DEPARTMENT OF THE ARMY T. Grucci/seb/274-9340
HEADQUARTERS US ARMY MATERIEL DEVELOPMENT AND READINESS COMMAND
5001 EISENHOWER AVENUE, ALEXANDRIA, VA. 22333

70-2626

DRCSF-P/82-0025

New

31 March 1982

RECEIVED
1982 APR 5 AM 11 49
U.S. NUCLEAR REG. COMMISSION
MAIL SECTION

Director
Nuclear Material Safety and Safeguards
ATTN: Radioisotopes Licensing Branch
US Nuclear Regulatory Commission
Washington, DC 20555

Gentlemen:

Forwarded is US Army Communications-Electronics Command application for Special Nuclear Material License. This request is for possession and use of plutonium-239 sources in AN/UDM-6 Radiac Calibrator Set. This application when approved will transfer responsibility for management control of AN/UDM-6 Radiac Calibrator Set from US Army Armament Materiel Readiness Command which holds Special Nuclear Material License SNM-1745 for the materials to US Army Communications-Electronics Command.

Please acknowledge receipt of correspondence on inclosed DA Form 209 Mail Reply Card.

Sincerely,

2 Incl
as

DARWIN N. TARAS
Chief, Health Physics
Safety Office

CF:
HQDA (DASG-PSP-E) WASH DC 20310 (ltr to NRC)
Dir, DARCOM FSA, Charlestown, IN 47111 (ltr to NRC & copy & marked FSA)
Cdr, US Army Communications-Electronics Command, ATTN: DRSEL-SF-H, Ft. Monmouth, NJ 07703 (ltr to NRC)
Cdr, US Army Armament Materiel Readiness Command, ATTN: DRSAR-SF, Rock Island, IL 61299 (ltr to NRC)

20509

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FEE EXEMPT

DEPARTMENT OF THE ARMY
HEADQUARTERS US ARMY COMMUNICATIONS-ELECTRONICS COMMAND
AND FORT MONMOUTH
FORT MONMOUTH, NEW JERSEY 07703

REPLY TO
ATTENTION OF:

25 FEB 1982

DRSEL-SF-H

SUBJECT: Application for US Nuclear Regulatory Commission (NRC)
Special Nuclear Material License

Commander
US Army Materiel Development and Readiness Command
ATTN: DRCSF-P
5001 Eisenhower Avenue
Alexandria, Virginia 22333

1. The Department of the Army, US Army Communications-Electronics Command (CECOM), ATTN: DRSEL-SF, Fort Monmouth, New Jersey 07703, is hereby making application for an NRC license to receive title to, own, acquire, deliver, receive, possess, use and transfer special nuclear material in accordance with paragraph 70.21 of Title 10, Chapter 1, Code of Federal Regulations, Part 70. This application, when approved, will transfer responsibility for management control of the special nuclear material referenced below which is presently authorized under NRC License Number SNM-1745 issued to the Department of the Army, US Army Armament Materiel Readiness Command, Rock Island, Illinois 61201.

2. The special nuclear material, $^{239}$Plutonium, is used as an alpha emitting source of radiation in the AN/UDM-6 Radiac Calibrator Set, each containing approximately 23 micrograms (1.4 microcuries) of $^{239}$Plutonium. The maximum quantity that will be possessed at any one time will be 11.5 milligrams (705 microcuries) of $^{239}$Plutonium. Supplement A contains the manufacturing criteria for this radiac calibrator.

3. The AN/UDM-6 Radiac Calibrator Set will be utilized at Lexington-Blue Grass Depot Activity (LBDA), Lexington, Kentucky; the US Army Ionizing Radiation Dosimetry Center of the US Army Test Measurement Diagnostic Equipment (TMDE) Support Group (formerly the Army Metrology and Calibration Center) at LBDA; and Department of Defense (DOD) installations and activities at worldwide locations. The AN/UDM-6 Radiac Calibrator Sets at DOD installations and activities will be possessed and utilized under the control of Department of the Army military and/or civilian personnel meeting the minimum requirements contained in Supplements B and C.

4. Management of the radiation protection program for these radiac calibrators are the responsibility of Mr. Bernard M. Savaiko, License Manager, Mr. Steven A. Horne, Radiation Protection Office (RPO), Mr. Barry J. Silber, Alternate RPO, and Ms. Patricia Ann Elker, Alternate RPO. Supplement D contains the

DRSEL-SF-H
SUBJECT: Application for US Nuclear Regulatory Commission (NRC) Special Nuclear Material License

qualifications of those individuals. Supplement E contains the radiation protection program for the control of this radioactive commodity. Supplements F and G contain information relative to facilities, instrumentation and ultimate disposal requirements.

FOR THE COMMANDER:

7 Incl
as

JOHN T. PATTERSON
Colonel, GS
Chief of Staff

1. Inclosures 1, 2, 3, 4, 5 and 6 are concurrences from the major Army commands which are responsible for the use of the AN/UDM-6 Radiac Calibrator Set.

2. Inclosure 7 is the concurrence from the Army Test Measurement Diagnostic Equipment Support Group who is assigned the worldwide calibration mission for the AN/UDM-6 Radiac Calibrator Set.

3. Inclosure 8 is the concurrence from the effected DESCOM Depot with regards to bulk storage and/or maintenance function associated with the AN/UDM-6 Radiac Calibrator Set.

4. This license application was reviewed and concurred in by the Fort Monmouth Ionizing Radiation Control Committee on 30 December 1981.

DEPARTMENT OF THE ARMY
[illegible]TH THEATER ARMY MATERIEL MANAGEMENT CENTER
APO NEW YORK 09052

AEAGD-MMC-RA-CS

30 DEC 1981

SUBJECT: Application for US Nuclear Regulatory Commission Special Nuclear Material License - AN/UDM-6 Radiac Calibrator Set

Commander
HQ, US Army Communications - Electronics
Command and Fort Monmouth
ATTN: DRSEL-SF-H
Fort Monmouth, NJ 07703

1. References:

a. Letter, DRSEL-SF-H, HQ CECOM, dated 23 November 1981, subject as above, (U).

b. Telephone conversation between MAJ Lind, this center, and Mr. Horne, CECOM, 10 December 1981, subject as above.

2. This center has reviewed reference 1a for matters pertaining to the implementation of regulatory requirements for the control of the subject radioactive commodity.

3. This center concurs in the license application when the proposed modifications to the training requirements discussed in reference 1b are included.

FOR THE COMMANDER:

for Dave Pickett

BOBBY N. CROWE
LTC, OD
Chief, Armament Systems Division

DRSEL-SF-H 8 February 1982

MEMORANDUM FOR RECORD

SUBJECT: Application for US Nuclear Regulatory Commission Special Nuclear Material License - AN/UDM-6 Radiac Calibrator Set

1. Reference is made to letter, AEAGD-MMC-RA-CS, dated 30 Dec 81, subject as above.

2. Reference 1 provided concurrence to subject application and recommended change to Supplement B, paragraph 3, of subject application. The recommended change has been incorporated into subject application.

Prepared By: Steven A Horne for
BARRY J. SILBER
Health Physicist

Reviewed and Approved By: Steven A Horne
STEVEN A. HORNE
Chief, Readiness Division
Safety Office

DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY FORCES COMMAND
FORT MCPHERSON, GEORGIA 30330

REPLY TO
ATTENTION OF

AFLG-MAC

7 DEC 1981

SUBJECT: Application for US Nuclear Regulatory Commission Special Nuclear Materiel License - AN/UDM-6 Radiac Calibrator Set

Commander
US Army Communications - Electronics Command
ATTN: DRSEL-SF-H
Fort Monmouth, NJ 07703

1. Reference letter, CECOM, DRSEL-SF-H, 23 November 81, SAB.

2. Concur in application for US Nuclear Regulatory Commission Special Nuclear Material License.

FOR THE COMMANDER:

for Acting Officer

M. A. BLACK
CPT, AGC
Asst AG

DJ-MS-MC (23 Nov 81) 1st Ind
SUBJECT: Application for US Nuclear Regulatory Commission Special Nuclear Material License - AN/UDM-6 Radiac Calibrator Set

Headquarters, Eighth United States Army, APO 96301 22 DEC 81

TO: Commander, US Army Communications-Electronics Command and Fort Monmouth
ATTN: DRSEL-SF-H, Fort Monmouth, NJ 07703

Concur in subject application.

FOR THE COMMANDER:

wd all incl

HAROLD DAVIS, JR.
CPT, AGC
Assistant Adjutant General

NGB-ARL-M (23 Nov 81) 1st Ind
SUBJECT: Application for US Nuclear Regulatory Commission Special Nuclear Material License - AN/UDM-6 Radiac Calibrator Set

HQ, Departments of the Army and the Air Force, National Guard Bureau, Washington, DC 20310 08 DEC 1981

TO: Commander, US Army Communications and Electronics Command, ATTN: DRSEL-SF-H, Fort Monmouth, NJ 07703

Concur.

FOR THE CHIEF, NATIONAL GUARD BUREAU:

wd all incl

WILLIAM C. MACKERT
Colonel, GS
Chief, Army Logistics Division

ATCD-NC (23 Nov 81) 1st Ind
SUBJECT: Application for US Nuclear Regulatory Commission Special Nuclear Material License - AN/UDM-6 Radiac Calibrator Set

HQ, TRADOC, Ft Monroe, VA 23651 14 DEC 1981

TO Commander, US Army Communications-Electronics Command, ATTN: DRSEL-SF-H, Ft Monmouth, NJ 07703

Subject application has been reviewed. This headquarters concurs.

FOR THE COMMANDER:

DOREATHA MANGRUM
ASSISTANT ADJUTANT GENERAL

1 Incl
nc

DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY WESTERN COMMAND
FORT SHAFTER, HAWAII 96858

REPLY TO
ATTENTION OF:
APOP-NC

23 DEC 1981

SUBJECT: Application for US Nuclear Regulatory Commission Special Nuclear Material License - AN/UDM-6 Radiac Calibrator Set

Commander
US Army Communications-
Electronics Command
ATTN: DRSEL-SF-H
Ft Monmouth, NJ 07703

1. Reference letter, DRSEL-SF-H, 23 Nov 81, SAB.

2. Concur in license application to Nuclear Regulatory Commission for the AN/UDM-6.

FOR THE COMMANDER:

For THOMAS H. SPENCE
Colonel, GS
Deputy Chief of Staff for
Operations and Plans

DRSMI-MSR (23 Nov 1981) 1st Ind
SUBJECT: Application for US Nuclear Regulatory Commission Special Nuclear Material License - AN/UDM-6 Radiac Calibrator Set

HQ, US Army Missile Command, Redstone Arsenal, AL 35898 15 December 1981

TO: HQ, US Army Communications-Electronics Command, DRSEL-SF, Fort Monmouth, NJ 07703

This office concurs in subject inclosure.

Delbert D Loney

wd incl

DELBERT D LONEY
Acting Chief
Radiation Standards & Development Lab
Metrology and Laboratory Directorate
US Army TMDE Support Group

DRSMI-MCI-DCN (23 Nov 81) 1st Ind
SUBJECT: Application for US Nuclear Regulatory Commission Special Nuclear Material Licence - AN/UDM-6 Radiac Calibrator Set

TO: Dept. of the Army, HQ US Army Communications-Electronics Command, ATTN: DRSEL-SF-H, Fort Monmouth, New Jersey 07703

C, US Army Ionizing Radiation Dosimetry Center, ATTN: DRSMI-MCI-DCN, Lexington, Kentucky 40511 10 December 1981

1. Concur that the subject license application properly describes our current responsibility to provide radiation officer services to Lexington-Blue Grass Depot Activity.

