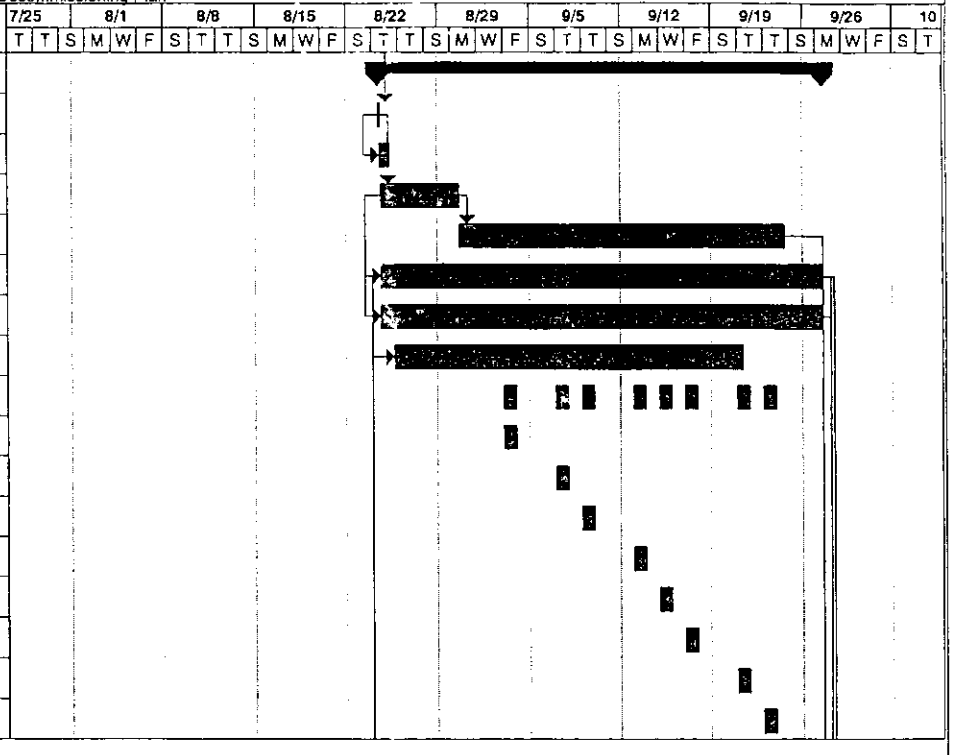
ID	WBS	Task Name	Duration	Start	Finish	Predecessors
18	3	**Burial Mound Remediation**	**26.5 days**	**Tue 8/24/99**	**Mon 9/27/99**	
19	3.1	Degrub Pile	0.5 days	Tue 8/24/99	Tue 8/24/99	17
20	3.2	Process Vegetation	0.5 days	Tue 8/24/99	Wed 8/25/99	19SS+0.2 day
21	3.3	Extract Known Contaminated Soil	4 days	Tue 8/24/99	Mon 8/30/99	19
22	3.4	Remove Balance of Area Soil	21 days	Mon 8/30/99	Fri 9/24/99	21
23	3.5	Screen, Monitor, Sort Soil	26 days	Tue 8/24/99	Mon 9/27/99	21SS
24	3.6	Material Sampling & Staging	26 days	Tue 8/24/99	Mon 9/27/99	23SS
25	3.7	Bulk Waste Packaging	20 days	Wed 8/25/99	Tue 9/21/99	23SS+1 day
26	3.8	**Expected Waste Shipments**	**16.44 days**	**Fri 9/3/99**	**Thu 9/23/99**	
27	3.8.1	Expected Waste Shipments 1	1 day	Fri 9/3/99	Fri 9/3/99	
28	3.8.2	Expected Waste Shipments 2	1 day	Tue 9/7/99	Tue 9/7/99	
29	3.8.3	Expected Waste Shipments 3	1 day	Thu 9/9/99	Thu 9/9/99	
30	3.8.4	Expected Waste Shipments 4	1 day	Mon 9/13/99	Mon 9/13/99	
31	3.8.5	Expected Waste Shipments 5	1 day	Wed 9/15/99	Wed 9/15/99	
32	3.8.6	Expected Waste Shipments 6	1 day	Fri 9/17/99	Fri 9/17/99	
33	3.8.7	Expected Waste Shipments 7	1 day	Tue 9/21/99	Tue 9/21/99	
34	3.8.8	Expected Waste Shipments 8	1 day	Thu 9/23/99	Thu 9/23/99	



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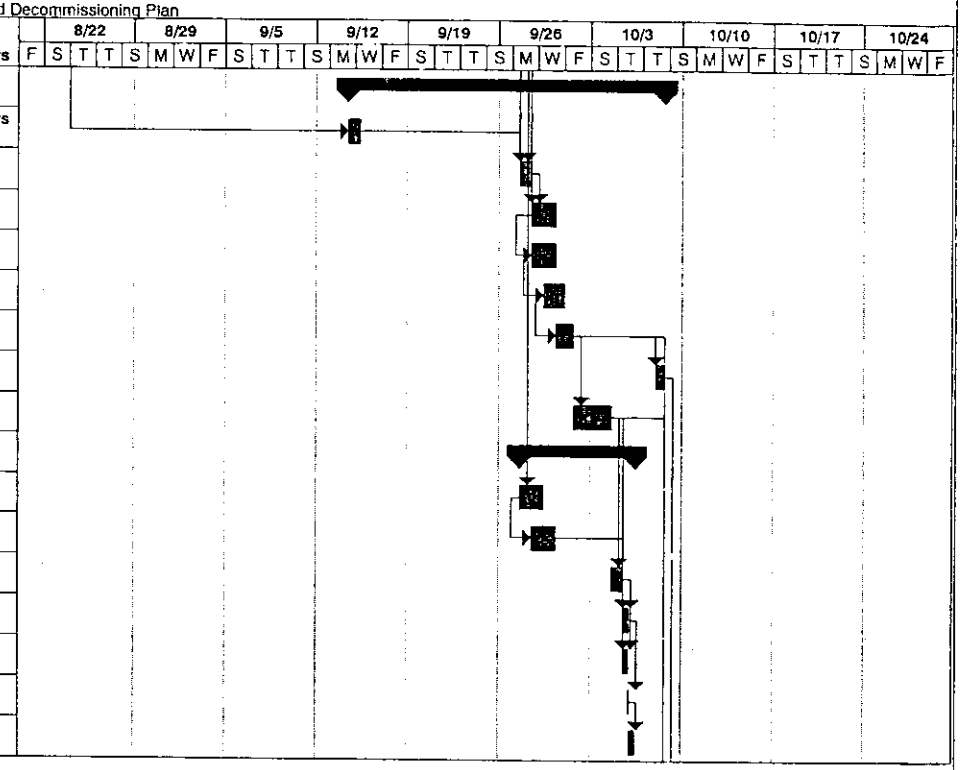
ID	WBS	Task Name	Duration	Start	Finish	Predecessors
35	4	**Final Status Survey**	**22 days**	**Tue 9/14/99**	**Fri 10/8/99**	
36	4.1	Establish Background	1 day	Tue 9/14/99	Wed 9/15/99	23SS+15 days
37	4.2	Re-establish Grid	1 day	Mon 9/27/99	Tue 9/28/99	22,24,36
38	4.3	Walkover Gamma Scan Survey	2 days	Tue 9/28/99	Thu 9/30/99	23,37
39	4.4	Exposure Rate Measurements	2 days	Tue 9/28/99	Thu 9/30/99	38SS
40	4.5	Sampling of Surface Soil	2 days	Wed 9/29/99	Fri 10/1/99	39SS+1 day
41	4.6	On-site Sample Analysis	2 days	Thu 9/30/99	Fri 10/1/99	40SS+1 day
42	4.7	Third Party Analysis	1 day	Fri 10/8/99	Fri 10/8/99	41FS+5 days
43	4.8	Final Remedial Action / Resample	1 day	Fri 10/1/99	Mon 10/4/99	41
44	5	**Demobilization**	**8.1 days**	**Mon 9/27/99**	**Wed 10/6/99**	
45	5.1	Decontaminate Major Equipment	2 days	Mon 9/27/99	Wed 9/29/99	23
46	5.2	Major Equipment Surveys	2 days	Tue 9/28/99	Thu 9/30/99	45SS+1 day
47	5.3	Final Equipment Decon / Survey	1 day	Mon 10/4/99	Tue 10/5/99	43
48	5.4	Final Waste Shipment	0.5 days	Tue 10/5/99	Tue 10/5/99	43,47
49	5.5	Site Clean-up	0.5 days	Tue 10/5/99	Tue 10/5/99	46,47
50	5.6	Exit Bioassys	0.1 days	Tue 10/5/99	Wed 10/6/99	48
51	5.7	Return Travel	0.5 days	Wed 10/6/99	Wed 10/6/99	50



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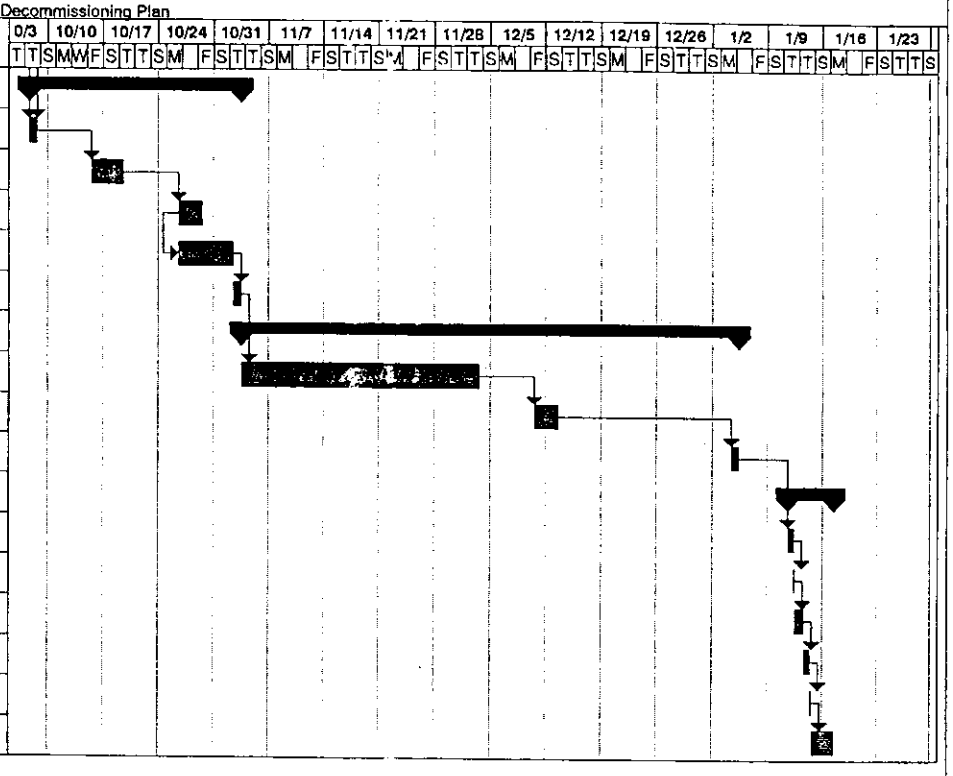
ID	WBS	Task Name	Duration	Start	Finish	Predecessors
52	6	**Final Report**	**19 days**	**Thu 10/7/99**	**Wed 11/3/99**	
53	6.1	Receive Analytical Results	1 day	Thu 10/7/99	Fri 10/8/99	41,42,43
54	6.2	Standardize & Compare Data	2 days	Fri 10/15/99	Tue 10/19/99	53FS+5 days
55	6.3	Draft Narrative Report	3 days	Tue 10/26/99	Fri 10/29/99	54FS+5 days
56	6.4	Assemble Report & Supporting Data	5 days	Tue 10/26/99	Tue 11/2/99	55SS
57	6.5	Submit Final Report	1 day	Tue 11/2/99	Wed 11/3/99	56
58	7	**License Termination**	**37 days**	**Wed 11/3/99**	**Wed 1/5/00**	
59	7.1	NRC Review of Report	20 days	Wed 11/3/99	Fri 12/3/99	57
60	7.2	Third Party Confirmatory Survey	1 day	Fri 12/10/99	Mon 12/13/99	59FS+5 days
61	7.3	Authorization to Backfill	1 day	Tue 1/4/00	Wed 1/5/00	60FS+10 days
62	8	**Area Closure**	**3.75 days**	**Tue 1/11/00**	**Mon 1/17/00**	
63	8.1	Partial Re-Mob	0.5 days	Tue 1/11/00	Wed 1/12/00	61FS+5 days
64	8.2	Remove Safety & Silt Fencing	0.25 days	Wed 1/12/00	Wed 1/12/00	63
65	8.3	Push in Staged Soil	1.5 days	Wed 1/12/00	Thu 1/13/00	64
66	8.4	Receive & Place Imported Fill	0.5 days	Thu 1/13/00	Fri 1/14/00	65
67	8.5	Final Grading	0.5 days	Fri 1/14/00	Fri 1/14/00	66
68	8.6	Final Demob	0.5 days	Fri 1/14/00	Mon 1/17/00	67