2. Request that the note in para 2-2 b of the revised draft of TM 3-6665-203-10 be changed to read:

> No maintenance or repair will be performed by the operator. Lexington-Blue Grass Depot Activity is the only authorized facility for maintenance or repair of the calibrator. Requests for maintenance or repair will be submitted to the radioactive material control point for coordination with CECOM and LBDA.

wd all incl

JOSEPH M. KING
C, US Army Ionizing Radiation
Dosimetry Center

DRSEL-SF-H 8 February 1982

MEMORANDUM FOR RECORD

SUBJECT: Application for US Nuclear Regulatory Commission Special Nuclear Material License - AN/UDM-6 Radiac Calibrator Set

1. Reference is made to letter, DRSMI-MCI-DCN, dated 10 December 1981, subject as above.

2. Reference 1 provided concurrence to subject application for the AN/UDM-7C Radiac Calibrator Set and recommended changes for the technical manual utilized with this calibrator.

3. The technical manual has been revised to reflect these changes in accordance with reference 1 above.

Prepared By: Steven A Horne for
BARRY J. SILBER
Health Physicist

Reviewed and Approved By: Steven A Horne
STEVEN A. HORNE
Chief, Readiness Division
Safety Office

SUPPLEMENT A

1. Reference: Paragraph 2 of letter/application.

2. The AN/UDM-6 Radiac Calibrator Set is the military version of the commercially available Eberline Instrument Corporation (EIC) Model S94-1 Calibrator Set. The AN/UDM-6 is comprised of a wooden carrying case incorporating four cast aluminum source jigs each containing one $^{239}$Plutonium source of specific activity, a mask utilized for the reduction of the source count rate, and a cushioning pad to assure that the source jigs are held in place.

3. $^{239}$Plutonium is electroplated onto 1¼ inch diameter stainless steel or nickel disks, with a one inch diameter active area. A solution containing a known quantity of $^{239}$Plutonium Nitrate is utilized in the electroplating process. The sources are dried and fired at elevated temperatures to assure the adherence of the radioactive material. One hundred percent of the radioactive source disks are tested for adherence by applying masking tape directly onto the active area. The masking tape is removed and the adhesive side is analyzed for removable contamination. As specified by EIC, adherence criteria requires that no more than 0.01 percent of the active material be removed.

4. The radioactive source disks are incorporated into two inch aluminum doughnut shaped source frames held together with the use of compression rings. The source frames are labeled with a radioactive decal containing radioactive caution symbols, radionuclide, calibrated source activity in counts per minute (cpm) and source serial number. This assembly is incorporated into the cast aluminum source jig with three machine screws.

5. The radioactive content of the four sources are of the order of 1.4E3 cpm, 1.4E4 cpm, 1.4E5 cpm and 1.4E6 cpm which are calibrated with calibration standards certified by, or traceable to, the National Bureau of Standards. Each AN/UDM-6 Radiac Calibrator incorporates certification documentation as to the accuracy of each of the radioactive sources.*

*The use of exponential notation, i.e., 1.4E3 ($1.4 \times 10^3$), is employed in lieu of standard notation, i.e., 1400.

SUPPLEMENT B

1. Reference: Paragraph 3 of letter/application.

2. Local Radiation Protection Officer (RPO). All calibration in which the AN/UDM-6 Radiac Calibrator Set is used will be supervised by a qualified local RPO. To be qualified as such, a person must have received a minimum of 40 hours of formal training in radiation protection including the following topics:

a. Principles and practices of radiation protection.

b. Biological effects of radiation.

c. Radioactivity measurement standardization and monitoring techniques and instruments.

d. Mathematics and calculations basic to the use and measurement of radioactivity.

e. The operation and use of the AN/UDM-6.

NOTES

A. Completion of the Radiological Safety Course at the US Army Chemical School or at the US Army Ordnance Center and School meets these requirements.

B. Where circumstances warrant, alternate training may be substituted if this training is approved by Commander, US Army Communications-Electronics Command, ATTN: DRSEL-SF, Fort Monmouth, New Jersey 07703. Such training must be received under the guidance of a qualified local RPO, and must include at least 16 hours of actual experience in the use of the AN/UDM-6.

3. Operator or User. The operator or user of the AN/UDM-6 shall have a minimum of 8 hours training under the guidance of a qualified local RPO for the AN/UDM-6 in the basic fundamentals of radiological operations, radiac instrumentation theory, application, survey techniquest and on-the-job training in operation and care of the AN/UDM-6. Instructions shall include safe working practices and inherent hazards associated with the instrument.

4. Radiation Control Officer (RCO). To be qualified as an RCO for the AN/UDM-6, a person must have a technical, scientific or engineering background and have successfully completed a minimum of 80 hours of formal training in radiation protection including the topics listed in item 2 above.

5. Maintenance Depot for the AN/UDM-6.

a. Depot Radiation Protection Officer and Alternate(s) must have a minimum:

(1) A Bachelor's degree, or specialty, in Science, Engineering, Health Physics or equivalent discipline.

(2) 160 hours of specialized training in radiation protection including:

(a) Principles and practices of radiation protection.

(b) Biological effects of radiation.

(c) Radioactivity measurement standardization and monitoring techniques and instruments.

(d) Mathematics and calculations basic to the use and measurement of radioactivity.

(e) At least one year of satisfactory experience in applied Health Physics.

b. Technicians. The following are the minimum requirements necessary for persons performing leak tests:

(a) Same as in 3 above, and

(b) Sufficient training by the depot RPO or his appointed representative(s) in the use of radiation detection instruments for leak test analysis, which shall include the method of performing the test, e.g., points on equipment to be smeared and method of taking smear; method of calibration of the instruments; and analysis of smears and reporting of smear results.

SUPPLEMENT C

1. Reference: Paragraph 3 of letter/application.

2. AN/UDM-6 Radiac Calibrator Sets will be issued only to authorized calibration activities at the direct support/general support level. Typically, instrumentation will be sent to authorized calibration activities or will be calibrated by a visiting mobile calibration activity (team). Calibration activities are authorized by US Army TMDE Support Group on the basis of approved facilities, equipment, standards, procedures and qualifications of personnel.

3. Most of the sets will be used by four to seven-man Army TMDE Support Teams (one set per team) who have received training in the principles and practices of radiation protection which included specific training in the safe use of the calibrator set. At least one team member will be qualified and approved as a local RPO receiving a minimum of 40 hours formal training in radiation protection as outlined in paragraph 2 of Supplement B. The teams will operate at various Army installations/activities described in Supplement F which possess alpha detection instrumentation. Other users will be authorized Army depots, installation and activity calibration facilities, and the US Army Chemical School, Fort McClellan, Alabama, radiation safety training branch.

SUPPLEMENT D

1. Reference: Paragraph 4 of letter/application.

2. Inclosures 1, 2 and 3 are the qualifications of License Manager, Radiation Protection Officer, and Alternate Radiation Protection Officers.

BERNARD M. SAVAIKO, Chief, Safety Office, US Army Communications-Electronics Command (CECOM), Fort Monmouth, New Jersey

a. Education: 1957 - B.S. Industrial Engineering, Columbia University, New York, New York.

b. Professional Experience:

(1) 5 years - Safety Officer - US Air Force.

(2) 4 years - Industrial Safety - U.S. Steel Corporation.

(3) 20 years - Industrial Safety and Chief, Safety Office- USACECOM (formerly US Army Communications and Electronics Materiel Readiness Command and US Army Electronics Command) Fort Monmouth, New Jersey, including 3 years experience as a Radiation Protection Officer with responsibilities for the control of various commodities containing radioactive materials.

Mr. Savaiko is designated as the manager of Nuclear Regulatory Commission Licenses and Department of the Army Authorizations.

Incl 1

STEVEN A. HORNE, Chief, Readiness Division, Safety Office and Health Physicist, US Army Communications-Electronics Command (CECOM), Fort Monmouth, New Jersey

1. Educational Background:

| | | |
|---|---|---|
| Old Dominion University<br>Norfolk, Virginia | 3 Years | 1964 - Associate in Applied Science |
| The Catholic University of America<br>Washington, DC | 2 Years | 1975 - BSE Nuclear Science and Engineering |
| The Catholic University of America<br>Washington, DC | - | 1975 - Graduate Work in Nuclear Science and Engineering |

2. Formal Training and Experience in Radiation Protection Methods, Measurements and Effects:

| | Duration of Training | On The Job | Formal Course |
|---|---|---|---|
| a. Fifty-six semester hours pertaining to radiation, including college physics, Environmental Aspects of Nuclear Power Plant Management, Environmental Radioactivity, Nucleonic Fundamentals, Nuclear Properties and Interactions, Nuclear Physics, Nuclear Radiation Detection, Nuclear Reactor Physics, Radiation Biology, Radioisotope Techniques and Radiological Physics - Old Dominion University and The Catholic University of America. | 1961-1975 | No | Yes |
| b. Radiation Detection Effects and Devices Utilizing various type of high energy accelerators - Virginia Associated Research Center Newport News, Virginia, and NASA Langley Research Center, Langley, Virginia. | 1 Year | Yes | No |
| c. Radiation safety, detection instrumentation and isotopic handling equipment - Flow Corp, Fort Belvoir, Virginia. | 2 Months | Yes | No |

| | Duration of Training | On The Job | Formal Course |
|---|---|---|---|
| d. Radiological Safety Course pertaining to Nuclear Moisture/ Density Instrumentation - Seaman Nuclear Corporation, Milwaukee, Wisconsin. | 24 Hours | No | Yes |
| e. Occupational Radiation Protection Course 212 - Public Health Services, Las Vegas, Nevada. | 80 Hours | No | Yes |
| f. Fundamentals of Non-Ionizing Radiation Protection Course 264 - Public Health Service, Rockville, Maryland. | 40 Hours | No | Yes |
| g. Laser Safety Course - University of Cincinnati, Ohio. | 40 Hours | No | Yes |
| h. Radionuclide Analysis by Gamma Spectrocopy Course 208 - Public Health Service, Winchester, Massachusetts. | 80 Hours | No | Yes |
| i. Radiation Guides and Dose Assessment Course 272 - Environmental Protection Agency, Las Vegas, Nevada. | 80 Hours | No | Yes |

3. Experience with Radioisotopes:

| Isotope | Maximum Activities in Curies | Duration of Experience | Type of Experience |
|---|---|---|---|
| $^{241}Am$ | 1 | 3 Years | For all radionuclides listed, experience consisted of laboratory analysis, wipe tests, experiments and evaluations utilizing these sources. |
| $^{252}Cf$ | .27 | 3 Years | |
| $^{57}Co$ | 0.1 | 4 Years | |
| $^{60}Co$ | 1200 | 8 Years | |
| $^{137}Cs$ | 1 | 8 Years | |
| $^{3}H$ | 20 | 8 Years | |
| $^{192}Ir$ | 100 | 8 Years | |
| $^{147}Pm$ | 1 | 8 Years | |

| Isotope | Maximum Activities in Curies | Duration of Experience |
|---|---|---|
| $^{226}$RaBe | 1 | 5 Years |
| $^{239}$PuBe | 1 | 1 Year |
| $^{90}$Sr | 0.1 | 2 Years |

4. Experience with other Radiation Producing Machines:

| Radiation Machine | Duration of Experience | Type of Experience |
|---|---|---|
| a. NASA Langley Research Center, and Virginia Associated Research Center's, Space Radiation Effects Laboratory consisting of a 2 MeV Van de Graff accelerator, 3 MeV Dynamitron accelerator, 10 MeV Linear Electron Accelerator, a 600 MeV Proton Synchrocyclotron Accelerator and a 14 MeV Neutron Generator. | 1.5 Year | Radiation damage Shielding Experiments and Related Health Physics Studies. |
| b. 250 KeV General Electric Corporation X-ray machine | 8 Years | Health Physics and laboratory experiments. |
| c. Various energy dispersive and wave length X-ray fluorescence spectrometry with X-ray generators up to 50 KeV. | 8 Years | Health Physics and laboratory experiments. |

5. Experience with radiation:

1964-1965 - Virginia Associated Research Center, NASA, Langley Research Center, Virginia as Health Physics Technologist.