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2.2 Decommissioning Organization and Responsibilities

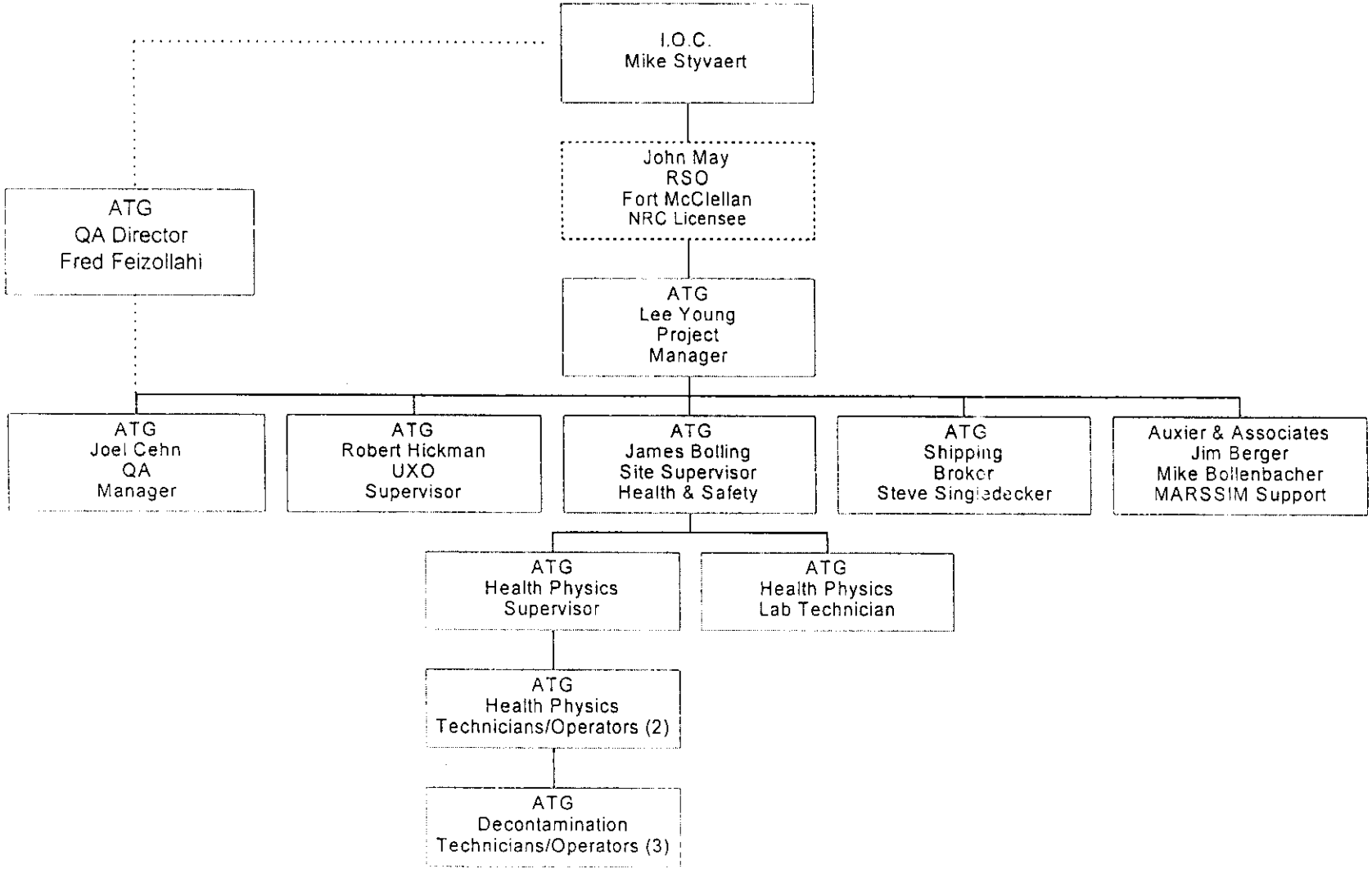
The project organization chart follows. The basic structure depicts the ATG approach, with streamlining by project implementation under the current NRC radioactive material license possessed by the site, which provides for decommissioning of the 'Burial Mound'. Additional benefit may be realized in the prospect of naming the ATG project manager as the designated Radiation Safety Officer for license coverage during any interim in which the facility RPO may be off-site. The slated ATG project manager has served as the licensed Radiation Safety Officer on sites governed by the States of Tennessee and Texas, and for NRC licensees.

The project team provides for integrated activities during the project (see Schedule, Section 2.1.4) to facilitate compressing the overall time on-site. Expertise is provided in the areas of project management, construction / excavation, radiological protection, health and safety, quality assurance, and in military explosives/ordnance. Technical specialties also include the application of MARSSIM in the final status survey, and experienced transportation brokerage of wastes into Envirocare. Key project resumes are provided as Attachment 6.

The basic work force for the range remediation activities will consist of a Project Manager with on-site QA responsibilities, Project Supervisor with combined Health and Safety responsibilities, and a remediation team including 2 senior health physics technicians and 3 decontamination technicians / operators. Supplemental crew include one EOD/UXO Specialist, a health physics lab/count room technician, and an IOC approved Broker during the waste shipment campaigns.

MARSSIM expertise is provided by a subcontractor, Auxier & Associates, including Mr. Jim Berger who drafted the predecessor guide NUREG/CR-5849, and was a contributor to the present survey protocol.

ORGANIZATIONAL CHART



2.3 Training

Each member of the project on-site crew will be trained and qualified as radiation workers. Training records will be maintained on-site as part of meeting the Quality Assurance Plan requirements. Training specific to the project will be performed prior to the start of work activities by the Project Manager or the Health and Safety Manager, and recorded on the Training Record (ATG Form 027). All training records will be retained as part of the permanent project file.

Radiation worker training will include, but not be limited to the following subjects:

1) Radiation Worker Rights
2) Sources of Radiation and Contamination
3) Types of Radiation and Contamination
4) Units of Radiation and Radioactivity
5) Prenatal Exposure (Reg. Guide 8.13)
6) Biological Effects of Radiation
7) Concepts of Radioactive Contamination Control
8) Use of Anti-C Clothing
9) ALARA Concepts
10) Emergency Procedures
11) Use of Radiation and Contamination Detection and Measurement Instrumentation

The personnel assigned to the Fort McClellan 'Burial Mound' project shall have completed the 40 Hour Hazardous Waste Operator and Emergency Response (HAZWOPER) training, and be current in the 8 Hour Refresher. Supervisory personnel shall have completed the 8 Hour HAZWOPER Supervisor training, per 29 CFR 1910.120. All on-site personnel will be required to provide evidence of their current OSHA training (29 CFR 1910.120 e.6) and Medical Certification (29 CFR 1910.120.f)

All respirator wearers will be trained on the specific use of respiratory protective equipment and have documented evidence of current fit testing per 29 CFR 1910.134. Additionally, Site Specific Training will be performed to familiarize the workers with the base and project specific and requirements. Supplemental site-specific training will be documented on a Training Record (ATG Form 027), and will be maintained as part of the permanent project file.

2.4 Contractor Assistance

Allied Technology Group, Inc. (ATG) is the prime contractor for the Decommissioning of the 'Burial Mound' at Fort McClellan.

There will be no lower-tier subcontractors directly involved with performance of the on-site objective., with the limited exception of the IOC-approved broker for shipping to Envirocare, Steve Singledecker, contracted through ADF. All on-site personnel will be trained to and abide by the site specific project Plans.

Auxier and Associates will provide off-site consultation for implementation of the verification survey of the site using the MARSSIM protocols, and will provide subsequent data evaluation. A local subcontractor will provide excavation services for final site restoration, but will be involved only upon closure of site concerns regarding radioactivity and UXO. An ATG representative will accompany final restoration events to ensure that administrative controls are maintained.

3.0 DESCRIPTION OF METHODS USED FOR PROTECTION OF OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY

3.1 Facility Radiological History Information

The history of radioactive materials used at the base, and specifically the origination of the 'Burial Mound' was described in Section 1.1. In summary, the base was used for training exercises for the Army Chemical Corp. for simulated large area radioactive contamination (fallout) from the surface detonation of a nuclear weapon. The training concept was to raise and lower sealed radioactive sources, and have students perform both ground and aerial surveys to map the radiological fallout pattern. The training facility was utilized to train Radiation Control Teams in support of nuclear weapons testing performed by the Atomic Energy Commission (AEC).

There were two radiological training areas during the operational period of the mid 1950's through May of 1973, referred to as New and Old Rideout Fields. A large number of source storage wells were placed for use in the training exercises. The majority of the sources used were locally fabricated Co-60 sources and higher activity commercially procured Cs-137 sources. While the Co-60 sources were used to simulate a uniform fallout pattern, the Cs-137 sources were used to simulate hot spots within the fallout pattern. The sources were raised and lowered manually from their shielded storage positions, located approximately 6' below the ground surface. An excessive number of leaking locally fabricated Co-60 sources contributed to the formation of the on-site 'Burial Mound' for use as an interim on-site disposal cell. The contaminated soil resulting from historically leaking sources was accumulated and transported to the location which is now designated as the 'Burial Mound'.

A recent radiological characterization of the 'Burial Mound' was performed by the U.S. Army Center for Health Promotion and Preventive Medicine (CHPPM), reference Industrial Radiation Study No. 27-MH-0987-R2-97, Pelham Range Burial Mound Site, Fort McClellan, Alabama, 29 August - 15 September 1995 and 14 - 28 January 1996. The survey followed much of the protocols of NUREG/CR-5849, including background determination, walkover surface scans, hole logging, and sample analysis. A total of 571 systematic random and select bias samples were analyzed for radiological parameters. Both elevated Co-60 and Cs-137 were observed in surface soil samples, but only elevated Co-60 was found in subsurface samples. The observed range of concentrations of radioactivity were observed at 1.6 to 330 pCi/gm of Co-60 and 0.2 to 179 pCi/gm of Cs-137, respectively.

Although the characterization data indicates less than extremely high concentrations, there exists some concern regarding the observed heterogeneity of the 'Burial Mound' as depicted in the CHPPM report. First, an isolated speck of significant Co-60 radioactivity was discovered within one of the discrete surface soil samples. A discrete item with significant SpA exceeding the Envirocare WAC was found and segregated. The related concern is with the significant gamma readings recorded during hole logging when samples from the bore hole and nearby indicated only trace amounts of contamination. The trend leads toward a conclusion of significant heterogeneity, and limits the credibility of sample results being actually representative of the existing source term.

As a result of the earlier characterization, the 'Burial Mound' location was added to the NRC license governing other radioactive materials usage, unrelated to this decommissioning phase. Under the BRAC, Fort McClellan is undergoing closure this year with a target of remediation to strive for submittal of a license termination request prior to September 1, 1999.

3.2 Ensuring that Occupational Radiation Exposures Are As Low As Reasonably Achievable (ALARA)

All of the field work encompassed by this Plan will be performed in accordance with the ATG Project Operational Procedures, included as Appendix 4. These procedures provide information on equipment, special techniques, and practices that will be employed on-site to ensure that exposures are minimal, in keeping with our corporate ALARA policy. Instruction is provided for the use of Radiation Work Permits (RWPs), contamination control practices, the respiratory protection program, and hazard assessment for the appropriate application of personal protective equipment (PPE). Additional project-specific instructions can be found in the Health and Safety Plan, including the use of dosimetry devices and internal monitoring via air sampling and bioassay samples.

A project worker dose projection has been established from data included in the earlier characterization by the Center for Health Promotion and Preventive Medicine (CHPPM) Report "Industrial Radiation Study No. 27-MH-0987-R2-97", Table F-3, and in consideration of the project schedule, per the following:

- Maximum general area dose rate was 11.7 uR/hr @ 1 meter above the ground surface of the burial mound at sample location BM C2-3.

- The referenced exposure (dose) rate was determined by a Reuter Stokes Pressurized Ionization Chamber for which 220 counts of 5-second integrated measurements were averaged electronically.

- The total work time for each individual on the site specifically at the 'Burial Mound' will be 10 hrs per day for 25 days for a total cumulative duration of 250 hours each. The conservative (worst case) assumption is made that each individual will spend the entire work time in activities immediately above the 'Burial Mound'.

- The total dose is estimated as: 11.7 uR/hr x 250 hours = 2925 microRem, rounded to 3 mrem total per worker.

3.3 Health Physics Program

All QA audits, inspections, air sampling, personal protective equipment (PPE) requirements, and surveys will be completed in accordance with Appendix 1, site Health and Safety Plan, Appendix 2, project Quality Assurance Plan, Appendix 3, Ordnance and Explosives Avoidance Plan, and Appendix 4, Field Operations Procedures which are included a integral parts of this plan.

3.4 Contractor Personnel

ATG is the designated subcontractor assigned to implement this Plan to complete the remediation project. There are no additional outside contractors to be affected by radioactive materials associated with this effort. The MARSSIM consultation will be per off-site communications, and the final restoration will be performed after release of the site.

3.5 Radioactive Waste Management

The project objective is the removal of soil within the 'Burial Mound', comprehensive radiological monitoring and systematic verification sampling for appropriate sorting of the contents, and the final disposal of the LLRW fraction of the total volume found to exceed the site criteria. Requisite excavation, material handling, and soil monitoring will be performed in such a manner as to limit the prospect for cross-contamination and eliminate the prospect of dilution of existing elevated concentrations of radioactivity prior to or during the monitoring phase. Results of the planned approach will include: 1) meeting the Envirocare Waste Acceptance Criteria (WAC); and, 2) minimization of the final waste volume by comprehensive screening and sorting.

3.5.1 Waste Profile

The 'Burial Mound' waste stream has been sampled and analyzed for the necessary parameters to complete the waste profile for pursuit of acceptance authorization by Envirocare of Utah. The Burial Mound was sampled by ATG in May of 1998. Sample analysis was performed by Mountain States Analytical, Inc., and the Envirocare Waste Profile Record was completed and submitted, referencing the CHPPM report for radioanalytical data. Subsequent communications resulted in additional analysis of an archived sample for clarifying radiological parameters.

Preliminary acceptance of the 'Burial Mound' waste stream as LLRW (low-level radioactive waste) was received from Envirocare in October 1998. The requisite Pre-Shipment samples were subsequently forwarded to Envirocare for their footprint analysis in November 1998. Both the Waste Profile Record (EC-0230) and the Pre-Shipment Sample Record (EC-2000) provided a tentative waste delivery date of March 1999, and a tentative volume in the estimated range of 870 cubic yards. Note: Final release criteria had not been determined during waste profiling, which resulted in an estimated final volume being employed.

The adoption of site-specific release criteria (Section 6.8.2) per development of this Plan and supporting data permits refinement of the final waste volume. Referencing the CHPPM report and enclosed Attachments 1, 2, and 5 along with Appendix 6, an in-situ soil volume of approximately 383 cubic yards is expected. The assigned volume expansion (fluff factor) of the primarily clay material attributed to the soil excavation and conditioning for placement onto the conveyor / monitor is +30%, resulting in ~ 498 yd^3.

3.5.2 Waste Packaging

The 'Burial Mound' LLRW waste streams will be appropriately packaged early after segregation from the unaffected balance of materials. Soils exceeding criteria via the monitoring system and/or sample analysis will be ultimately packaged in rigid-topped lined Intermodal containers. When not being transferred, any staged waste material will be securely covered with plastic on-site. Secondary wastes, including spent PPE, filters, and plastic materials, will be bagged as it is accumulated throughout the project and packaged with the soil waste stream in the Intermodals.

The waste profile will be amended as applicable to reflect the proportion of non-soil material attributed to the secondary waste stream even at its slight volume ratio over the original profile record for the straight soil, i.e., secondary waste estimated at ~ 2% by volume, but easily less than 10%, and thus not impacting the disposal category type of "soil-like" material.

Even though the profiled LLRW waste stream from the 'Burial Mound' is represented by concentrations of radioactivity which are less than that governed by D.O.T. regulations, the waste will be conservatively conveyed in lined Intermodal containers that meet the general design requirements of a strong tight container as defined in 49CFR173.410. Additionally, the container also complies with 49CFR173.420, meeting the description of a sift-proof non-specification portable tank and closed bulk bin as defined in 49CFR171.8.

Should any impacted material be found to have concentrations of radioactivity in excess of the Envirocare WAC, referencing specific limits of $3.0E^{4}$ pCi/gm for Co-60, and 6.0E pCi/gm for Cs-137, respectively, the LLRW will be further segregated. Materials exceeding the Envirocare WAC will be contained in D.O.T. packaging (drums) and staged for final disposal at Barnwell under a contract modification.

The density of the clay type soil, depending on the current moisture content, ranges from 92 to 112 lb./ft^3. At the optimum moisture content of 13% and slight recompaction during container loadout and subsequent resettling, the average density of ~ 100 lb./ft^3 is assumed. At 1.35 tons/yd^3, the weight becomes the limiting factor on content capacity. The net payload per Intermodal container is limited to $\leq$ 20 tons, providing a restriction by packaged volume, i.e., 20 tons/1.35 tons/yd^3 = 14.8 yd^3. Thus the quantity of waste packages required is derived from ~ 498 yd^3/14.8 yd^3 = 34.

3.5.3 Waste Manifesting and Transportation

An IOC-approved broker will inspect the containers, contents, loaded packages, and the transportation vehicle. All shipments will meet applicable DOT requirements for packaging and transportation. Additionally, all shipments will be in accordance with the IOC Standard Operating Procedure 'Shipping Procedures for Unwanted Radioactive Materials', May 1997. Also, shipments will comply with ATG Field Procedures for loading, survey, and transportation of radioactive materials per BR-003, Packaging Material for Disposal; BR-004, Shipping of Radioactive Material and Waste; and, BR-006, Brokering.

Dose-to-millicurie conversions will be established via the application of the MicroShield code. Content weights for activity per container will be established by volume/free-board measurement and off-site weighing of the initial packages for assigning an observed density for subsequent use with volume measurements, with subsequent confirmation vehicle weighing.

Note: Alternatively, bucket-scales may be obtained for the actual tracking of individual package content weight by weighing the payload as it is placed. However, due to the relatively small quantity of the waste stream, the application of bucket-scales may not be feasible.

Based upon both the concentration and the total activity per package, the waste will be appropriately manifested and labeled. Packaging with DOT-exempt material will not require vehicle placarding. It is expected that the majority of packages will be classified as Limited Quantity and suitably indicated per 49 CFR 173.421.

The Intermodals will be shipped in campaigns, picked-up by truck carrier at one package per vehicle. Live load-out is not anticipated. The permitted carrier will haul the manifested Intermodals to a railhead in Birmingham, where they will be trans-loaded to rail cars. The transfer will be performed by the carrier. Groups of the Intermodals will ultimately be shipped to the designated disposal facility. Prior notification will be initiated in concert between ATG and the carrier to the disposal facility. Subsequent tracking will be provided by the carrier.

3.5.4 Waste Disposal

The Waste Profile Record has been preliminarily approved, permitting acceptance of the waste stream for disposal as soil-like LLRW. The approximately 13,446 ft^3 of waste will be disposed at Envirocare under an existing contract held by the Army Corps of Engineers and administered by the IOC for this project, or other approved disposal facility.

Note: The presented funding information, Section 8.0, does NOT include disposal costs, which are to be borne by other than the remediation contractor.

3.6 Groundwater Assessment Plan

3.6.1 Introduction

A mound of soil containing low levels of Co-60 and Cs-137 is located at Rideout Field on Pelham Range. The U.S. Nuclear Regulatory Commission (NRC) has requested that the U.S. Army determine whether these radionuclides have leached into the groundwater beneath the mound. A site-specific groundwater assessment plan is included in this decommissioning plan to evaluate potential radiological impacts on groundwater from the historical presence of the 'burial mound' containing Co-60 and Cs-137. The assessment of potential groundwater impacts will involve the installation of three groundwater monitoring wells at the 'burial mound' site by a separate contractor (IT Corporation), sample collection and analyses, and a written report. The elements of the groundwater assessment plan are discussed in detail below.

3.6.2 Site Description and Monitoring Well Locations/Installation

The mound, at the north end of Rideout Field, is located on the northwestern portion of Pelham Range. Rideout Hall and Cane Creek are located approximately 1200 feet and 4200 feet to the north and south, respectively. The topography slopes down from north to south toward Cane Creek. Cane Creek flows toward the west. Presently, the mound is oval shaped and is posted as an area with radioactive materials present. The perimeter of the posted area is approximately 270 feet. There are several armored vehicles located immediately adjacent to the perimeter of the posted area.

It is anticipated that three monitoring wells will be installed at the mound site immediately outside the perimeter of the posted area. Installation of the wells will be performed in accordance with the procedures outlined in the Installation Wide Work Plan (IT 1998a). Two of the monitoring wells will be installed downgradient from the mound and one of the monitoring wells will be installed upgradient from the mound. Groundwater in the residuum is assumed to move south-southwest toward Cane Creek.

3.6.3 Monitoring Well Sampling and Sample Analysis

Upon completion of the well installation task, the wells will be sampled in accordance with the procedures outlined in the Installation Wide Sampling and Analysis Plan (IT 1998b). The SAP will be modified by addendum to include the analytical specifications for C0-60 and Cs-137 in groundwater.

The water samples collected from the monitoring wells will be analyzed for the gamma-emitting radionuclides Co-60 and Cs-137.

3.6.4 Health and Safety

Prior to the initiation of field activities at the site, a site-specific work plan and health and safety plan that outline the work to be completed and the appropriate health and safety requirements for performing the work will be prepared. Each field work task will be performed with radiation protection personnel present. All workers involved in field activities (e.g., drillers, geologists, and sampling technicians) will be trained at an appropriate level of radiological worker safety training.

3.6.5 Investigatively Derived Wastes

All investigatively derived waste will be handled in accordance with the procedures outlined in the Installation Wide Work Plan (IT 1998a).

3.6.6 Reporting

Upon receipt of the sample analytical results from the laboratory, a report will be prepared that describes the field activities performed, the geology and hydrogeology of the site, and the analytical results of the samples. A determination will be made regarding the potential leaching of radionuclides from the mound into the groundwater based on the analytical results.

4.0 MONITORING, SORTING, AND DISPOSAL OF THE 'BURIAL MOUND'

The entirety of material from the earlier eight 10 m x 10 m grids will be removed and radiologically screened to eliminate the prospect of the inadvertent omission of significant contamination attributed to the heterogeneity of the waste stream, coupled with the history of stray specks of high SpA from failed radioactive sealed sources. Material from the top 8' of the sloped perimeter sides will also be removed to comply with OSHA trenching and excavation requirements in lieu of exorbitant shoring efforts, and the resultant volume will be treated as the balance of material for screening. The same methodology was recently employed by ATG for the IOC at the Lake City Army Ammunition Plant in Missouri. The contaminant there was Depleted Uranium fragments. The emissions from the Co-60 and Cs-137 contaminants of the 'Burial Mound' provide greater sensitivity for detection.

4.1 Site Preparations

Pre-mobilization events will be completed as scheduled, including off-site refresher training, updated physicals / fit-tests, instrument calibration, and final procurement and logistical events. Mobilization to the site will be accompanied with site-specific training, the assignment of TLDs and the collection of baseline bioassay samples for third party analysis.

A preliminary radiological screening survey will performed in conjunction with implementation of the OE Avoidance Plan, Appendix 3.

4.1.1 Site Set-Up

Plastic safety fencing will be installed around the perimeter of the entire site. The office / break room / lab trailer will be placed just outside the controlled area. Temporary support utilities will be imported, i.e., generator, lavatories, handwash units, etc. Instrumentation will be set-up and checked to ensure operability, including:

- -MCA with NaI detector and shield
- -Ludlum 2929 dual alpha/beta counter(s)
- -Drying Oven
- -Soil Monitor (Multiple Ludlum 177 Alarming Ratemeters with 44-10 2" x 2" NaI detectors)
- -Ludlum Model 2221 Scaler/Ratemeter with 44-10 NaI detectors for field use
- -Ludlum Model 3 with 44-9 GM probe (friskers)
- -Bicron Micro Rem Meter
- -Air Samplers

The locations of material staging, monitoring and pending segregation will be identified. The PowerScreen soil handling unit will be received and placed for operation. The NaI detector array will be installed and tested for start-up using sources initially, and then known impacted soil from the "Burial Mound" after collection and on-site analysis by gamma spec.

The 'Burial Mound' surface will undergo a screening survey per the OE Avoidance Plan to limit unexploded ordnance hazards. The surface of the mound will be degrubbed, and the vegetation will be shredded and staged on-site for packaging with the initial impacted soil. A comprehensive UXO/EOD survey of the exposed mound area will be performed upon removal of the vegetation.

4.1.2 Base-Line Survey

The location within the fenced controlled area, adjacent to the 'Burial Mound' itself, which will receive the sorted "clean" material upon soil screening, will undergo a baseline survey in parallel with the other set-up activities. The objective is to assure that the ground is not radiologically impacted in association with the 'Burial Mound' prior to covering it with a significant volume of cleared material. Upon completion of the soil removal and screening effort, the surface of the pending mound of monitored and clean soil will be included in the Final Status Survey as a Class 1 area.