1965-1966 - E.R. Squibb, New Brunswick, New Jersey as Radiochemist Isotope Technologist.

1966-1968 - Flow Corporation, Nuclear Division, Fort Belvoir, Virginia as Radiation Engineer.

1968-1976 - US Army Mobility Equipment Research and Development Command, Fort Belvoir, Virginia as Health Physicist.

1976-1978 - US Army Electronics Command, Fort Monmouth, New Jersey as Health Physicist.

1978-1981 - US Army Communications and Electronics Materiel Readiness Command, Fort Monmouth, New Jersey, as Health Physicist.

1981-Present - US Army Communications-Electronics Command, Fort Monmouth, New Jersey, as Chief, Readiness Division, Safety Office and Supervisory Health Physicist.

BARRY J. SILBER, Health Physicist, US Army Communications-Electronics Command (CECOM), Fort Monmouth, New Jersey

a. Education:

(1) A.A. - Brooklyn College of the City University of New York, Brooklyn, New York - 1965.

(2) B.S. - Brooklyn College of the City University of New York, Brooklyn, New York - 1969. Major: Chemistry.

b. Professional Experience:

(1) October 1966 - May 1967:
Allen Pharmacal Corporation, 175 Pearl Street, Brooklyn, New York.
Laboratory Technician - Analytical Chemistry Laboratory.
Laboratory analyses of pharmaceuticals at various stages of manufacture to insure compliance with Food and Drug Administration Regulations as well as United States Pharmacopeia and National Formulary Monographs.

(2) June 1967 - March 1970:
EON Corporation, 175 Pearl Street, Brooklyn, New York.
Chemist - Responsible for all health physics activities, including radiation surveys, air sampling and wipe tests, leak testing of sealed sources, decontamination of facilities and equipment, disposal of radioactive wastes, calibration of radiation survey and measurement instrumentation, record-keeping, etc., to insure compliance with US Nuclear Regulatory Commission (NRC) and New York State Regulations; liaison between regulatory agencies and corporate management; authorized radiation worker (user) of multiple types of radioactive materials used in the manufacture of radiation sources for commercial, military and highly specialized (custom-made) use; responsible for all chemistry activities including metallurgical applications on products at various stages of manufacture to meet quality control specifications.

(3) March 1970 - June 1977:

State of New York Department of Labor, Division of Safety and Health, 2 World Trade Center, New York, New York.
Senior Radiophysicist - Radiological Health Unit.
Responsible for the review of applications, including the evaluation of facilities, equipment, personnel and products containing radioactive materials, and in the preparation of State licenses authorizing the possession and use of radioactive materials by persons in industry and related activities in this State; assist in the administration of the licensing program; consult with and assist industrial management personnel and others in establishing radiation protection programs; conduct inspections, special prelicensing investigations, radiation surveys and tests at the sites of licensees and registrants using radiation sources to enforce state regulations and to insure that radiation workers and the general public are fully protected; assemble environmental research data, analyze and interpret this data, assist in the publication of scientific reports, and training of new staff members.

(4) June 1977 - January 1978:
US Army Electronics Command (ECOM), Fort Monmouth, New Jersey.
Health Physicist - Responsible for health physics functions in the establishment and implementation of the ECOM Safety Program aimed at establishing life cycle controls of ECOM commodities utilizing radioactive material and ionizing radiation producing devices; responsible for the evaluation of radiological protection programs and radiation facilities to determine their adequacy and to insure compliance with DA Authorizations and NRC Licenses; perform studies and evaluations necessary to minimize the health risks to personnel; prepare and review applications for DA Authorizations and NRC Licenses; establish and maintain radiation protection records and files.

(5) January 1978 - April 1981:
US Army Communications and Electronics Materiel Readiness Command (CERCOM), Fort Monmouth, New Jersey.
Duties are the same as in Item b(4) above. Name change from ECOM to CERCOM.

(6) May 1981 - Present:
CECOM, Fort Monmouth, New Jersey.
Duties are the same as in Item b(4) above. Name change from CERCOM to CECOM.

c. Formal Training in Radiation Protection Methods, Measurements and Effects:

| | Duration of Training | On-The-Job | Formal Course |
|---|---|---|---|
| (1) X-Ray Technology for Radiological Health Personnel-Memorial Hospital for Cancer and Allied Diseases, 444 East 68th Street, New York, New York - 11 January - 14 January 1971. | 3 Days | No | Yes |
| (2) Orientation Course in Regulatory Practices and Procedures - NRC, Bethesda, Maryland - 1 March - 19 March 1971. | 3 Weeks | No | Yes |
| (3) Health Physics and Radiation Protection - Special Training Division, Oak Ridge Associated Universities, Oak Ridge, Tennessee - 12 February 1973 to 20 April 1973. Sponsored by the NRC for Agreement State regulatory personnel. | 10 Weeks | No | Yes |
| (4) Radiological Safety Course - US Army Ordnance and Chemical Center and School, Aberdeen Proving Ground, Maryland - 25 October - 15 November 1977. | 3 Weeks | No | Yes |
| (5) Internal Dosimetry for Fixed Nuclear Facilities-Oak Ridge Associated Universities, Oak Ridge, Tennessee - 5 November - 9 November 1979. | 1 Week | No | Yes |
| (6) Managers' Environmental Course - US Army Logistics Management Center, Fort Lee, Virginia - 13 July - 17 July 1981. | 1 Week | No | Yes |

d. Experience with Radiation.

| | Isotope | Maximum Amount | Duration of Experience | Type of Use |
|---|---|---|---|---|
| (1) | $^{14}C$ | 60 mCi | 3 Years | For items 1 through 10-manufacture of sealed sources, health physics surveys and wipe tests. |
| (2) | $^{32}P$ | 10 mCi | 3 Years | |
| (3) | $^{36}Cl$ | 10 mCi | 3 Years | |
| (4) | $^{63}Ni$ | 10 mCi | 3 Years | |
| (5) | $^{90}Sr/^{90}Y$ | 50 mCi | 3 Years | For items 11 and 14-calibration of radiation instrumentation, health physics surveys and wipe tests. |
| (6) | $^{99}Tc$ | 100 mCi | 3 Years | |
| (7) | $^{106}Ru/^{106}Rh$ | 50 mCi | 3 Years | |
| (8) | $^{144}Ce/^{144}Pr$ | 500 mCi | 3 Years | |
| (9) | $^{147}Pm$ | 500 mCi | 3 Years | For items 12 and 13-health physics surveys and wipe tests. |
| (10) | $^{204}Tl$ | 50 mCi | 3 Years | |
| (11) | $^{60}Co$ | 10 mCi | 3 Years | |
| (12) | $^{60}Co$ | 200 Ci | 3 Years | |
| (13) | $^{137}Cs$ | 250 Ci | 3 Years | |
| (14) | $^{226}Ra$ | 20 mCi | 3 Years | |

PATRICIA ANN ELKER, Health Physicist, US Army Communications-Electronics Command (CECOM), Fort Monmouth, New Jersey

a. Education:

(1) Rutgers University, New Brunswick, New Jersey
Presently completing program of graduate study in Radiation Science. Course work has included: Bioinorganic Chemistry; Radiation Physics; Special Topics in Radiologic Health; Laboratory Methods of Radiation Detection; Radiation Chemistry; Radiation Biophysics; Electronics and Instrumentation; Advanced Special Problems; Radiation Dosimetry.

(2) J.F.K. School of Nuclear Medicine, Edison, New Jersey
Certificate in Nuclear Medicine Technology, 1976. ARRT, NM-1976, NMTCB-1978. Award: Mallinckrodt Academic Achievement Award.

(3) Monmouth College, West Long Branch, New Jersey
BS Degree in Biology, January 1976. Minor - Medical Technology

(4) Susquehanna University, Selinsgrove, PA
Biology program 1971-1973.

b. Professional Experience:

(1) July 1981 - present

Health Physicist, US Army Communications-Electronics Command, Fort Monmouth, NJ.
Responsible for health physics functions in the establishment and implementation of the CECOM Safety Program aimed at establishing life cycle controls of CECOM commodities utilizing radioactive material and ionizing radiation producing devices; responsible for the evaluation of radiological protection programs and radiation facilities to determine their adequacy and to insure compliance with DA Authorizations and NRC Licenses; perform studies and evaluations necessary to minimize the health risks to personnel; prepare and review applications for DA Authorizations and NRC Licenses; establish and maintain radiation protection records and files.

(2) July 1980 - July 1981

Supervisor, Radioactive Material Section, Radiation Physicist, Department of Environmental Protection (DEP), Bureau of Radiation Protection (BRP) Trenton, NJ.
Responsible for supervision and coordination of the radioactive material (RAM) program. Authorized to approve or reject licenses or amendments for possession and use of RAM after assessment of user qualification, radiation safety program, and compliance with State rules and regulations. Reorganized

program format and developed inspection procedures, forms and criteria. Evaluated and provided recommendations for quality assurance of radio-pharmaceuticals and instruments at facilities. Assigns and trains inspectors for RAM facility program review. Issued letters of non-compliance or compliance resulting from inspection. Performed inspections and violation investigations. Registered NRC licensable materials. Registered accelerators and reviewed radiation safety surveys. Authorized to approve or reject applications for certificates of handling in the transportation of any RAM above 20 curies. State Radiological Assessment Officer on call for nuclear generating station emergency response, and assists in emergency planning. Member of emergency response team with authority to make immediate decisions relative to public health and safety regarding control of radiation. Maintained Bureau's RAM storage area and records of accountability, radiation safety surveys, and compliance with NRC license requirements. Responsible for monthly report and statistic preparation involving RAM users, inspections, violations, NRC registrations, and accelerators. Responded to all inquiries involving RAM or non-ionizing radiations. Developed fee schedule format, and maintained records. Proposed regulations for NJ Administrative Code adoption.

(3) February 1980 - July 1980

Radiation Physicist, DEP, BRP, Trenton, NJ.

Enforced State rules and regulations governing medical and industrial or research radiation producing units. Responsible for compliance testing and evaluation, report preparation, and performance of radiation safety surveys. Authorized to impound non-compliant units preventing usage establishing public and/or occupational safety. Conducted special projects evaluating radiation hazards and development of procedures for control and reduction of unnecessary radiation. Investigated violations and incidents post notification of radiation hazard with authority to establish improved radiation safety requirements. Participated as member of radiation emergency response team.

(4) January 1979 - January 1980

Nuclear Medicine Technologist, St. Peter's Medical Center, New Brunswick, NJ.

Performed diagnostic imaging and evaluation for improved medical diagnosis. Performed quality control and calibration of instrumentation and computer. Responsible for patient orientation to procedures, radiopharmaceutical preparation, dose calculation and assay for intravenous or other approved aseptic method of dose administration. Performed radiation monitoring for safety and regulation compliance evaluation. Responsible for proper radioactive waste disposal compliant with all regulatory agencies and safety standards. Performed sophisticated computer analysis for diagnostic studies. Performed in vivo diagnostic evaluations. Responsible for on call emergency routines.

(5) May 1976 - January 1979

Nuclear Medicine Technologist, Jersey Shore Medical Center, Neptune, New Jersey

Same as above, including ultrasound and Doppler technologies for diagnostic procedures. Radioimmunoassay for in vitro procedures. Responsible for monitoring and maintaining records for therapeutic sealed source storage area.

c. Additional Formal Training in Radiation Protection Methods, Measurements, Effects:

(1) Internal Dosimetry for Fixed Nuclear Facilities-Special Training Division, Oak Ridge Associated Universities, Oak Ridge, TN, September 1981. One week formal course.

(2) Emergency Response for Nuclear Incidents - Sponsored by the Federal Emergency Management Agency at the DOE Nevada Test Site, Las Vegas, Nevada, November 1980. Two week formal course.

(3) Emergency Response - Sponsored by the NJ Bureau of Emergency Response at the NJ Bureau of Radiation Protection, Trenton, NJ, 1980. One week formal course.

(4) Quality Control in Radiographic Procedures and Processing - E.I. duPont Nemours Training Center, 1980. One week formal course.

(5) Quality Control in Nuclear Medicine - Bureau of Radiological Health program, sponsored by the NJ State Society of Nuclear Medicine at Middlesex General Hospital, New Brunswick, NJ, 1979. Twelve hours formal training.

d. Experience with Radioactive Materials:

(see attached list)

| | Isotope | Maximum Amount | Duration of Experience | Type of Use |
|---|---|---|---|---|
| 1. | $^{99}Mo/^{99m}Tc$ | 1.0-3.0 Ci | 5 Years | |
| 2. | $^{131}I$ | 10 mCi | 5 Years | For items 1 through 16, radiopharmaceutical preparation, dose injection, and/or related diagnostic procedures, health physics surveys, wipe test analysis, and instrument calibration. |
| 3. | $^{75}Se$ | 5 mCi | 5 Years | |
| 4. | $^{67}Ga$ | 50 mCi | 5 Years | |
| 5. | $^{201}Tl$ | 30 mCi | 5 Years | |
| 6. | $^{32}P$ | 20 mCi | 5 Years | |
| 7. | $^{133}Xe$ | 100 mCi | 5 Years | |
| 8. | $^{81}Rb/^{81m}Kr$ | 25 mCi | 2 Years | |
| 9. | $^{125}I$ Sealed Source RIA | 50 mCi | 5 Years | |
| 10. | $^{123}I$ | 10 mCi | 5 Years | |
| 11. | $^{137}Cs$ | 500 mCi | 5 Years | |
| 12. | $^{226}Ra$ | 500 mg | 5 Years | |
| 13. | $^{192}Ir$ | 80 Ci | 6 months | |
| 14. | $^{60}Co$ | 100 Ci | 1 month | |
| 15. | $^{57}Co$ | 30 mCi | 5 Years | |
| 16. | $^{133}Ba$ | 10 mCi | 5 Years | |
| 17. | PuBe | | 1 month | |

SUPPLEMENT E

1. Reference: Paragraph 4 of letter/application.

2. The Army program for control of radioactive items of supply is prescribed specifically in two regulations. AR 700-64, Radioactive Commodities in the DOD Supply Systems, is an interservice regulation which prescribes responsibilities for control of radioactive items and components which are introduced in the supply system. AR 385-11, Ionizing Radiation Protection, establishes requirements for obtaining NRC licenses for radioactive materials and authorizations to possess radioactive material not controlled by NRC, and requirements for individually controlled items of supply, the transportation of radioactive materials and the disposal of unwanted radioactive material. Major Army commands are implementing these Department of the Army (DA) regulations.

3. The authority contained in NRC licenses and DA authorizations issued to CECOM permits DOD installations and activities to acquire and use certain radioactive calibration and test items without obtaining their own license or authorization for these items (a DA authorization is required for radioactive material not controlled under an NRC specific license). This is based upon commitments made by CECOM that all Army elements will comply with conditions contained in those licenses and authorizations and with pertinent Federal, DOD and Army regulations. Both NRC and DA require control of all operations involving radioactive items to insure the safety of personnel and property. Army activities possessing licensed radioactive sources and the agencies controlling them are subject to inspection by the NRC in addition to inspection by Army elements.

4. The mission of CECOM includes the management and performance of all material life cycle functions and services and acts as DA licensee for Army-wide distribution of these items. The following is a description of functions of the various CECOM elements providing a coordinated effort:

a. The functions for the manager of the NRC License/DA Authorization are assigned to the Chief, Safety Office of the Command Staff of this headquarters. The responsibilities of the manager are to:

(1) Coordinate, obtain, administer, review, amend and maintain necessary licenses/authorizations for radioactive commodities managed by this command.

(2) Provide information and guidance to all commanders, with respect to limitations, constraints, conditions or procedures which affect the responsibilities of those commanders for the radioactive commodity.

(3) Monitor the various elements of the life cycle program of the radioactive commodities to assure compliance with conditions of the applicable license/ authorization.

(4) Assure that licensed/authorized material is not transferred to unauthorized persons or organizations.

b. The health physicists serve as the CECOM staff contact for radiation

control and license/authorization matters to the Army Materiel Development and Readiness Command, other major commands and DA elements, other services and federal agencies; provide advice and assistance to other CECOM elements involved in the fielding of radioactive items, the National Inventory Control Point (NICP) (an element of CECOM), depots and other Army elements; prepare applications for NRC Licenses/DA Authorizations for Army-wide distribution of assigned items; prepare radiation safety instructions for incorporation in technical literature and other published guidance pertaining to the items; coordinate with the NICP to assure that requisitioning elements are authorized to and technically capable of receiving the item and the procurements do not exceed the quantity or use limitations imposed by the various licenses; perform pre-award and post award health physics surveys of contractors; provide health physics advice to be included in instructions for disposal of radioactive waste, and serve as staff officers for notification, investigation, and preparation of reports required in the event of an accident or incident in which this command's radioactive items may be involved.

c. The CECOM NICP located at Fort Monmouth, New Jersey in conjunction with the CECOM Safety Office has adopted special procedures for individually controlled radioactive items that are in addition to standard Army Supply practices used for all type classified items through maintenance of a computerized data retrieval system that contains information such as the radioactive commodity type number, set serial number, location, responsible RPO, alternate RPO, where applicable, their qualifications, and all leak test results. In addition, the control point maintains records of procurements, receipts, storage locations, shipments, using locations, authorizes, issues, and assures adequate supply. It reviews requisitions submitted and when approved, issues material release orders to the designated depot for shipment of the material to the requisitioner. Requisitions are submitted through various command control channels. The control point bases its approval on previously established authorization of the requisitioner to receive the item from the supply standpoint such as an approved Table of Allowances. Upon approval of the requisition, the control point issues a material release order to the depot storing the item. The depot ships the item directly to the requisitioner, notifies the control point and furnishes other shipping data which is forwarded also through supply property office channels.

d. The major Army commands have established regulatory requirements for control of the radioactive items. Each major command has established at the headquarters level a radioactive material control point and appointed a command radiation control officer to administer control of radioactive items within the commands. That officer reviews and concurs in the qualifications of local RPO within the command, maintains records of radioactive items by location and assures periodic inventory and leak tests by using activities, performs periodic inspections/audits of accountable installations/activities to assure that items are properly handled in accordance with Army and NRC regulations, and to assure the submission of inventory and leak test reports and accident/incident reports to the appropriate commodity command as required by Army regulations. The local RPO is responsible for administering the local radiation protection program. Local programs provide for designated controlled areas, dosimetry, instrumentation, operating procedures to supplement published manuals for the items, receipts, transfers, storage and records. Requisitions originated by using elements are processed through the local RPO to the major command radiation control officer.

The requisition is reviewed from the radiation protection standpoint and logistics authority for possession. If approved, the requisition is forwarded to the NICP. Upon receipt of notification from the NICP of the transaction the information is forwarded to the local radiation protection officer who assumes radiation protection responsibility for the item. Requests for transfers of items between installations/activities are reviewed by the command radiation control officer and if approved reported to the NICP. Transfers outside the major commands are reviewed and approved by the NICP following coordination with CECOM health physicists. Reports of excess items are submitted through command channels to the NICP for review of serviceability, turn-in, or disposal as radioactive waste. The NICP, in conjunction with assistance and directives provided by health physicists at the CECOM Safety Office, determines disposition of the excess items.

e. LBDA will provide bulk storage, maintenance, where required, leak test analyses, recalibrations, quality surveillance and issue of the AN/UDM-6 Radiac Calibrator Set. No maintenance will be performed on the radioactive material/ radiation source itself. Cosmetic maintenance may be performed on the calibrator casing. Where radioactive materials are involved, LBDA has established warehousing facilities and handling procedures governed by a formal radiation protection program. The program is administered by a qualified physicist (RPO) from the US Army Ionizing Radiation Dosimetry Center (AIRDC) of the US Army TMDE Support Group located at LBDA through a Memorandum of Understanding (MOU) between the two organizations. Mr. Joseph M. King, Chief, AIRDC has been designated to serve in this capacity. As with non-radioactive items, items are inspected when received, at intervals during storage and immediately before shipment. All AN/UDM-6 Radiac Calibrator Sets are tested for leakage of radioactive material prior to shipment to users. Item inspections are conducted according to established surveillance procedures as determined by CECOM. The quality surveillance program for the AN/UDM-6 Radiac Calibrator Set will be performed by either the LBDA-AIRDC RPO, his alternates or the CECOM Health Physicists and will involve the annual leak testing of a random sampling of at least one percent of depot assets and/or a minimum of five each of the AN/UDM-6 Radiac Calibrator, whichever is greater. LBDA-AIRDC will provide the results to Commander, USACECOM, ATTN: DRSEL-SF-H, Fort Monmouth, New Jersey 07703. Appropriate action will be taken if results indicate a trend toward leakage. LBDA will provide the NICP with notification of individually controlled item receipts, inspections and shipments. NRC licenses issued to LBDA-AIRDC, NRC Byproduct Material License 16-05033-01, NRC Source Material License SUB-417, and NRC Special Nuclear Material License SNM-623, describe the qualifications of the LBDA-AIRDC RPO, his alternates and the LBDA-AIRDC Radiation Protection Program.

f. The program for control of the AN/UDM-6 Radiac Calibrator Set, as with other radioactive items is, to the extent practical, the same logistics procedures applied to other Army supplies. Regulatory guidance has been established by DA and implemented by the various commands governing the management process, life-cycle management of material, logistics management and support, procurement, maintenance, storage, transportation, including packaging and disposal. For radioactive items the procedures are augmented by specific regulatory controls pertaining to the possession and use of radioactive materials, control of personnel radiation exposure, safe storage, handling, maintenance, transportation and disposal of the items. For the AN/UDM-6 Radiac Calibrator Set, morestringent controls have been

established as distribution of these devices are limited to authorized calibration activities as outlined in Supplements B and C. These controls include identifying and insuring that the AN/UDM-6 Radiac Calibrator Set is coded in the Commodity Command Standard System Automated Data Processing Program as radioactive in accordance with Appendix A of AR 708-1, Cataloging and Supply Management Data. This calibrator set is coded with a Special Control Item Code (SCIC) of "A" meaning Regulated and containing a radioactive item. Requisitions are processed initially by computers and due to the radioactive SCIC designation, are then processed manually by the NICP item manager to verify that the requisitioners are authorized to receive the calibrator set. To insure that the above requirements are being implemented, the CECOM Health Physicists maintain close coordination with the item manager. Recalibration and recertification of the AN/UDM-6 Radiac Calibrator Set will be performed by AIRDC, the US Army TMDE Support Activity Pacific (ATMDESAP), Camp Carroll, Korea; Nucleonics Branch, US Army Area TMDE Calibration and Repair Center - Pirmasens, Germany (ACRC-P); and the Nucleonics Laboratory Branch, US Army Calibration and Repair Center - Sacramento (ACRC-S), Sacramento Army Depot, Sacramento, California. In addition to AIRDC, health physics laboratory counting equipment capable of measuring 0.001 microcuries are also available from ATMDESAP, ACRC-P and ACRC-S for evaluation of the three month leak test smears of the calibrator set. Leak test results are forwarded through Army channels to Commander, USACECOM, ATTN: DRSEL-SF-H, Fort Monmouth, New Jersey 07703 for inclusion into the computerized data retrieval system as specified in paragraph b above. The Health Physicists of the CECOM Safety Office will review wipe test analysis for trends toward leakage of the source sets as contained within the AN/UDM-6 Radiac Calibrator Set to determine timely replacement prior to source(s) becoming hazardous.

g. Users of the AN/UDM-6 Radiac Calibrator Set are provided with specific instructions on the operation, safe handling, control and maintenance as described in Technical Manual 11-6665-248-10 (Inclosure 1). This information satisfies the radiation protection instructions to users as required by Title 10, Chapter 1, Code of Federal Regulations, Parts 19 and 20. In addition, Form NRC-3, Notice to Employees, is provided with the technical manual. Commander, USACECOM, ATTN: DRSEL-SF-H, Fort Monmouth, New Jersey 07703 will make available to the users the appropriate NRC regulations, the NRC license, license conditions, documents incorporated into the license by reference, and amendments thereto, and any notice of violation involving radiological working conditions for examination.