An area of approximately 1,200 m^2 slightly distant from the present 'Burial Mound', but within the boundary of the site controlled area, will be initially surveyed as if it represented a probable contamination area per the MARSSIM protocols. Although the vicinity may represent the characteristics of a Class 2 area more closely, it is prudent to perform a comprehensive survey and sample at the higher frequency of a Class 1 area for greater confidence in defense of early ground covering. The expanse of surface area necessary to accommodate the balance of clean material after screening, up to approximately 7,700 yd^3 uncompacted, is significant even with building up. The initially surveyed and radiologically cleared receiving area could feasibly be covered with up to 9' of compacted overburden during the course of the project.

The grid locations will be marked and labeled for cross-reference to both prominent landmarks and for overlay with the pending Class 1 site areas of the Final Status Survey, Section 6.0. Also, see Attachments 2 and 4.

A comprehensive gamma walkover survey will be performed over the area. Any locations identified with increased detectable gamma activity will be marked for subsequent sampling and on-site analysis. Systematic sampling will be performed per MARSSIM, and ten surface samples will be collected systematically, beginning at a random starting location and adopting the triangular pattern for subsequent locations. Initial analysis of the samples will be performed on-site via gamma spectroscopy, and 10% of the samples will additionally be submitted along with the completed chain of custody record for third party (QC) analysis. Data from this baseline ground surface survey will be included in the report package per Section 6.0.

4.2 In-Line Monitoring System

Upon completion of the initial set-up activities and the baseline surface survey of the clean material staging area, excavation of the 'Burial Mound' will begin. Material will be excavated and removed from the pile and grounds below, and conveyed to the monitoring system. The soil conveyor / monitor is a conventional PowerScreen system with a powered screen sizer for culling any large items, a grinder for soil preparation (i.e., breaking up the compacted clay) , and a discharge conveyor. The detector array is added by ATG, and is a series of ten individual calibrated units comprised of alarming ratemeters with NaI detectors, mounted over the conveyor.

4.2.1 Description

The conveyor has an effective width of 24", and a scraper for controlling the maximum height/depth of the product conveyed. The throughput speed is variable. The length of the conveyor is over 20', permitting ample opportunity to stop the system in the event of an alarm and permit segregation of the contaminated payload from other discharged unaffected material at the end destination of the conveyor.

4.2.2 Sensitivity

The calculated sensitivity of the system is demonstrated in Appendix 5. At a conveyor speed of 0.5 m/second, with the detectors at 6" above the conveyor and the soil at a maximum depth of 3" on the conveyor, the sensitivity is calculated to be 1.5 pCi/gm of Co-60 and 2.8 pCi/gm of Cs-137.

The site-specific $DCGL_w$'s (Derived Concentration Guideline Limits) per Section 6.8.2 and Appendix 6 are shown to be 100 pCi/gm for Co-60 and 21 pCi/gm for Cs-137, respectively, to meet the NRC acceptable dose of 25 mrem/y.

The strategy has been determined that compliance can be demonstrated if the combined activity of the two radionuclides does not exceed the lesser value of 21 pCi/gm.

Actual alarm points in the field will be set at 1.5 times the background rate. A 2" x 2" NaI detector will have a nominal background of about 8,000 cpm at the soil conveyor/monitor (variable). Thus, the detector will alarm at 12,000 cpm, or 4,000 net cpm. This corresponds to a uniform contamination level of 8.6 pCi/gm of Co-60 or 16.8 pCi/gm of Cs-137. Since Cs-137 produces a lower detector response, it is prudent to assume that the combined activity is all Cs-137. In this case, the detector will alarm at 16.8 pCi/gm, compared to a DCGL of 21 pCi/gm. This ensures that the concentration criteria for any combination of Co-60 and Cs-137 will be satisfied.

4.3 Verification of Monitored Material

Impacted material tripping an alarm will be segregated by sacrificing the entire length of contents over the halted conveyor as LLRW. Each positive hit represents as much as 1 yd^3 of rejected material unless further sorted by hand or passed back through the monitor. Rejected material will be sampled and analyzed on-site by gamma spec to establish the correlation between monitor system response and actual concentration by analysis. Additionally, batches of non-rejected material will be initially sampled and analyzed on-site for comparison of monitoring system direct measurement response and actual soil concentrations by sample analysis.

4.4 Sorting and Segregation of Waste Streams

An attempt will be made during excavation and removal of the 'Burial Mound' pile and subsurface material, to extract the known contaminated locations first. The CHPPM report has provided evidence of discrete areas of elevated activity (Attachment 5), from which the present impacted volume estimate has been derived. The early extraction of impacted material allows monitoring system assurance testing with actual product, but more importantly, minimizes the prospect and/or appearance of dilution of the impacted material with otherwise intermixed volumes of uncontaminated or lesser contaminated material.

The operation of the conveyor / monitor will become relatively automated. As long as the operable system has no alarms annunciating with the exception of shift start and end point QC checks, the discharged clean material will be accumulated at the end of the conveyor. The clean material pile will be conveyed and placed on the next 6"lift at the staging pile being constructed.

When an alarm goes off indicating elevated activity on the conveyor, the monitoring technician halts the conveyor and flags the impacted area of material (i.e., chalk, lime). The remaining clean material stockpile at the discharge end of the conveyor is removed entirely. The impacted material is then conveyed under the speed of the conveyor to discharge the contents. As practical, the affected material will be discharged into the awaiting equipment bucket for transfer directly to packaging. At times when a high volume of material is found to be impacted, or when the capacity of existing packages has been exhausted, impacted material will be placed on a plastic barrier over the ground, accumulated, and moved to staging. Any impacted materials on-site which cannot immediately be packaged will be enclosed with plastic and secured.

5.0 EQUIPMENT SURVEYS

All equipment having come in direct contact with the suspect materials within the controlled work area on-site will undergo limited decontamination (gross removal) and a formal radiological release survey prior to permitting removal from the project site.

5.1 Regulatory Criteria for Unconditional Release

The limits for residual surface contamination shall conform to that prescribed in "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material", U.S. NRC, April 1993.
The site contaminants, Co-60 and Cs-137, are provided for in the associated table, which lists them as:

NUCLIDES	AVERAGE	MAXIMUM	REMOVABLE
Beta-gamma emitters	5000 dpm/100 cm^2	15000 dpm/100 cm^2	1000 dpm/100 cm^2

5.2 Surface Surveys

Accessible surfaces of equipment will be surface surveyed by scanning with a calibrated ratemeter and a GM pancake probe. Additional measurements will be performed using gamma sensitive instrumentation, i.e., Micro R meter to rule-out any obvious contamination which would warrant decontamination prior to the intensive surface scan. Care will be made to ensure that select regions, including contact points and intakes, are scrutinized intensely.

Data will be recorded in the field on sketches/diagrams of the components. Records will include the name of the surveyor, date, equipment identification, instrumentation by model, serial number, date of calibration, background rate, and observed gross measurement readings. The survey will ultimately be corrected to include standardized units of net dpm/100 cm^2.

5.3 Surface Sampling

Swipe samples will be collected of equipment surfaces during the survey. Swipes will be counted on-site for both alpha and beta-gamma activity on a manual Ludlum Model 2929.

Swipe sample measurements will be documented to include the technician, date, identification of individual swipe sample, instrument background rates, instrument efficiencies, and gross count rate in each channel. The corrected activity will be also recorded in units of net dpm/100 cm^2.

5.4 Instrument Selection

Table 1 lists the radiological detection and measurement instrumentation to be employed for the survey activities, along with typical parameters and detection sensitivities for the type of instrument and its application.

TABLE 1
INSTRUMENTATION FOR RADIOLOGICAL SURVEYS

Type of Measurement	Instrumentation Detector	Meter	Background Rate	4π Efficiency	Detector Sensitivity
Surface Scan beta-gamma	GM Pancake Ludlum 44-9	Ratemeter Ludlum Model 18	50 cpm	0.1	3760 dpm/100cm^2
Surface Scan (alpha)-beta	Gas Proportional Ludlum 43-68	Ratemeter Lud. Model 2221	400 cpm	0.15	980 dpm/100cm^2
Surface Activity beta (alpha)	Gas Proportional Ludlum 43-68	Scaler Lud. Model 2221	400 cpm	0.15	638 dpm/100cm^2
RemovableSurface Activity - beta	Plastic Scint (ZnS) Ludlum 43-10-1	2 Channel Scaler Lud. Model 2929	80 cpm	0.3	727 dpm/100cm^2
RemovableSurface Activity - alpha	Plastic Scint (ZnS) Ludlum 43-10-1	2 Channel Scaler Lud. Model 2929	3 cpm	0.35	151 dpm/100cm^2
Exposure Rates	1" x 1" NaI	Micro R Meter Ludlum Model 19	-	-	< 1 µR/hr
Surface Dose Rates	2" x 2" NaI Lud. Model 44-10	Ratemeter Ludlum Model 18	8,000 - 12,000 cpm	Cs-137 > Co-60 >	900 cpm/µR/hr 450 cpm/µR/hr

Scan sensitivity based on MDA (dpm/100cm^2) = $\dfrac{4.65\sqrt{\dfrac{\text{Bkg (cpm)}}{2 \times \text{Tc (min)}}}}{\text{Eff} \times \text{A}/100}$

Where Tc = Meter Response Time
A = Area of Probe

Surface measurement sensitivity based on MDA (dpm/100cm^2)

$$= \frac{2.71 + 4.65\sqrt{\text{Bkg (cpm)} \times \text{Tc (min)}}}{\text{Eff} \times \text{A}/100 \times \text{Tc (min)}}$$

6.0 FINAL STATUS RADIATION SURVEY

6.1 Introduction

The area known as the Rideout Field, Pelham Range, Area 24C, at Fort McClellan, Alabama, was used as a low-level radioactive material burial site (up to 1959) and a radiological training area (mid 1960's to 1972). The facility was used to train Radiation Control Teams in support of nuclear weapons testing performed by the Atomic Energy Commission (AEC). The training employed the use of sealed radioactive sources that were raised and lowered to produce radiation fields similar to those associated with fallout from detonation of a nuclear weapon. Students were trained to perform ground and aerial surveys to map the radiation fields present.

The US Army Chemical Center and School training mission was transferred in 1973 from Fort McClellan, Alabama to the US Army Ordnance Center and School at Aberdeen Proving Ground, Maryland. Records indicate that the radioactive materials associated with the burial and training area (primarily Co-60 and Cs-137) were removed and disposed of in off-site licensed facilities around this time. Although the AEC licenses (BML 1-2861-1, BML 1-2861-2, and SNM 344) held by the U.S. Army Chemical Center and School were terminated in 1973, a formal closeout survey was not performed. Since no record of a formal close-out survey could be located, the U. S. Army Toxic and Hazardous Materials Agency requested the U.S. Army Environmental Hygiene Agency, currently the U. S. Army Center for Health Promotion and Preventive Medicine (USACHPPM), to investigate these areas.

The Army Base Closure and Realignment Committee has identified Fort McClellan as an installation for closure. The Fort McClellan Pelham Range will be licensed to the Alabama Army National Guard (USACE, 1998). As part of this closure, the Fort McClellan NRC radioactive materials license number 01-02861-05 will be terminated. Termination of the facility licenses requires submission of a formal decontamination and decommissioning plan.

Previous surveys identified radiological conditions not suitable for unrestricted release. Remedial actions are being planned and the U.S. Army IOC has requested that their contractor design a final status survey to demonstrate the effectiveness of remediation in satisfying applicable radiological guidelines for soil. This Plan describes the scope, objectives, and methodologies of such a survey.

6.2 Results of Previous Radiological Surveys

Radiological surveys of the Burial Mound and several background areas were conducted in August/September 1995 and January 1996 by the U.S. Army Center for Health Promotion and Preventive Medicine. Survey methods and results are presented in "Industrial Radiation Study No. 27-MH-0987-R2-97, Pelham Range Burial Mound Site, Fort McClellan, Alabama, 29 August –15 September 1995 and 14-28 January 1996" (USACHPPM 1996). These surveys included surface gamma scans to identify discrete areas of elevated activity, gamma exposure rate measurements at 1 meter above the surface, collection and analysis of surface soil samples, collection and analysis of subsurface soil samples, and gamma logging of subsurface sampling core holes.

Background exposure rates ranged from 7.2 to 10.2 μR/h. Background concentrations of Co-60 and Cs-137 in soil samples (surface and subsurface) ranged up to 0.1 pCi/g and 0.3 pCi/g, respectively. Radionuclides from the naturally occurring uranium and thorium decay series and K-40 were present at typical background concentrations.

Surface and subsurface surveys indicated that radiological conditions of most of the Burial Mound are not significantly different than background. In two of the eight 100 m^2 survey grids, isolated locations of elevated activity were identified on the surface of the Burial Mound by the gamma scans. Concentrations of Co-60 and Cs-137 at these locations ranged up to 187 pCi/g and 179 pCi/g, respectively. Gamma exposure rates at 1 meter above the surface ranged up to a maximum of 1.25 μR/h above background on the Burial Mound. Subsurface gamma logging indicated elevated gamma levels to a maximum depth of 3.1 to 3.6 meters below the surrounding soil surface at four locations. Subsurface soil samples contained concentrations of Co-60 and Cs-137 ranging up to 330 pCi/g and 12 pCi/g, respectively. There was no evidence of other radionuclides at above-background concentrations.

6.3 Site Description

The Burial Mound is located in a fenced portion in the northeast corner of the Pelham Range. Mound dimensions are approximately 15 m x 25 m; the Mound is about 1.2 m above the surrounding surface and extends to a depth of approximately 3.7 m below the surface. An area of approximately 9,000 m^2, including the 'Burial Mound', is the subject of this survey. The area of interest is generally level; conditions of vegetative cover and presence of surface features are not known.

6.4 Organization and Responsibilities

The final survey will be implemented immediately upon completion of site remediation activities by the same contractor, ATG, Inc. Refer to Plan section 2.2 for the organization chart. Note that additional health physics expertise is contracted through Auxier and Associates for final survey plan implementation (consult) and data evaluation.

6.5 Purpose and Scope

The purpose of this Plan is to provide a framework for conducting a final status survey of the soils at the Burial Mound site. The survey will determine the levels and extent of residual radiological material, if any, in site soils and compare the current radiological conditions with the guidelines established for the project (see Section 6.8.2).

6.6 Radiological Contaminants

The potential radiological contaminants are Co-60 and Cs-137 based on previous survey results. Contaminants are present at varying concentrations and ratios.

6.7 General Approach

Guidance provided in the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) (DoD 1997) will be the basis for this survey. The MARSSIM process was developed collaboratively by the Nuclear Regulatory Commission, Environmental Protection Agency, Department of Energy, and Department of Defense, for use in designing, implementing, and evaluating radiological surveys. This process emphasizes the use of Data Quality Objectives (DQO) and Data Quality Assessment processes, along with a sound program of quality assurance/quality control. The "graded approach" concept is also used to assure that survey efforts are maximized in those areas where there is the highest probability for residual contamination or greatest potential for adverse impacts of residual contamination. Examples of integration of the graded approach into the MARSSIM process include use of site history, site conditions, equipment capabilities, and results as the survey progresses to establish/adjust: degree of scanning coverage of a survey area, survey unit size, sampling frequency, and criteria for evaluation of elevated measurements.

The primary focus of MARSSIM is to demonstrate compliance of a site or facility with regulatory agency criteria for future use without radiological restrictions. This type of survey is known as a "Final Status Survey," and MARSSIM provides highly prescriptive guidance for designing and conducting such a survey.

On the basis of prior surveys, residual contamination of Co-60 and Cs-137 in excess of the established guidelines for unrestricted release (Section 6.8.2), is anticipated on portions of this site. Remediation will therefore be performed to remove contaminants to satisfy acceptable levels. It is anticipated that remediation will include excavation and subsequent sorting of soil from the Burial Mound. An area will be identified for placement of the clean sorted soil. Soil determined to be clean as a result of the sorting process will be spread out at a location inside of the fenced area. This area will be surveyed in the same manner as the remainder of the site prior to and following placement of the sorted soil. The Final Status survey will be implemented, following completion of the remedial actions unit and prior to backfilling or other restoration actions.

This Plan is based on information available at the time of its preparation. The primary source of information used in the design was the "Industrial Radiation Study No. 27-MH-0987-R2-97, Pelham Range Burial Mound Site, Fort McClellan, Alabama, 29 August –15 September 1995 and 14-28 January 1996" (USACHPPM 1996). It is recognized that additional historic information on site operations, conditions encountered at the time of the survey implementation, and findings as the remediation and/or survey progress may require modifications to this Plan. If modifications are determined necessary, they will be justified and documented, including appropriate project approvals.

Field activities will include:

- surface gamma scans to identify potential locations of contamination,
- exposure rate measurements, and
- sampling of surface soil.

6.8 Survey Objectives

6.8.1 General

The objective of the survey described in this Plan is to determine the radiological conditions of soils at the Burial Mound Site, following remedial actions, for comparison with the guidelines established for the project (see Section 6.8.2).

6.8.2 Radiological Guidelines

The following guidelines (also referred to as $DCGL_W$'s or Derived Concentration Guideline Limits) for residual radionuclide concentrations in soil have been established for individual radionuclides (A&A 1999).

The criteria developed for the Burial Mound Site are 100 pCi/g Co-60 and 21 pCi/g Cs-137 in soil, based on an acceptable dose of 25 mrem/y. The survey objective is to demonstrate compliance that the combined residual concentrations of these two radionuclides are such that the total dose to an exposed individual would be less than 25 mrem/y.

6.8.3 Radiological Survey Parameters

Surface scans of the ground surface will be recorded in count rate (counts/minute (cpm) or counts / second (cps)); the primary purpose of the scans will be to be identify locations where direct gamma radiation levels are elevated, thus suggesting possible radiological contamination in excess of natural background levels. Scanning location and results will be recorded by hand. Relative instrument count rate will be continuously monitored during scanning through use of the audible response signal from the instrument. The estimated scanning sensitivities are 3.4 pCi/g for Co-60 and 6.4 pCi/g for Cs-137 based on a nominal background level of 10,000 cpm at the ground surface with a 2" x 2" scintillation detector in the manual scanning mode. (Table 6.4 of NUREG-1507). The scanning technique is more sensitive for larger areas of contaminated soil. The scan procedure would therefore be capable of identifying areas of soil with Co-60 and/or Cs-137 contamination well below the dose-based criterion.

Exposure rates in μR/h will be used as a surrogate measurement to demonstrate compliance with the concentration criteria for Co-60 and Cs-137 in surface soil. Twenty-one pCi/g of Cs-137 equates to an exposure rate of 6 μR/h above background. The Co-60 concentration associated with an exposure rate of 6 μR/h above background is 4 pCi/g—well below the dose-based criterion of 100 pCi/g. The use of 6 μR/h as a surrogate measurement for the $DCGL_W$ ensures that the concentration criteria for any combination of Co-60 and Cs-137 will be satisfied. Measurements of integrated counts in 0.5 minutes will be performed at "data point" locations, described below, using the 2221/44-10 instrument combination. Count rate will be converted to exposure rate (μR/h) using correlations determined by intercomparison with a Pressurized Ionization Chamber. Results will be tested for compliance, using the non-parametric statistical approach recommended in MARSSIM.

Soil samples will be collected at selected "data point" locations, and analyzed by gamma spectrometry for Co-60 and Cs-137 content. Concentrations will be reported in units of pCi/g, dry weight. Results will be compared with the established criterion.

Results will also be tested for compliance at the 95% confidence level, using the Student t-test approach of NUREG/CR-5849.

6.8.4 Data Quality Objectives

To enable testing of data relative to guidelines, the USACHPPM has established acceptable decision errors for this project. The Type I (alpha) decision error to be used in data testing is 0.05; this provides a confidence level of 95% that the statistical tests will not incorrectly determine that a surveyed area satisfies criteria when, in fact, it does not. The Type II (beta) decision error is also 0.05; this provides a confidence level of 95% that the statistical tests will not incorrectly determine that a surveyed area does not satisfy criteria when, in fact, it does.

Data quality indicators for precision, accuracy, representativeness, completeness, and comparability have been established.

- Precision will be determined by comparison of replicate values from field measurements and sample analysis; the objective will be a relative percent difference of 30% or less at 50% of the criterion value.

- Accuracy is the degree of agreement with the true or known; the objective for this parameter will be +/- 30% at 50% of the criterion value.

- Representativeness and comparability do not have numeric values. Performance for these indicators is assured through the selection and proper implementation of systematic sampling and measurement techniques.

- Completeness refers to the portion of the data that meets acceptance criteria and is therefore useable for statistical testing. The objective is 90% for this project.

When the site is determined to satisfy the established guidelines, a final report will be prepared, documenting the survey procedures and results.

6.9 Background Levels

Actual background levels of Co-60 and Cs-137 in soil and exposure rate were determined for 2 site reference areas as part of the previous surveys (USACHPPM

1996). The values from the "Reconnaissance" Area survey will be used as a starting point for survey design. Those levels are approximately: Co-60 in soil, <0.2 pCi/g; Cs-137 in soil, 0.6 ± 0.4 (1 σ) pCi/g and exposure rate, 8.2 ± 0.8 (1 σ) μR/h. Because these radionuclide concentrations in soil are less than 10% of the guideline values, they are not considered present in background. However, the parameter selected for demonstration of compliance, i.e. exposure rate, has a background level (8.2 μR/h) that is greater than 10% of the guideline implementation value (14.2 μR/h), and is therefore considered as present in background. Prior to initiating field survey activities, these values will be reviewed for appropriateness; additional reference area(s) will be identified and direct gamma radiation levels and/or radionuclide concentrations in soil determined, as necessary. The number of background reference data points is discussed in Section 6.13. Background measurements will be performed in the same manner as site measurements to permit comparisons of site and background data by non-parametric statistical methods.

6.10 Testing for Compliance with Guidelines

As part of the DQO process, the null hypothesis for demonstrating compliance of data with guidelines must be stated. The null hypothesis (H_0) tested is that residual contamination exceeds the acceptance criterion (guideline); by rejecting the null hypothesis, the alternative hypothesis must be accepted and the finding of the evaluation is that the site satisfies the guideline. In accordance with recommendations of MARSSIM, the non-parametric Wilcoxon Rank Sum (WRS) test will be used for this purpose because the survey parameter selected for demonstration of compliance has an associated background. As a supplemental evaluation, results of soil sampling will be compared with the dose-based criterion, using the Student t-test as described in NUREG/CR-5849.

6.11 Classification of Areas by Contamination Potential

For the purposes of guiding the degree and nature of survey coverage, MARSSIM identifies three classifications of areas, according to contamination potential. Class 1 areas have a potential for contamination that exceeds guidelines; Class 2 areas have a potential for contamination, but it is unlikely that the contamination level exceeds the average $DCGL_w$; and Class 3 areas are not expected to contain residual activity in excess of background. Due to the relocation of the material previously present in the Burial Mound during the sorting process, the entire area will be classified as a Class 1 area and will be gamma scanned at essentially 100% coverage. No Class 2 or 3 areas are planned for this final status survey.

6.12 Identification of Survey Units

The site will be divided into survey units following the general guidance of MARSSIM Section 4.6. Approximately 10 Class 1 survey units, typically consisting of approximately 1,000 to 1,700 m^2, are anticipated. Division into specific survey units will be performed at the time of the survey. Survey units will be assigned unique two-digit identifiers and will be referenced to the grid coordinate at the southwest corner of the unit.

Final designation of survey units will be performed after remediation is completed and just prior to initiating post-remediation screening and the final status survey. There will also be one reference area selected at the time of the survey.

6.13 Determination of Data Requirements

The survey plan takes advantage of the strong radiation signal from Co-60 and Cs-137 to identify and quantify areas of soil contamination in the field. Exposure rates will be used as a surrogate for the DCGLs to guide the remediation and determine when remediation is complete and an area is ready for soil sampling. The soil sampling ill be used to confirm that the remediation achieved the DCGLs for each survey.

6.13.1 Exposure Rate Measurements

The Wilcoxon Rank Sum statistical test was used to calculate the number of systematic exposure rate measurements needed to determine the status of a survey unit. This test requires information on the following parameters:

- The $DCGL_w$ defined in Section 6.8.2;
- The Lower Bound of the Grey Area (LBGA) defined in MARSSIM;
- The sigmas of the reported exposure rates in the reference (σ_r) and survey (σ_s) areas;
- The decision error percentiles for the null hypothesis.