5. In evaluating possible radiological hazard resultant from utilization of the AN/UDM-6 Radiac Calibrator Set, an Environmental Assessment (EA) was prepared based on conservative assumptions which lead to the conclusion that external exposure rate would not exceed 1.41E-12 gray/hour (1.41E-10 rad/hour) at an operating distance of one foot. Hypothetical internal dose evaluations resulting from ingestion or inhalation following source damage, improper disposal, installation fire and a transport accident identify committed dose equivalents below recommendations stated in the International Commission on

Radiological Protection Publications 26 and 30. Complete analyses for external and internal doses are presented within the EA for radiological considerations.. Exposure levels presented confirm that the utilization of the AN/UDM-6 Radiac Calibrator Set poses insignificant to non-existent radiological consideration and excludes consideration of environmental quality degradation. The EA is included as Annex I.

NOTE

Inclosed is an abbreviated organizational chart as required by paragraph 3-2.g.(3) of AR 700-64, Radioactive Commodities in the DOD Supply Systems.

## RADIATION SAFETY CONTROLS-FUNCTIONAL CHART

ARMY MATERIEL DEVELOPMENT
AND READINESS COMMAND
QUALITY ASSURANCE PROGRAM MANAGEMENT
RADIATION PROTECTION PROGRAM MANAGEMENT

ARMY TEST MEASUREMENT DIAGNOSTIC EQUIPMENT SUPPORT GROUP
TECHNICAL GUIDANCE, ARMY METROLOGY SYSTEM
STANDARDIZATION OF CALIBRATION STANDARDS & PROCEDURES

ARMY COMMUNICATIONS - ELECTRONICS
COMMAND
COMMODITY MANAGEMENT, CALIBRATION SOURCES

**OTHER INSPECTION AGENCIES**

DEPARTMENT OF THE ARMY, OFFICE OF THE INSPECTOR GENERAL AND SUBORDINATE COMMAND COUNTERPARTS

US ARMY AUDIT AGENCY

US ARMY HEALTH SERVICES COMMAND, ENVIRONMENTAL HYGIENE AGENCY

**DIRECTORATE OF MAINTENANCE**
MAINTENANCE PROCEDURES
LOGISTICS SUPPORT
TECHNICAL MANUALS

**SAFETY OFFICE**
**HEALTH PHYSICS**
RAD SAFETY PROCEDURES
LICENSING
CONTRACTOR SAFETY
PRE-AWARD, POST AWARD SURVEYS

**DIRECTORATE OF PROCUREMENT**
INVITATION FOR BIDS
REQUEST FOR QUOTATION
PROCUREMENT
PROCUREMENT AUTHORIZATION

**DIRECTORATE OF PRODUCT ASSURANCE**
QUALITY ASSURANCE PROCEDURES
PRE-PRODUCTION TESTS
INITIAL PRODUCTION TESTS
PRODUCTION ACCEPTANCE TESTS
DEPOT QA SURVEILLANCE PROCEDURES

DIRECTORATE OF MATERIEL MANAGEMENT
NATIONAL INVENTORY CONTROL POINT
CATALOGING
INVENTORY CONTROL
REQUISITION REVIEW
MATERIAL RELEASE ORDERS

**LEXINGTON-BLUEGRASS DEPOT ACTIVITY**
INITIAL RECEIPT AND INSPECTION
BULK STORAGE
CALIBRATION
ISSUE
REPAIR
RECALIBRATION
QA SURVEILLANCE
LEAK TEST EVALUATION

**SACRAMENTO ARMY DEPOT**
RECALIBRATION
LEAK TEST EVALUATION

**PIRMASENS, GERMANY**
RECALIBRATION
LEAK TEST EVALUATION

**CAMP CARROLL, KOREA**
RECALIBRATION
LEAK TEST EVALUATION

## MAJOR COMMAND RADIOACTIVE MATERIAL CONTROL POINTS

COMMAND RADIATION CONTROL PROGRAM MANAGEMENT
INVENTORY AND LEAK TEST PROCEDURES, RECORD, REPORTS
SURVEYS/INSPECTIONS OF USER ACTIVITES

## SUBORDINATE COMMAND RADIATION CONTROL PERSONNEL

IMPLEMENTATION OF COMMAND RADIATION CONTROL PROGRAM
SURVEYS/INSPECTIONS OF USER LOCATIONS

## USERS - AUTHORIZED CALIBRATION ACTIVITIES

### MOBILE TEAMS

CALIBRATE INSTRUMENTS
AT USER LOCATIONS

### DEPOTS

CALIBRATE INSTRUMENTS
RECEIVED FROM USERS
NOT VISITED BY
MOBILE TEAMS AND
INSTRUMENTS FOR OWN USE
EVALUATION OF USER LEAK
TESTS AS REQUESTED

### INSTALLATIONS

CALIBRATE INSTRUMENTS
FOR OWN USE

### TRAINING CENTER/SCHOOL

RAD SAFETY TRAINING OF ARMY
PERSONNEL

# DISPOSITION FORM

For use of this form, see AR 340-15, the pro, nt agency is TAGCEN.

| REFERENCE OR OFFICE SYMBOL | SUBJECT |
|---|---|
| DRSEL-SF | Requested Changes to Technical Manual (TM) 11-6665-248-10 (DRAFT), Operators Manual, Calibrator, Radiac, AN/UDM-6 (NSN 6665-00-767-7497) |

TO DRSEL-ME-PES FROM DRSEL-SF DATE 17 Feb 82 CMT 1

/gr/54427

1. Reference is made to DA Form 2028, DRSEL-SF-H, dated 17 Feb 82, SAB,(Incl 1).

2. Request changes listed in reference 1 be implemented in TM 11-6665-248-10 (DRAFT) as required for inclosure to this command's application for US Nuclear Regulatory Commission Special Nuclear Material License for the AN/UDM-6 Radiac Calibrator.

Steven A Horne

1 Incl
as

STEVEN A. HORNE
Chief, Readiness Division
Safety Office

DA FORM 1 FEB 62 2496. REPLACES DD FORM 96, WHICH IS OBSOLETE.

☆GPO—1975—665-422/1063

**RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS**

For use of this form, see AR 310-1; the proponent agency is the US Army Adjutant General Center.

Use Part II (reverse) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).

DATE: 17 Feb 82

TO: (Forward to proponent of publication or form) (Include ZIP Code)
Commander
Army Communications-Electronics Command
ATTN: DRSEL-ME-PES
Fort Monmouth, New Jersey 07703

FROM: (Activity and location) (Include ZIP Code)
Commander
US Army Communications-Electronics Command
ATTN: DRSEL-SF-H
Fort Monmouth, New Jersey 07703

**PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS**

| PUBLICATION/FORM NUMBER | DATE | TITLE |
|---|---|---|
| TM 11-6665-248-10 | DRAFT | Operator's Manual, Calibrator, Radiac,AN/UDM-6 (NSN 6665-00-767-7497). |

| ITEM NO. | PAGE NO. | PARAGRAPH | LINE NO.* | FIGURE NO. | TABLE NO. | RECOMMENDED CHANGES AND REASON (Exact wording of recommended change must be given) |
|---|---|---|---|---|---|---|
| 1 | Warning Page | 2 | 13 | | | Change: "... damage it in anyway" to "... damage it in any way." |
| 2 | 8 | 1-5a (2) | | | | Change: "... forwarding two copies of appointee's orders and qualifications to: Commander, US Army Communications-Electronics Command, ATTN: DRSEL-SF-H, Fort Monmouth, New Jersey 07703." to: "... forward two copies of appointee's orders and qualifications to: Commander US Army Communications-Electronics Command ATTN: DRSEL-SF-H Fort Monmouth, NJ 07703." |
| 3 | 8 | 1-5a (3) | 2 | | | Change: "... forwarding two copies of procedures to: Commander, US Army Communications-Electronics Command, ATTN: DRSEL-SF-H, Fort Monmouth, New Jersey 07703." to: "... forward two copies of procedures to: Commander US Army Communications-Electronics Command ATTN: DRSEL-SF-H Fort Monmouth, NJ 07703." |
| 4 | 11 | 1-7e | 1 | | | Change: "Submit Radiation Incident Report according to published directives." to: "Submit Radiation Incident Reports according to published directives." |

*Reference to line numbers within the paragraph or subparagraph.



| TYPED NAME, GRADE OR TITLE | TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION | SIGNATURE |
|---|---|---|
| Y J. SILBER<br>ch Physicist | x54427 | Steven A Thorne |

DA FORM 1 FEB 74 2028 REPLACES DA FORM 2028, 1 DEC 68, WHICH WILL BE USED.

**RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS**

For use of this form, see AR 310-1; the proponent agency is the US Army Adjutant General Center.

Use Part II *(reverse)* for Rep Parts and Special Tool Lists (RPSTL) Supply Catalogs/Supply Manuals (SC/SM).

DATE: 17 Feb 82

TO: *(Forward to proponent of publication or form) (Include ZIP Code)*

FROM: *(Activity and location) (Include ZIP Code)*

**PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS**

| PUBLICATION/FORM NUMBER | DATE | TITLE |
|---|---|---|
| TM 11-6665-248-10 | DRAFT | |

| ITEM NO. | PAGE NO. | PARA-GRAPH | LINE NO.* | FIGURE NO. | TABLE NO. | RECOMMENDED CHANGES AND REASON *(Exact wording of recommended change must be given)* |
|---|---|---|---|---|---|---|
| 5 | 11 | 1-7f | 1 | | | Change: "Establish radiation controlled areas for AN/UDM-6 ..." to: "Establish radiation control procedures for AN/UDM-6 ..." |
| 6 | 11 | 1-7g | 1 | | | Change: "Post Radiation Area warning signs." to: "Post "Radioactive Material" warning signs." |
| 7 | 11 | 1-7o | | | | Change: "... place all AN/UDM-6's under his jurisdiction in locked storage." to: "... place all AN/UDM-6's under his jurisdiction under control of newly appointed RPO approved by RMCP and HQ, CECOM, or in locked storage." |
| 8 | 15 | 1-11a | 6 | | | Change: "... the jigs not use." to: "... the jigs not in use." |
| 9 | 19 | 2-1a | 1 | | | Change: "Unpack the AN/UDM-6." to: "Perform required transportation surveys and wipe tests and unpack the AN/UDM-6." |
| 10 | 22 | 2-2e | 1 | | | Change: "... a calibrated radiac set 1/16 to 18 inch ..." to: "... a calibrated radiac set 1/16 to 1/8 inch ..." |
| 11 | 23 | 2-3a | 6 | | | Change: "... the Radiation Control Officer, (AR 385-11) to ... " to: "... the Radiation Control Officer (AR 385-11) to ... " |

*Reference to line numbers within the paragraph or subparagraph.



| TYPED NAME, GRADE OR TITLE | TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION | SIGNATURE |
|---|---|---|
| | | |

DA FORM 1 FEB 74 2028

REPLACES DA FORM 2028, 1 DEC 68, WHICH WILL BE USED.

**RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS**

For use of this form, see AR 310-1; the proponent agency is the US Army Adjutant General Center.

Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).

DATE: 17 Feb 82

TO: *(Forward to proponent of publication or form) (Include ZIP Code)*

FROM: *(Activity and location) (Include ZIP Code)*

**PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS**

| PUBLICATION/FORM NUMBER | DATE | TITLE |
|---|---|---|
| TM 11-6665-248-10 | DRAFT | |

| ITEM NO. | PAGE NO. | PARAGRAPH | LINE NO.* | FIGURE NO. | TABLE NO. | RECOMMENDED CHANGES AND REASON *(Exact wording of recommended change must be given)* |
|---|---|---|---|---|---|---|
| 12 | 23 | 2-3b | 1 | | | Change: "The US Army Ionizing Radiation Dosimetry Center located at Lexington-Blue Grass Depot Activity is the only ..." to: "The Lexington-Blue Grass Depot Activity (LBDA) is the only ..." |
| 13 | 23 | 2-3b | 6 | | | Change: "... Lexington-Blue Grass Depot Activity." to: "... LBDA." |
| 14 | 33 | 3-2a | 1 | | | Change "Operator maintenance is limited to ..." to: "Operator is limited to ..." |
| 15 | 33 | 3-2b | 2 | | | Change: "... National Inventory Control Point and the US Army Ionizing Radiation Dosimetry Center." to: "... National Inventory Control Point and LBDA." |
| 16 | 33 | 3-2a | 1 | | | Change: "No other maintenance or repair ..." to: "No maintenance or repair ..." |
| 17 | 34 | A-Z | 10 | | | Add after line 10: "Preventive Maintenance Schedule and Record ... ... DD Form 314" |

*Reference to line numbers within the paragraph or subparagraph.



| TYPED NAME, GRADE OR TITLE | TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION | SIGNATURE |
|---|---|---|
| | | |

DA FORM 1 FEB 74 2028 REPLACES DA FORM 2028, 1 DEC 68, WHICH WILL BE USED.

TM 11-6665-248-10

# OPERATOR'S MANUAL

# CALIBRATOR, RADIAC, AN/UDM-6

(NSN 6665-00-767-7497)

# WARNING

## RADIATION HAZARD

Use Radiac Calibrator AN/UDM-6 only under the guidance of an installation/ activity (local) Radiation Protection Officer and in accordance with requirements of Chapter 5, Section IV, AR 40-5 and AR 385-11.

Plutonium 239 (Pu239) is dangerous to living tissue. Small amounts of Pu239, when inhaled, ingested, or absorbed in open cuts or wounds, can cause serious illness or death. To avoid accident, observe the following:

- Use and store the calibrator only in designated radiation controlled areas.
- Do not eat, drink, smoke, apply cosmetics, or store food stuffs, drinks, tobacco, or cosmetics where the calibrators are used or stored.
- Do not allow personnel with open skin wounds to handle or work with the calibrators without the approval of the medical officer and the (local) Radiation Protection Officer (RPO).
- Prohibit loitering in the area by unauthorized personnel.
- Handle the calibrator carefully. Do not drop, rough handle, alter or damage it in anyway. Mishandling can cause source leakage.
- Do not touch the source surface with your hands. Wear plastic or surgical type protective gloves which allow sufficient dexterity during calibration and leak testing. Avoid contact of objects, such as tools, instruments, and components of the set, with the sou

- Always wash and dry your hands thoroughly after handling the calibrator; check your hands with a low-range alpha radiac meter; repeat the washing and drying if necessary. Notify the Radiation Protection Officer if washing does not remove contamination.
- DO NOT ATTEMPT TO CLEAN THE SOURCE OR SOURCE HOLDERS.

Technical Manual )

)

No. 11-6665-248-10)

HEADQUARTERS

DEPARTMENT OF THE ARMY

Washington, DC, March 1982

# OPERATOR'S MANUAL

# CALIBRATOR, RADIAC, AN/UDM-6

(NSN 6665-00-767-7497)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, US Army Communications-Electronics Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, New Jersey 07703. A reply will be furnished to you.

## TABLE OF CONTENTS

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# CHAPTER 1
# INTRODUCTION

## Section I. GENERAL INFORMATION

### 1-1. Scope

This manual describes Calibrator, Radiac AN/UDM-6 and covers its installation and operation. It includes instructions for initial service, operation, cleaning, and inspection of the equipment. The calibrator, radiac provides a calibration check for the AN/PDR-54 and AN/PDR-60 Alpha Radiac Sets (radiac sets). The calibrators contain plutonium which is controlled by the US Nuclear Regulatory Commission (NRC), Title 10 Code of Federal Regulations. AR 385-11 and AR 700-64 implement NRC regulations. Army-wide possession and use of the calibrators are authorized by a Special Nuclear Materials License issued to Department of the Army, US Army Communications-Electronics Command, Fort Monmouth, NJ 07703. The license is issued on the basis of statements concerning procedures established for the life-cycle control of the items. The sets are issued to authorized Army calibration activities, schools, and research and development laboratories through the US Army Communications-Electronics Command National Inventory Control Point (DRSEL-MME-VC). Established Army supply procedures are augmented by radiological control procedures (AR 385-11).

### 1-2. Maintenance Forms and Records

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by TM 38-750, The Army Maintenance Management System (TAMMS).

### 1-3. Reporting Equipment Improvement Recommendations (EIR)

If your AN/UDM-6 needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, US Army Communications-Electronics Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, NJ 07703. We'll send you a reply.

## Section II. US NUCLEAR REGULATORY COMMISSION REQUIREMENTS

### 1-4. General

The NRC sets standards/conditions and issues licenses for the use of radioactive materials in the United States. The AN/UDM-6 comes under the NRC regulations and a license for its use has been issued. Information required by the NRC license and regulations is contained below:

a. Radiation Protection. Users of the AN/UDM-6 should refer to instructions on control, safe handling, storage, emergency situations and operation and maintenance instructions contained in this technical manual. This satisfies the radiation protection requirements of the NRC regulations (Title 10, Code of Federal Regulations, Parts 19 and 20).

b. Notice to Employees. Form NRC-3, Notice to Employees, contained in the back of this manual, must be removed for posting wherever the AN/UDM-6 is used and/or stored. The posting requirements are contained on the form.

c. **NRC License.** The NRC license for the AN/UDM-6 and documents relating to that license are held by the US Army Communications-Electronics Command Safety Office at Fort Monmouth, New Jersey. AN/UDM-6 users may request further information on these documents by letter addressed to:

Commander
US Army Communications-Electronics Command
ATTN: DRSEL-SF-H
Fort Monmouth, NJ 07703

Requests for further information may also be made by phone by calling on AUTOVON 995-4427 or COMMERCIAL (201) 544-4427.

1-5. Responsibility

a. **Responsibilities of Major Commands.**
(1) Establish at least one Radioactive Material Control Point (RMCP) (AR 385-11).
(2) Appoint a Radiation Control Officer (RCO) for each RMCP and

forwarding two copies of appointee's orders and qualifications to: Commander, US Army Communications-Electronics Command, ATTN: DRSEL-SF-H, Fort Monmouth, New Jersey 07703.

(3) Develop implementation procedures to insure periodic leak testing (para 1-7j) and forwarding two copies of procedures to: Commander, US Army Communications-Electronics Command, ATTN: DRSEL-SF-H, Fort Monmouth, New Jersey 07703.

(4) Forward leak test smears to nearest approved smear counting station for evaluation (para 2-2b).

(5) Insure that each installation or activity using the AN/UDM-6 has an effective radiation protection program.

b. Responsibilities of Radiation Control Officer.

(1) Review and approve the qualifications of each local Radiation Protection Officer (RPO) for the AN/UDM-6 and forward to Commander, US Army Communications-Electronics Command, ATTN: DRSEL-SF-H, Fort Monmouth, New Jersey 07703 a list of these local RPO's and their qualifications for approval and certification.

(2) If a qualified local RPO is not available, take one or more of the following actions:

(a) Suspend requisition for the AN/UDM-6.

(b) Suspend use of the AN/UDM-6 until someone can be qualified by training.

(c) Transfer the AN/UDM-6 to an installation or activity with qualified personnel.

(3) Maintain the following records for each AN/UDM-6 under his control:

(a) National stock number.

(b) Description.

(c) Serial number.

(d) Isotope, source activity, and date activity was determined.

(e) Dates and results of leak tests.

(f) Shipment number.

(g) Shipped from.

(h) Shipped to.

(i) Date shipped.

(j) Date of manufacture.

(k) Name of manufacturer.

(l) Name of qualifications of local RPO's.

(m) Radiation incident reports.

(4) Insure that the AN/UDM-6 is properly handled in accordance with Army, DOD, and NRC regulations. Periodically inspect and audit records of installations and activities possessing the AN/UDM-6.

(5) Assure that a Radiation Incident Report is submitted by electrical means to Commander, US Army Communications-Electronics Command, ATTN: DRSEL-SF-H, Fort Monmouth, New Jersey 07703, within 24 hours after an incident occurs.

(6) Consolidate and forward DA Form 3252-R (Radioisotope Inventory and Leak Test Report) (RCS DRC-192) listing all Calibrators, Radiac AN/UDM-6 in area of responsibility to Commander, US Army Communications-Electronics Command, ATTN: DRSEL-SF-H, Fort Monmouth, New Jersey 07703 at least quarterly (31 January, 30 April, 31 July and 31 October). Reports may include information on other CECOM managed calibration and test items of supply listed in AR 385-11.

1-6. Supervision

a. All calibrations in which the AN/UDM-6 is used will be supervised by a qualified RPO. To be a qualified RPO, a person must have received a minimum of 40 hours formal training on radiation, including the following topics:

(1) Principles and practices of radiation protection.
(2) Biological effects of radiation.
(3) Radioactivity measurement standardization and monitoring techniques and instruments.
(4) Mathematics and calculations basic to the use and measurement of radioactivity.
(5) The operation and use of the AN/UDM-6.

**NOTES**

1. Completion of the Radiological Safety Course at the US Army Chemical School or at the US Army Ordnance Center and School meets these requirements.
2. Where circumstances warrant, alternate training may be substituted if this training is approved by Commander, US Army Communications-Electronics Command, ATTN: DRSEL-SF-H, Fort Monmouth, NJ 07703. Such training must be received under the guidance of a qualified RPO, and must include at least 16 hours of actual experience in the use of the AN/UDM-6.

b. The person appointed as RPO may be a commissioned officer, a warrant officer, an enlisted man, or civilian, if he meets the minimum qualifications prescribed above. An RPO designated custodian for the AN/UDM-6 is a specified person designated to control the use of the AN/UDM-6.

c. The operator of the AN/UDM-6 shall have a minimum of 8 hours training, under the guidance of a qualified RPO, in the following:

(1) Fundamentals of radiation operations.

(2) Radiac instrumentation theory.

(3) Application and survey techniques.

(4) Safe working practices and inherent hazards associated with the AN/UDM-6.

(5) 16 hours on-the-job training in operation and care of the AN/UDM-6.

1-7. Duties of Radiation Protection Officer (RPO)

The specific duties of the appointed RPO will be to:

a. Insure that the AN/UDM-6's under his jurisdiction are properly used and stored.

b. Train local users and operators and maintain list and record of training of users and operators.

c. Insure records are maintained on each equipment.

d. Advise RMCP of any forthcoming change in accountability, local RPO, or installation relocation for the AN/UDM-6.

e. Submit Radiation Incident Report according to published directives.

f. Establish radiation controlled areas for AN/UDM-6 storage and use.
g. Post Radiation Area warning signs.
h. Insure items are stored in a fire-resistant structure and no explosives of any kind are stored in the same structure.
i. Immediately refer actual or suspected overexposure to medical officer.
j. Insure that periods of time between leak tests do not exceed 3 months and supervise performance of leak tests.
k. Secure items against unauthorized use and removal.
l. Insure that all Army, DOD, and Federal Regulations are being followed and that personnel are exposed to a minimum of radiation consistent with practical considerations.
m. Conduct a physical inventory according to published frequencies.
n. Submit inventory, leak test, and other reports to RMCP as required.
o. Prior to relief from duties, place all AN/UDM-6's under his jurisdiction in locked storage.

p. Investigate each case of excessive or abnormal exposure to determine the cause. Recommend remedial action to prevent recurrence. Submit a complete written report to the Commander, US Army Communications-Electronics Command, ATTN: DRSEL-SF-H, Fort Monmouth, NJ 07703 within 24 hours after the incident.

1-8. Requisitioning Procedure

Stations in CONUS and Oversea supply agencies will submit requisitions through radioactive material supply channels to Commander, US Army Communications-Electronics Command, ATTN: DRSEL-MME-VC, Fort Monmouth, New Jersey 07703, for issue to certified Radiation Protection Officers. All requisitions will be accompanied by the name of the Radiation Protection/Control Officer who is to be responsible for the equipment. In addition, each request will include the following certification: "As required by chapter 3, AR 385-11, sufficient safety equipment, facilities, and trained personnel are available at this installation for the safe handling, use and storage of radioactive material ordered on this requisition!"The certification must have the signature and the typed name and grade of the appropriate radiation control officer.

1-9. Emergency Situations

The procedure outlined below will be followed in an emergency situation.

a. Loss of AN/UDM-6.

(1) Attempt to recover the AN/UDM-6.

(a) Review records to determine the responsible individual.

(b) Make a physical survey.

(2) If the AN/UDM-6 is recovered, adjust custodial requirements as necessary to prevent a recurrence.

(3) If the AN/UDM-6 is not recovered, report the loss through command channels to the Area Radioactive Material Control Point (AR 385-11) and to the US Army Communications-Electronics Command stating the serial number of the AN/UDM-6, the circumstances involved, and the action taken to prevent recurrence.

b. Internal Exposure of Personnel.

(1) Internal exposure is the result of personnel becoming contaminated when radiactive particles are inhaled, swallowed, or absorbed through breaks in the skin.

(2) In the event of a known or suspected internal exposure:

(a) Obtain immediate medical advice from the Medical Officer.

(b) Remove the individual from duties involving occupational exposure to ionizing radiation until subsequent exposure limitations are established by proper medical authority (AR 40-14).

(c) Prepare written report of circumstances leading to the internal exposure; include serial number(s) of the AN/UDM-6 involved, action taken to prevent recurrence, and other applicable

information. Forward the report through proper channels to Commander, US Army Communications-Electronics Command, ATTN: DRSEL-SF-H, Fort Monmouth, NJ 07703.

c. Damage or Leaking AN/UDM-6. The AN/UDM-6 could begin to leak as a result of being dropped, damage to the source, or even as a result of age. Action required in the event of a known or suspected leaking AN/UDM-6 is:

(1) Discontinue use of the AN/UDM-6. Cover it with plastic, seal it with tape, and label it as contaminated.

(2) Check personnel, equipment, and areas for possible contamination and decontaminate as required.

(3) Report the item to the Radioactive Material Control Point and to the US Army Communications-Electronics Command.

(4) Dispose of the AN/UDM-6 as directed by the US Army Communications-Electronics Command, the US Army Ionizing Radiation Dosimetry Center and the Radioactive Material Control Point.

(5) Report the completed disposal action to the US Army Communications-Electronics Command, ATTN: DRSEL-SF-H, Fort Monmouth, New Jersey 07703 and the Radioactive Material Control Point.

d. Firefighting Emergency Procedures.

(1) General. Emergency plans must include procedures for combating fires involving radioactive items. Plans should be commensurate with the quantity and type of items present. Firefighting personnel must know the location(s) of the items and must be familiar with radiation protection procedures. As a general rule, personnel should wear protective respiratory equipment when fighting fires involving radioactive items.

(2) Emergency procedures.

(a) Evacuate personnel in the immediate area who are not directly involved.

(b) Notify the fire department.

(c) Extinguish the fire, if possible, and if radioactive materials are involved, with possible release to the environment, clear personnel from downwind area immediately.

(d) Notify the RPO.

(e) Notify medical personnel when appropriate.

(f) Control access to the immediate area.

(g) Check personnel, equipment, supplies, and environs with appropriate alpha radiation survey instrument.

(h) Decontaminate personnel, equipment, supplies, and environs.

(i) The RPO shall record and report the results of the fire.

## 1-10. TRANSPORTATION

The AN/UDM-6 requires packaging and shipment in accordance with the requirements set forth in Title 49, Code of Federal Regulations (49 CFR) of US Department of Transportation (DOT) regulations and AR 385-11. These regulations require all appropriate information on radioactive shipments to be incorporated onto shipping documentation as follows:

a. Proper shipping name (49 CFR 172.101): Radioactive Material, NOS.

b. Hazardous Material Identification Number (49 CFR 172.202): NA 9181.

c. Pieces, weight, cube (49 CFR 172.202): One wooden case, 14-3/4 inches x 10-5/8 inches x 1-3/16 inches, with cushioning pad containing four jigs, 9-3/8 inches x 3-3/16 inches x 11/16 inch, made of anodized aluminum. Four radioactive sources are 2 inches diameter stainless steel disks with a coating of Pu239 applied to one side.

d. Type of packaging (49 CFR 172.202): Wooden case.

e. Name of radioactive material as listed in 49 CFR 173.390 (49 CFR 172.203): Pu239.

f. Description of chemical and physical form (49 CFR 172.203): Plutonium 239, solid applied as coating.

g. Activity (49 CFR 172.203): 1.4 microcuries.

h. Type label (49 CFR 172.203): Shipment of individual item requires no label as per 49 CFR 173.391(a). Shipment of 8 or more items as one package requires RADIOACTIVE WHITE I (SF 413) labels.

**i. The words FISSILE EXEMPT shall appear on the shipping documentation as required by 49 CFR 173.396(a).**

**j. Shipper's certification (49 CFR 172.204): As applicable.**

**k. Shipments of Plutonium 239 must be made in accordance with the applicable provisions of DOT and NRC regulations. At the present time, all shipments of the AN/UDM-6 should only be made by surface transportation.**

**l. Any other information as required.**

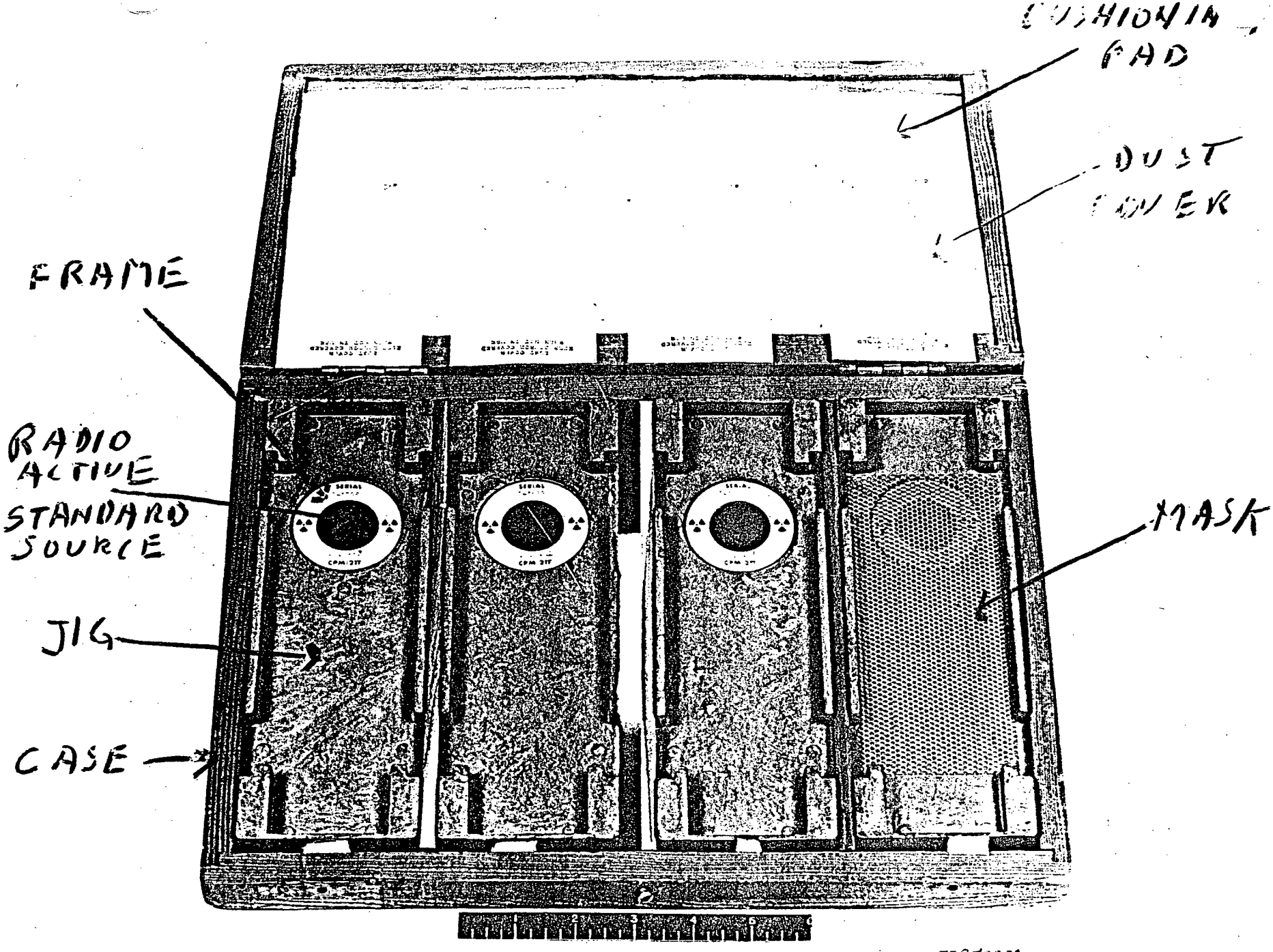



Figure 1-1. Radiac Calibrator AN/UDM-6, cover open.