A&A has calculated a dose equivalent rate of 6 μR/h, above background, at 1 m above the surface as a surrogate measurement for the $DCGL_w$'s for

guideline concentrations of Co-60 and Cs-137 in soil. The $DCGL_w$, plus the background average, is 14.2 μR/h. This is above the upper range of measured background, 10.2 μR/h. If the 3 sigma background level of 11.2 is taken as the LBGR, and the $DCGL_w$ as 14.2, then Δ, the width of the MARSSIM 'grey zone' is:

$$\begin{aligned}\Delta &= DCGL_w - LBGR \\ &= 14.2\ \mu R/h - 10.2\ \mu R/h \\ &= 3\ \mu R/h\end{aligned}$$

Where,

$DCGL_w$ = The Derived Concentration Guideline

LBGA = Lower Bound of the Grey Area

Once the width of the 'grey area' (Δ) is determined, the 1 sigma values of the reference area (σ_r) and survey areas (σ_s) are used to calculate the Relative Shift. The Relative Shift is the ratio of the width of the 'grey area' to the standard deviation of the measurements made within the survey units (Δ/σ). The one sigma values for the reference and survey areas have been determined to be approximately 1 μR/h, based on survey results obtained during the scoping/characterization phase. The relative shift is then calculated to be:

$$\Delta/\sigma = 3\ \mu R/h\ /\ 1\ \mu R/h = 3$$

Where,

Δ = The width of the 'grey region' defined in MARSSIM, and

σ = Sigma for the reference and survey areas.

MARSSIM recommends a range of 1 to 3 for the Relative Shift, Δ/σ. Three is within this range and will be used to determine the number of measurements required.

Once the Relative Shift is determined, the information can be used in conjunction with the acceptance decision errors on the null hypothesis to determine the number of data points required. In this case, the null hypothesis, (Ho) states that, for each survey unit, the residual radioactivity exceeds the $DCGL_w$. Acceptance decision errors for testing this hypothesis are set at 0.05 for both Type I and Type II errors.

The number of data points for statistical testing the status of each survey unit is obtained directly from MARSSIM (page 5-30, Table 5.3). The number of data points for performing the WRS statistical test is 10 for each survey unit (and the reference area). This number of samples includes an additional 20% to account for missing or unusable data.

Sensitivities of proposed instruments and techniques are such that $DCGL_w$ concentrations can be identified by scans; additional data are not needed for identifying areas of elevated activity.

6.13.2 Soil Sample Collection

Soil samples will be collected at the ground surface immediately below the locations in which integrated direct gamma measurements are to be obtained at the 1 meter elevation. Per the following sections 6.14 and 6.16.2, the described frequency provides an initial estimate of 10 data points for each survey unit. Approximately 70 samples, plus those of the reference area, will be obtained from throughout the site. The soil concentration data collected from these samples will be used in a Student's t-test to confirm the status of the survey unit.

6.14 Data Point Locations

MARSSIM recommends a triangular sampling pattern to increase the probability of identifying small areas of elevated activity. This type pattern will be used for the Burial Mound site, except where a triangular pattern is not practical, because of the size and shape of a specific area to be sampled; for such situations, a square sampling pattern may be used. For example a square pattern is more practical to install and implement than a triangular pattern for survey areas having one dimension that is less than the calculated average spacing between samples. The spacing (L) between samples on a triangular pattern is determined by:

$$L = [\text{Survey Unit Area}/(0.866)\ (\text{number of samples})]^{1/2}$$

For a Class 1 survey unit area of 1,500 m^2 and 10 samples, the area represented by each sample is approximately 150 m^2. The spacing between samples on a triangular pattern for this area is 4 m. If unusual survey unit dimensions and surface features prevent collection of an adequate number of systematic data points for statistical testing, additional points may be obtained from randomly selected locations within the survey unit.

To establish a random-start triangular pattern for a Class 1 survey unit, start from the southwest corner of the survey unit and select a random starting point north and east of this corner. Next, determine the grid coordinates of all locations within the survey unit at 4-m intervals along the same east-west reference grid line as the pattern starting point. Locate a point 3.5 m north (or south) and 2 m east (or west) of one of these locations, and determine the grid coordinates of all the sampling locations within the survey unit at 4-m intervals along an east-west reference grid line, parallel to the initial line of sampling locations. Repeat this process until the entire area to be surveyed is covered by the triangular pattern. For irregular shaped survey units, where use of east-west and north-south grid lines may be inconvenient, the baseline for the sampling pattern may follow the long axis of the survey unit to facilitate implementation.

6.15 Instrumentation

6.15.1 Instruments

The proposed Instrumentation for the Burial Mound Site survey will be the following, (or equivalent):

1) Ludlum Model 2221, scaler/ratemeter
2) Ludlum Model 44-10, gamma sensitive 2" x 2" NaI detector
3) Reuter Stokes, Pressurized Ion Chamber RSS-112
4) Ludlum Model 19, Micro R Meter

6.15.2 Specifications and Uses

6.15.2.1 Ludlum Model 2221

1) Count rate meter set to the operating voltage and input sensitivity characteristics of the detector in use;

2) Will be used as a scaler in continuous and timed collection durations;

3) Will be used as the instrument to configure with the Ludlum Model 44-10.

6.15.2.2 Ludlum Model 44-10

1) Gamma sensitive, 2"x2" NaI detector capable of identifying minimum levels of < 21 pCi/gm and as referenced in final release of MARSSIM manual, equation 6-10, and NUREG-1507. Exact MDC's for scans will be empirically determined upon site arrival and gaining knowledge of site conditions for surface efficiency and personnel for surveyor efficiency.

2) The weighted cpm/μR/h is approximately 900 for Cs-137 and 450 for Co-60.

6.15.2.3 Reuter Stokes RSS-112

1) The RSS-112 is a pressurized Ion Chamber and is considered a primary standard.

2) Intended use will be to establish scintillator response correlations.

6.15.2.4 Ludlum Model 19

1) The Model 19 is a 1" x 1" NaI detector instrument.

2) Its primary use will be for exposure rate measurements for exposure to occupationally and non-occupationally exposed individuals.

3) Quality control will be measured against the RSS-112 PIC.

6.15.3 Maintenance and Instrument Control

All instrumentation will have current calibration (within the past 12 months, or as recommended by the manufacturer). Daily performance checks will be conducted in accordance with individual instrument use procedures. These performance checks will be performed prior to and following daily field activities and at any time the instrument response appears questionable. Only data obtained using instruments that satisfy the performance requirements will be accepted for use in the evaluation.

6.16 Final Status Survey Implementation

6.16.1 Gamma Scans

Following remediation and/or prior to conducting sampling, screening gamma scans will be performed over 100% of surfaces of Class 1 survey units. The surveyor will advance at a speed of approximately 0.5 m/s while passing the detector over the surface in a serpentine pattern. Audible response of the instrument will be monitored, and locations of elevated audible response that are identified will be noted. Based on Section 6.8.2 of NUREG-1507, an increase of 1500 to 2000 cpm is detectable over an ambient level of 10,000 cpm (typical background level for a 2-inch x 2-inch NaI detector). Differences in fill materials, surface covering, structures, and source-to-detector geometry due to excavations and site topography will result in variable ambient direct gamma radiation levels. Therefore, the actual ambient background for a survey unit will be determined at the start of the survey and a scanning response, which is detectable above the background level, will be set as the investigation or screening level, indicating potential contamination exceeding guideline concentrations. As site survey data are collected and evaluated, correlation of instrument response with radionuclide concentrations will be developed to facilitate field identification of locations of elevated activity in excess of site-specific removal goals. Locations exceeding screening levels will be investigated and, if appropriate, remediated; following any remediation, scanning will be repeated to demonstrate effectiveness of the removal actions.

6.16.2 Direct Exposure Rate Measurements

Exposure rate measurements will be performed at systematic data point locations in accordance with the procedure, using a Ludlum Model 2221 meter with a Ludlum Model 44-10 gamma scintillation detector. The measurements will be performed at 3.3 ft above the surface by integrating the count for 0.5 minutes. The Pressurized Ionization Chamber will be used to develop a correlation between the instrument response and true exposure rate. Project-specific forms will be used to record data.

6.16.3 Soil Sampling

Soil samples of approximately 1 kg will be obtained to a depth of 15 cm; samples will be packaged and uniquely identified in accordance with chain–of–custody and site-specific procedures.

6.16.4 Sequence of Field Activities

The sequence of activities will be as follows:

1. If deemed necessary, select a reference survey unit of a similar geological nature to the Mound Burial Site, but not impacted by radiological contamination. Perform 10 exposure rate measurements in this reference area. Measurement locations in the reference survey unit will be selected randomly or systematically, depending on the size and dimensions of the area. The reference locations of each of the samples must be documented.

2. Determine ambient background direct gamma levels for gamma scintillation detectors and establish action levels to correspond to instrument responses, which are detectable above these ambient background levels.

3. Establish reference grids for survey areas and establish boundaries of survey units. Establish pattern for data points (Section 6.14).

4. Conduct surface gamma scans. Identify locations of elevated direct radiation and remediate and/or conduct sampling to determine the extent and concentrations of areas of elevated activity.

5. Establish random-start sampling location patterns.

6. Perform exposure rate measurements. The actual number of systematic measurements will depend on the actual area and pattern of excavation and results as the survey progresses.

7. Perform on-site sample analysis by gamma spectroscopy and send split samples (QC) accompanied with the appropriate chain-of-custody record, to a qualified laboratory for confirmatory analysis at a frequency of 10% of the total sample population.

Area Classification	Number of Survey Units	Samples/Survey Unit	Total Measurements
Reference Area	1	10	10
Class 1	7	10	70

6.16.5 Sample Analysis

Samples will be transferred to a radio-analytical laboratory for analyses in accordance with documented laboratory-specific standard methods. Samples will be dried and homogenized. A portion of each sample will be sealed in calibrated-geometry containers and then analyzed by high-resolution gamma spectrometry. Concentrations of Co-60 and Cs-137 and members of the natural uranium, thorium, and actinium decay series, which may be identified by the spectrometry analysis software, will be determined. In accordance with MARSSIM, analytical techniques will provide a minimum detection level of 50% of the individual radionuclide $DCGL_W$ values for all primary contaminants, with a preferred target minimum detection level of 10% of these individual radionuclide $DCGL_W$ values.

6.16.6 Investigation Levels

Direct radiation levels, identified by scans, that indicate potential residual radioactive contamination above background, will be investigated to identify the source, level, and extent of such residual activity. Areas that contain residual radioactivity concentrations of individual radionuclides or sum-of-ratio concentrations above respective guideline values and remediation goals will also be investigated. Depending upon the levels, extent, and other conditions of contamination, additional sampling and/or measurements may be performed to resolve uncertainties, and data reevaluated. Remediation will be performed, if required, and the location resurveyed.

6.16.7 Quality Control Measurements

A minimum of 5% replicate samples and exposure rate measurements will be performed for field quality control purposes. Other quality control activities are incorporated into specific field survey procedures.

6.17 Data Evaluation

6.17.1 Data Assessment

All data will be reviewed for conformance with indicated procedures and plans. Results will be converted to appropriate units for comparison with criteria and necessary calibration/correlation adjustments performed. All measurement data will be reported in the standard format of X +/- Y (2 σ) and detection capability. Laboratory analyses and exposure rate measurement QC data will be evaluated for accuracy and precision.

Data not meeting design quality objectives will be identified. Additional data needs, if any, will be identified.

- Scan data, locations of elevated direct radiation levels, and sampling locations will be identified on facility drawings.

- Tables of radionuclide concentrations in each sample from the reference area and each survey unit will be prepared.

- Individual sample concentrations will be graphically displayed on posting plots and histograms for each survey unit and reference area for visual identification of trends.

6.17.2 Data Interpretation

Exposure rate data meeting acceptance criteria will be evaluated using the Wilcoxon Rank Sum test. The Wilcoxon Rank Sum test (the method described in Appendix I, Section 11 of MARSSIM) will be conducted for each group of survey unit samples; the reference area sample set will be used for each of these tests. If the WRS test results in rejection of the hypothesis, the test has demonstrated that the survey unit satisfies criteria for unrestricted release. If the data do not reject the hypothesis, a site-specific risk assessment will be performed to determine options for further action.

Soil concentration data will be evaluated using the Student t-test. Findings that are inconclusive because of additional information needs and findings that criteria have not been met will be promptly reported within the project organization structure for early resolution.

6.17.3 Comparison with Project Objectives

Overall project results will be compared with DQOs, established during the design phases of the project.

6.18 Report of Survey Findings

Survey procedures and results will be documented in a report, following the general guidance for Final Status Survey Reports in draft NUREG/CR-5849 (NRC-1992), and submitted by ATG.

7.0 PHYSICAL SECURITY PLAN AND MATERIAL CONTROL AND ACCOUNTING PROVISIONS IN PLACE DURING DECOMMISSIONING

This section is not applicable. Fort McClellan is still an active base and security and material control are conducted by the U.S. Army.

8.0 FUNDING

The following cost estimate depicts the turnkey pricing for the entirety of project execution, from mobilization through remediation, final verification, and return for site closure upon regulatory release. Management, technical and labor support, travel and living expenses, normal consumables (plastic, PPE, etc.) and rentals are provided for the projected level of effort. Waste packaging and transportation is provided for an estimated volume of LLRW up to 500 yd^3 of impacted soil and secondary wastes. Waste volumes in excess of 500 yd^3 would require negotiation of unit rates to accommodate the extended schedule and additional transportation costs.

U.S. Army Fort McClellan HQ. IOC Project Number USA 98-046 Phase II
'Burial Mound' Decommissioning Funding

Direct Labor		**$ 72,709**
Fringe, P/R Tax, Workmans Comp.		**$ 20,569**
M&IE		**$ 31,847**
Travel		**$ 6,337**
Supplies		**$ 21,952**
Rental		**$ 74,818**
Freight		**$ 1,620**
Analysis		**$ 14,100**
Telephone		**$ 2,000**
	Direct Cost	**$245,951**
Overhead	**52.47%**	**$129,051**
Subcontractors		**$130,850**
	Subtotal (G&A Pool)	**$505,852**
G & A	**18.23%**	**$ 92,217**
	Subtotal	**$598,069**
Fee	**12.0%**	**$ 71,768**
	Subtotal	**$669,837**
Facilities Cost of Capital		
0.537% of Total Cost		**$ 1,321**
4.001% of Total Cost through Overhead		**$ 20,239**
Total Phase Cost Estimate		**$691,397**

9.0 REFERENCES

1. U.S. Nuclear Regulatory Commission Radioactive Material License Number 01-02861-05, as amended per docket number 030-17584, U.S. Army Chemical School, Fort McClellan, Alabama.

2. Code of Federal Regulations Title 10, Part 20, *Standards for Protection Against Radiation.*

3. Code of Federal Regulations Title 49, Parts 171 - 177, Transportation.

4. U.S. Nuclear Regulatory Commission Regulatory Guide 3.65, *Standard Format and Content of Decommissioning Plans for Licenses Under 10 CFR Parts 30, 40, and 70,* August 1989.

5. NRC 1998a, *Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminant and Field Conditions*, NUREG-1507, Nuclear Regulatory Commission, June 1998.

6. NRC 1998b, *A Nonparametric Statistical Methodology for the Design and Analysis of Final Status Decommissioning Surveys*, NUREG-1505, Nuclear Regulatory Commission, 1998.

7. NUREG-1575 / EPA 402-R-97-016, *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*, December 1997.

8. NUREG/CR-5849 (draft), *Manual for Conducting Radiological Surveys in Support of License Termination*, June 1992.

9. U.S. Nuclear Regulatory Commission Document, *Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material*, April 1993.

10. *Industrial Radiation Study No. 27-MH-0987-R2-97, Pelham Range Burial Mound, Fort McClellan, Alabama, 29 August - 15 September 1995 and 14 - 28 January 1996*, U.S. Army Center for Health Promotion and Preventive Medicine (CHPPM).

11. Waste Profile Record, Envirocare of Utah EC-0230, Fort McClellan "Burial Mound", Revision 2, ATG, October 1998.

12. A&A 1999, *Development of Derived Clean-up Guidelines for the Pelham Range 'Burial Mound', Fort McClellan, Alabama*, Auxier & Associates, Inc., February 12, 1999.

13. Envirocare of Utah, Inc. *Radioactive Material License Number UT 2300249 Dated 10/22/98 with Expiration Date of 10/22/2003*, Utah Department of Environmental Quality, Division of Radiation Control.

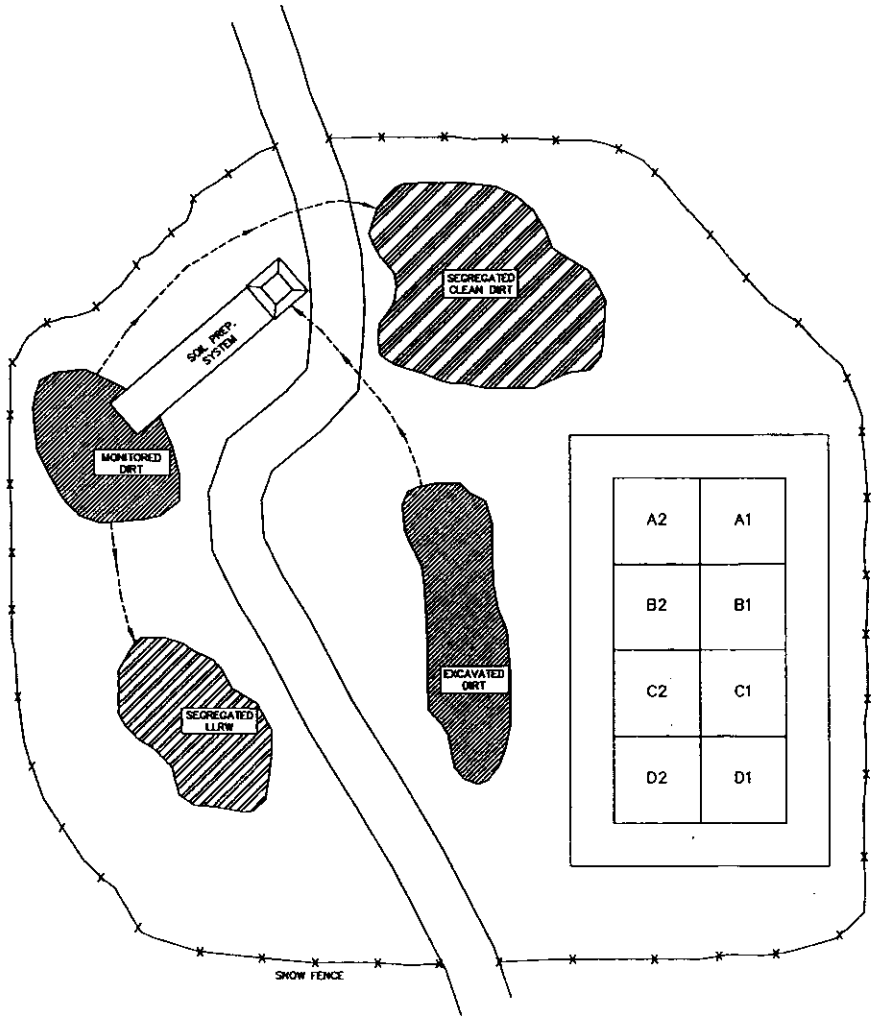
14. U.S. Army - Industrial Operations Command, Standard Operating Procedure, *Shipping Unwanted Radioactive Materials*, May 1998.

15. IT Corporation 1998a, *Fort McClellan Installation Wide Work Plan, Fort McClellan, Alabama*, IT Corporation, August 1998.

16. IT Corporation 1998b, *Fort McClellan Installation Wide Sampling and Analysis Plan, Fort McClellan, Alabama*, IT Corporation, August 1998.

ATTACHMENT 1

SITE LAY-OUT
(Sketch)



LEGEND

- EXCAVATED DIRT
- MONITORED DIRT
- SEGREGATED CLEAN DIRT
- SEGREGATED LLRW

REV.	DATE	DESCRIPTION	ENGR	CHKD	OPS	QA	APPD

DRAFTER	J. FRANKLIN	DATE 1.12.99
ENGINEER		DATE
CHECKER		DATE
OPERATIONS		DATE
QA		DATE
APPROVED		DATE

ATG NUCLEAR SERVICES

ATG FILE NUMBER:

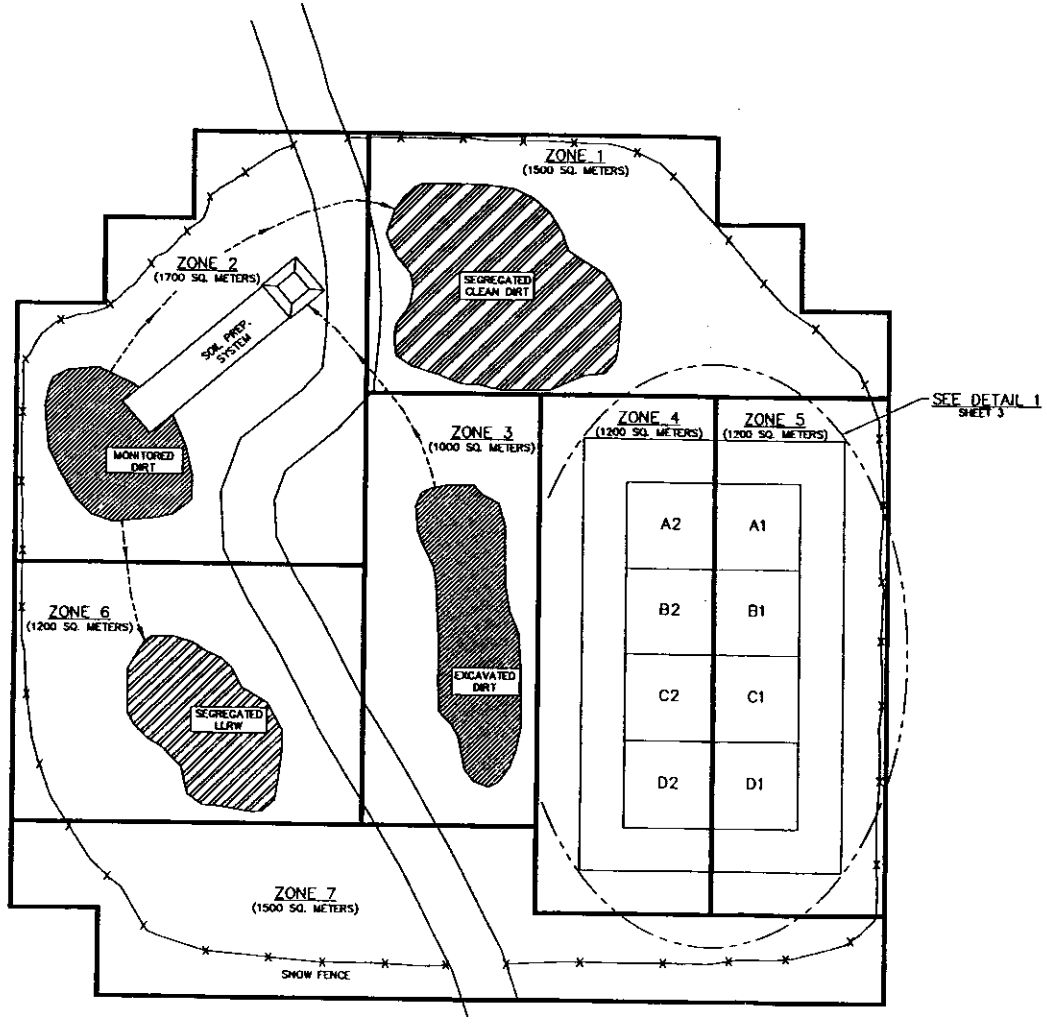
FORT McCLELLAN
BURIAL MOUND
SITE LAYOUT

SIZE: D | DRAWING NUMBER: | REV. 0

SCALE: 3/64"=1'-0" | SHEET 1 OF 4

ATTACHMENT 2

SITE LAY-OUT DEPICTING AREA CLASSIFICATION (Sketch)



LEGEND

- EXCAVATED DIRT
- MONITORED DIRT
- SEGREGATED CLEAN DIRT
- SEGREGATED LLRW

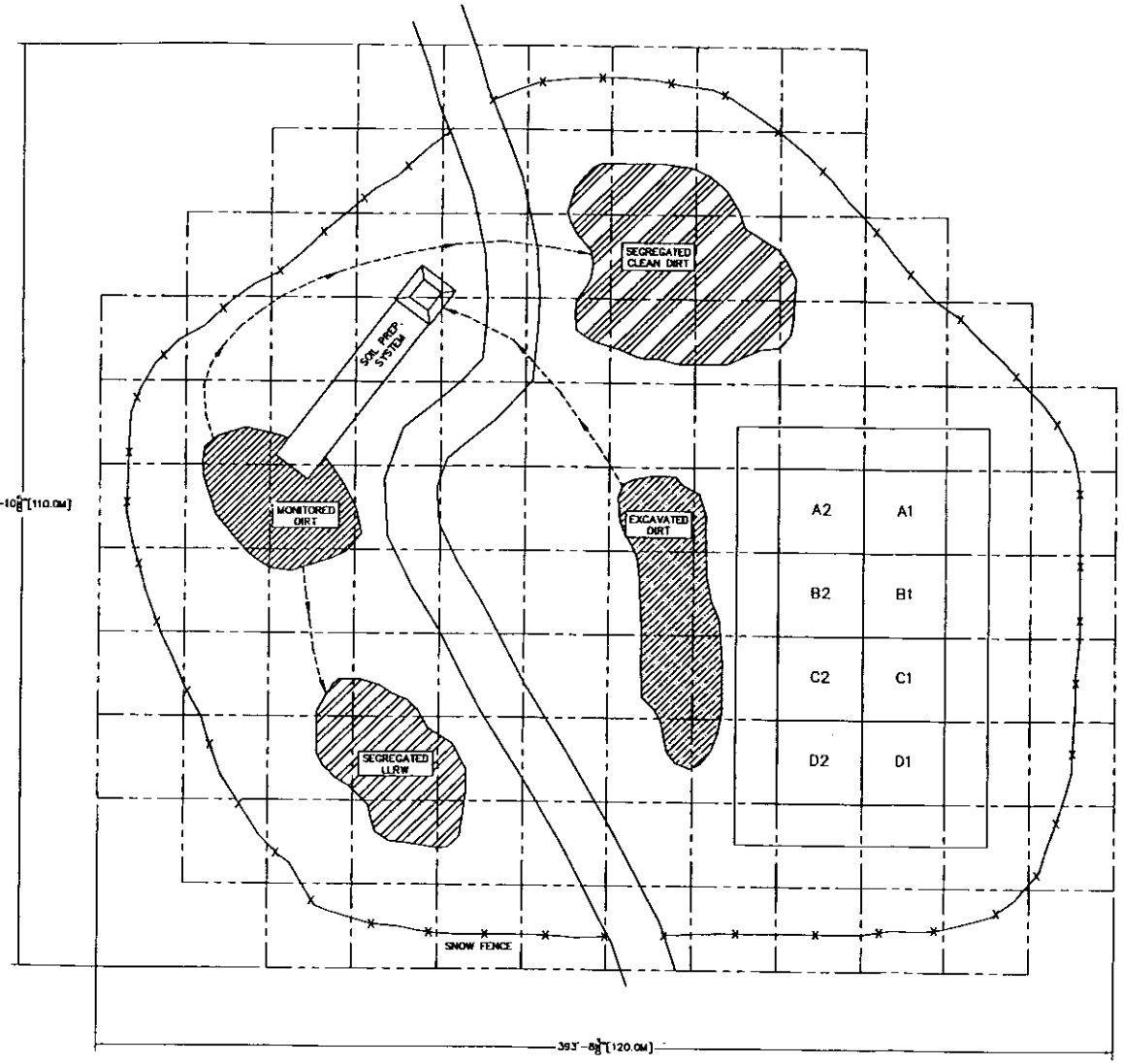
ATG NUCLEAR SERVICES

FORT McCLELLAN
BURIAL MOUND
CLASS 1 AREAS

SIZE: D
REV: 0
SCALE: 3/64"=1'-0"
SHEET 2 OF 4

ATTACHMENT 3

SITE LAY-OUT SHOWING CUT-AWAY (Sketch)



LEGEND

- EXCAVATED DIRT
- MONITORED DIRT
- SEGREGATED CLEAN DIRT
- SEGREGATED LLRW

REV.	DATE	DESCRIPTION	ENGR	CHKD	OPS	QA	APPD

DRAFTER: J. FRANKLIN 1.12.99
ENGINEER
CHECKER
OPERATIONS
QA
APPROVED

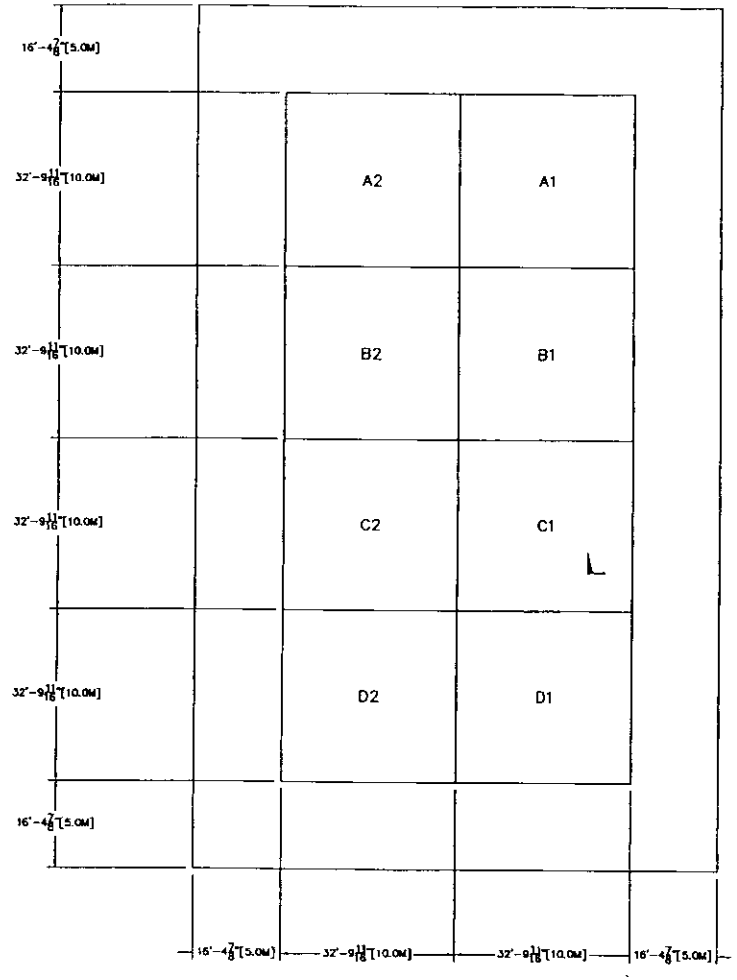
ATG NUCLEAR SERVICES

FORT McCLELLAN
BURIAL MOUND
GRID LAYOUT

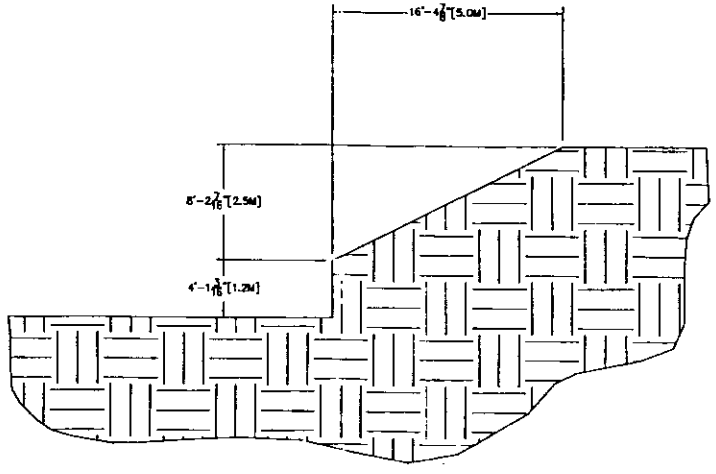
SIZE: D
REV: 0
SCALE: 3/64"=1'-0"
SHEET 1 OF 3

ATTACHMENT 4

SITE LAY-OUT DEPICTING ORIGINAL 10 m x 10 m GRID (Sketch)



DETAIL 1
FROM SHEET 2



SECTION A-A
SCALE: 1/4"=1'-0"

ATG NUCLEAR SERVICES

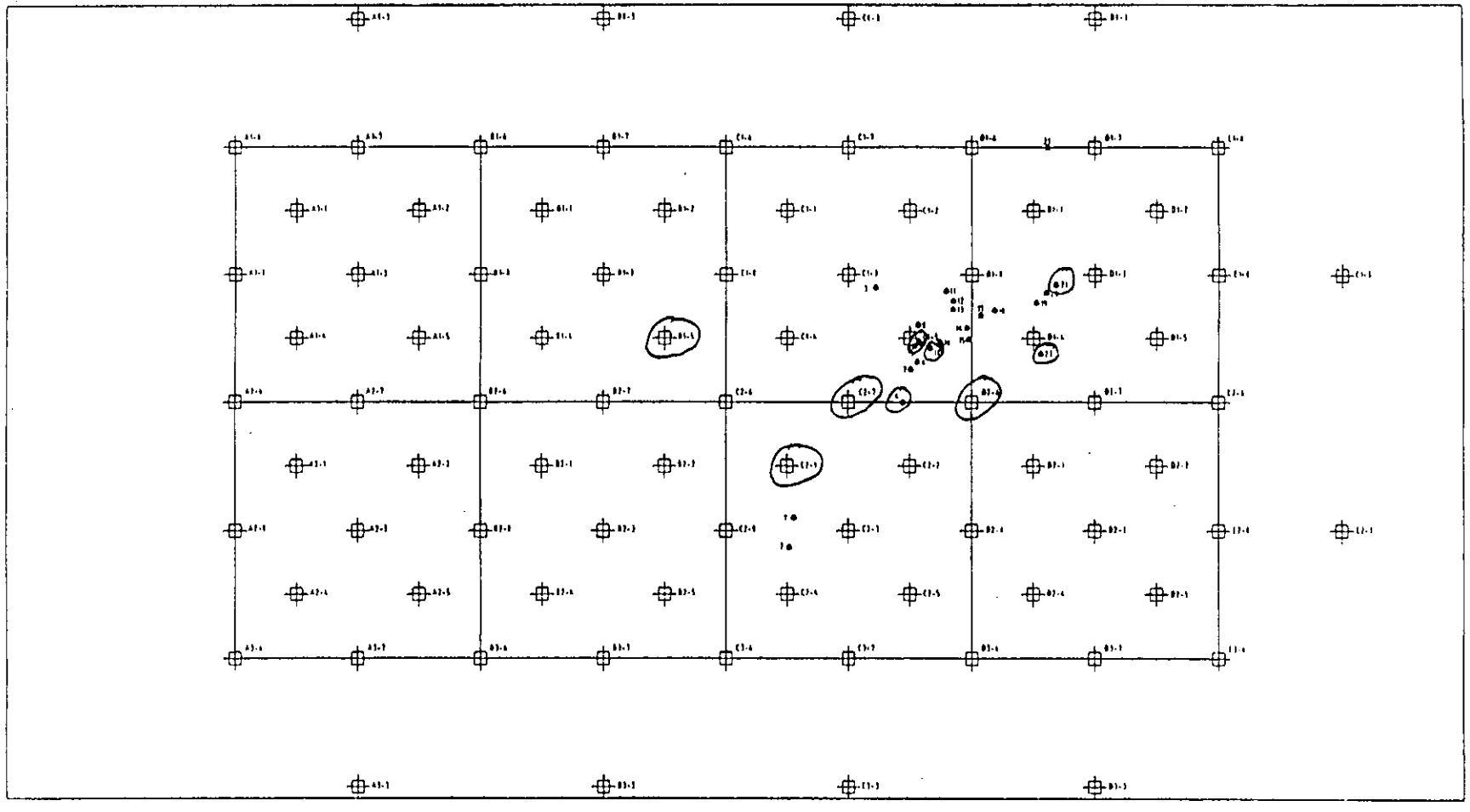
FORT McCLELLAN
BURIAL MOUND
EXCAVATION MAP

SIZE: D
REV: 0
SCALE: 3/32"=1'-0"
SHEET 3 OF 4

ATTACHMENT 5

LLRW VOLUME ESTIMATE DATA

Indust Radn Study No. 27-MH-0987-R2-97, Fort McClellan, AL,
29 Aug-15 Sep 95 and 14-28 Jan 96



ELEVATED ACTIVITY LOCATION PER CHPPM REPORT

10m x 20m x 12 ft. = Volume of soil to be removed
12 ft. X .304801 = m
10m x 20m x 3.66m = 732m^3
732m^3 x 1.30795 = 957.42 yd^3
957.42 x 40% = 382.96 yd^3

FROM TABLE F-5

SAMPLE	Co-60 pCi/gram	Cs-137 pCi/gram
HS 4	8+ / -1	26+ / -1
HS 4	9+ / -1	26+ / -1
HS 9	6.3+ / -.4	17+ / -1
HS 9	7+ / -1	18+ / -1
HS 11	22+ / -1	3.9+ / -.3
HS 11	23+ / -1	3.6+ / -.5
HS 20	187+ / -2	.9+ / -.5
HS 20	19+ / -1	1.1+ / -.3
HS 21	1.6+ / -.2	179+ / -2
HS 21	1.5+ / -.4	170+ / -2
HS 23	34+ / -1	.2+ / -.2
HS 23	32+ / -1	.5+ / -.4

FROM TABLE F-8

SAMPLE	Co-60 pCi/gram	Cs-137 pCi/gram
BM B-1-5-6/7	13	9.5
BM B-1-5-6/7	9	7
BM C-2-1-2/4	11	11
BM C-2-1-2/4	9	12
BM C-2-1-4/6	330	0.3
BM C-2-1-4/6	320	0.1
BM C-2-1-6/8	320	0.1
BM C-2-1-6/8	310	0.6
BM C-2-1-8/9	49	0.02
BM C-2-1-8/9	46	0.03
BM C-2-7-4/5	42	0.6
BM C-2-7-4/5	37	0.4

FROM TABLE F-7

BM LOCATION	-3	-4	-5	-6	-7	-8	-9	-10
C1-5	141362	129124	19540					
C2-1		69015	301991	121381	169164	249340	33725	
C2-7	12179	170097	939591	427340	16966			

Hole-Logging, Units in Gross CPM, Nal Detector