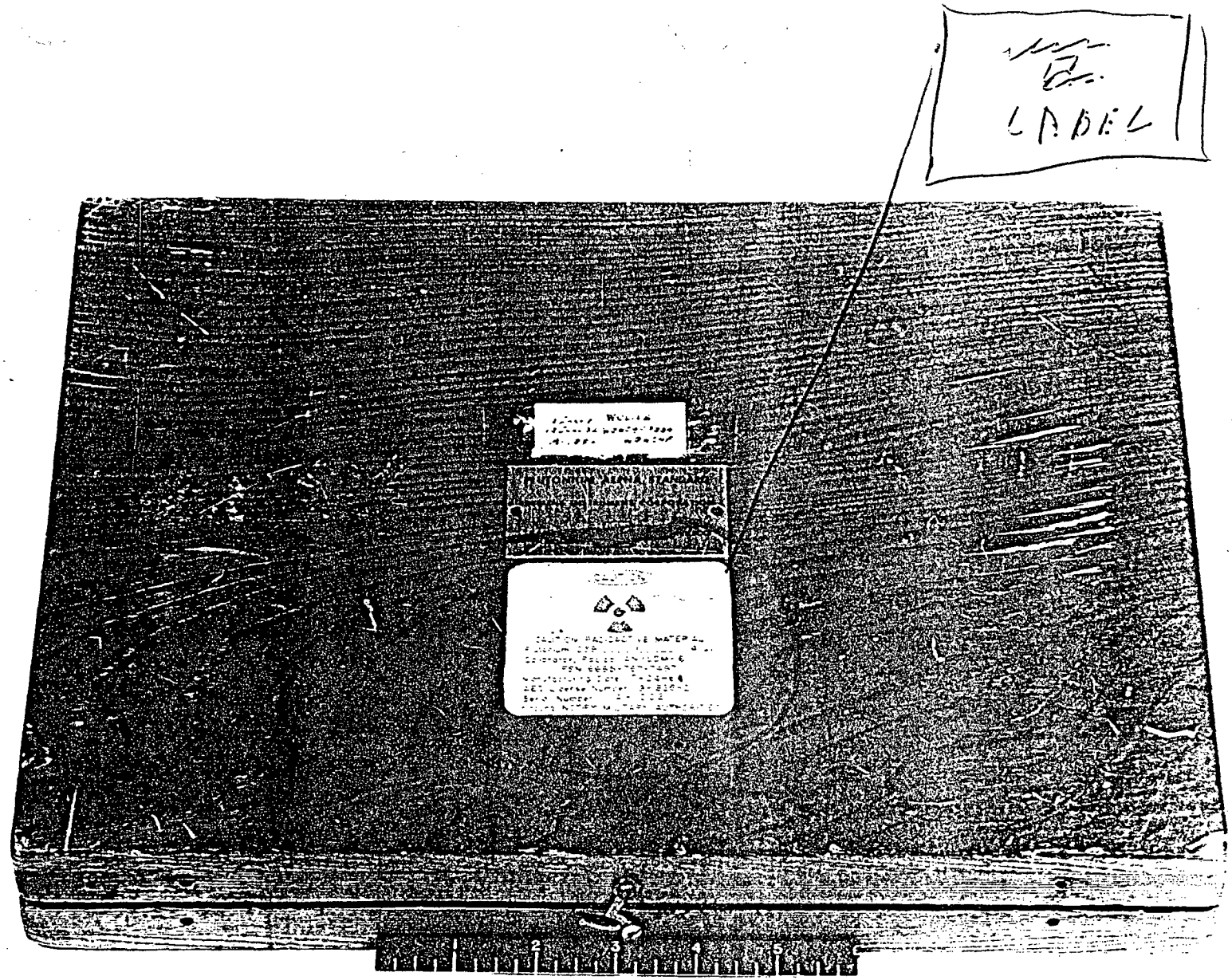
## Section III. DESCRIPTION AND DATA

1-11. Equipment Description.

(Fig. 1-1)

a. General. The Calibrator, Radiac AN/UDM-6 consists of a wooden case that contains four jigs, a perforated metal mask, a dust cover for each jig, and a cushioning pad. Each jig contains a Plutonium 239 (Pu239) radioactive standard source. The alpha particle counting rate is marked in the frame of the jig. The dust covers are used to cover the jigs not use. The cushioning pad fits over the jigs to hold them in place when the case is closed.

Figure 1-1. Radiac Calibrator, AN/UDM-6, cover open. EL850001




EL850002

Figure 1-2. Radiac Calibrator AN/UDM-6, cover closed.

Figure 1-2. Label. EL850002

b. Radioactive Standard Sources. The radioactive standard sources are 2-inch diameter stainless-steel disks. A coating of Pu239 (1-inch diameter) is applied to the surface of one side of each disk. A non-radioactive frame (1/2-inch wide) is around the radioactive surface. The frame is marked with the manufacturer's code number, two radiation symbols, and the alpha counting rate of the calibrated source. Each source is attached to a jig with screws.

c. Jigs. The jigs are made of anodized aluminum. The jigs are designed so that when the probe of the radiac being calibrated is placed upon the jig it is the proper distance above the standard source. The jigs are arranged from left to right in an ascending sequence according to the alpha counting rate of each source. The counting rates are approximately 1,400 ($1.4 \times 10^3$), 14,000 ($1.4 \times 10^4$), 140,000 ($1.4 \times 10^5$), and 1,400,000 ($1.4 \times 10^6$) counts per minute, respectively. The alpha counting rate marked on each source is accurate to within $\pm 4$ percent. (If the radioactive sources are accidentally touched, the counting rates of the sources may be altered sufficiently to warrant recalibration.)

d. Mask. The mask is a flat rectangular sheet of perforated stainless steel. It is designed to fit in any of the four jigs. The portion of the mask that lies flat directly over a radioactive standard source

cuts the alpha particle counting rate to 38 percent of the normal counting rate. By placing the mask between the source and the probe of an AN/PDR-54 or AN/PDR-60 Radiac Set, it is possible to calibrate a second point on each scale of the radiac sets.

e. Case. The case for the AN/UDM-6 is a wood box with a hinged cover. When the case is fully open, the cover lies flat. A label (fig. 1-2) is affixed to the top of the case.

1-12. TECHNICAL CHARACTERISTICS.

| | |
|---|---|
| Radioactive material | Plutonium 239 (Pu239) |
| Type of radiation | Alpha particle emission |
| Energy of alpha particles | 5.15 Mev. |
| Total quantity in calibrator | 1.4 microcuries (approx.) |
| Half life | 24,360 yr. |
| Number of jigs | 4 |
| Number of radioactive standard sources | 4 |
| Transmission factor of mask | 38 percent |
| Jig (approx.): | |
| Length | 9 3/8 in. (23.8 cm) |
| Width | 3 3/16 in. (8.1 cm) |
| Height | 11/16 in. (1.8 cm) |
| Case (approx.): | |
| Length | 14 3/16 in. (36.0 cm) |
| Width | 10 5/8 in. (27.0 cm) |
| Height | 13/16 in. (3.0 cm) |
| Serial numbers | A 1000 through A 1385 |

# CHAPTER 2

# OPERATING INSTRUCTIONS

## WARNING

1. Use the AN/UDM-6 only under the guidance of an installation/activity (local) Radiation Protection Officer and in accordance with requirements of Chapter 5, Section IV, AR 40-5 and AR 385-11.
2. Plutonium 239 (Pu239) is dangerous to living tissue. Small amounts of Pu239, when inhaled, ingested, or absorbed in open cuts or wounds, can cause serious illness or death. To avoid accident, observe the following:
   (a) Use and store the AN/UDM-6 only in designated radiation controlled areas.
   (b) Do not eat, drink, smoke, apply cosmetics, or store food stuffs, drinks, tobacco, or cosmetics where the AN/UDM-6 is used or stored.
   (c) Do not allow personnel with open skin wounds to handle or work with the AN/UDM-6 without the approval of the medical officer and the (local) Radiation Protection Officer.
   (d) Prohibit loitering in the area by unauthorized personnel.

2-1. Service Upon Receipt of Equipment

a. Unpack the AN/UDM-6.

b. Inspect the wood case to see that it is undamaged and that the label (fig. 1-2) is attached to the cover.

c. Put on protective gloves.

d. Open the case fully. Remove the cushioning pad and set it in the cover of the case. Check the mask to make sure that it is flat. If the mask is deformed (does not lie perfectly flat), it is unserviceable. A deformed mask will not provide the proper transmission factor, may come in direct contact with a radioactive source and damage it, or may become contaminated.

e. Check the markings on the standard sources and see that the jigs are properly arranged in the case.

f. Perform a leak test (wipe test) (para. 2-2) on all the sources to make certain that they are undamaged.

g. Replace the mask and the cushioning pad and close the case.

2-2. Initial Checks and Services

NOTE

A leak test must be performed immediately upon receipt of the AN/UDM-6 and at least every 3 months thereafter, while it is in use.

a. Perform the leak test as follows:

(1) Five 1-inch smear papers (Whatman filter papers or equivalent) are required. The smear papers are supplied in a kit which is periodically replaced. They are also commercially available.

(2) With a ballpoint pen or china marker number the smear papers consecutively. Key each smear paper to each item to be checked. For example, number the jigs from left to right 1 through 4. The number can be marked on the case with a china marker. Number the mask number 5. If necessary, this can be marked on the mask with a china marker without affecting its properties.

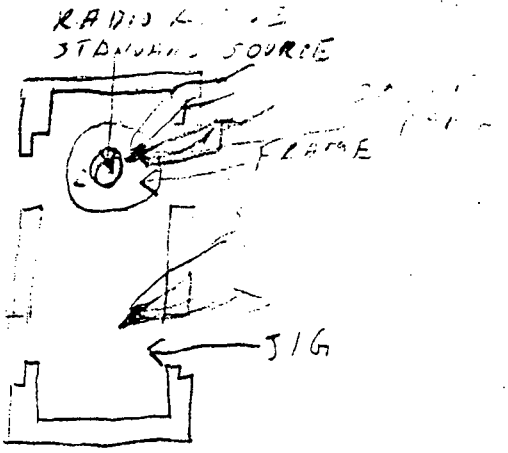
(3) Dampen the smear papers with water. Do not soak them.

(4) Put on protective gloves.

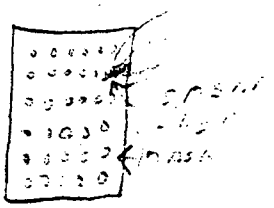
WARNING

Plutonium 239 is DANGEROUS. Handle the AN/UDM-6 carefully. DO NOT TOUCH THE RADIOACTIVE STANDARD SOURCE SURFACE. Avoid contact of objects, such as tools and instruments and calibrator components with the sources. Wear plastic or surgical protective gloves when performing leak tests and calibrations.

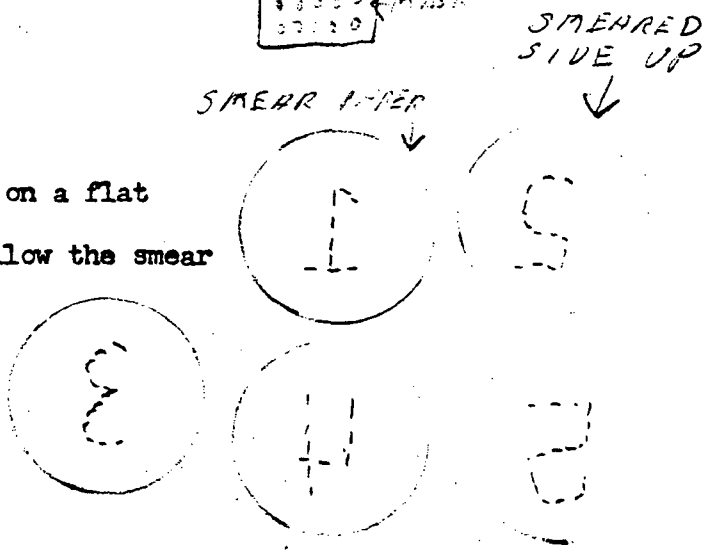
b. Open the case and wipe each radioactive standard source frame and jig with the same smear paper. DO NOT TOUCH THE RADIOACTIVE STANDARD SOURCE WITH THE SMEAR PAPER.



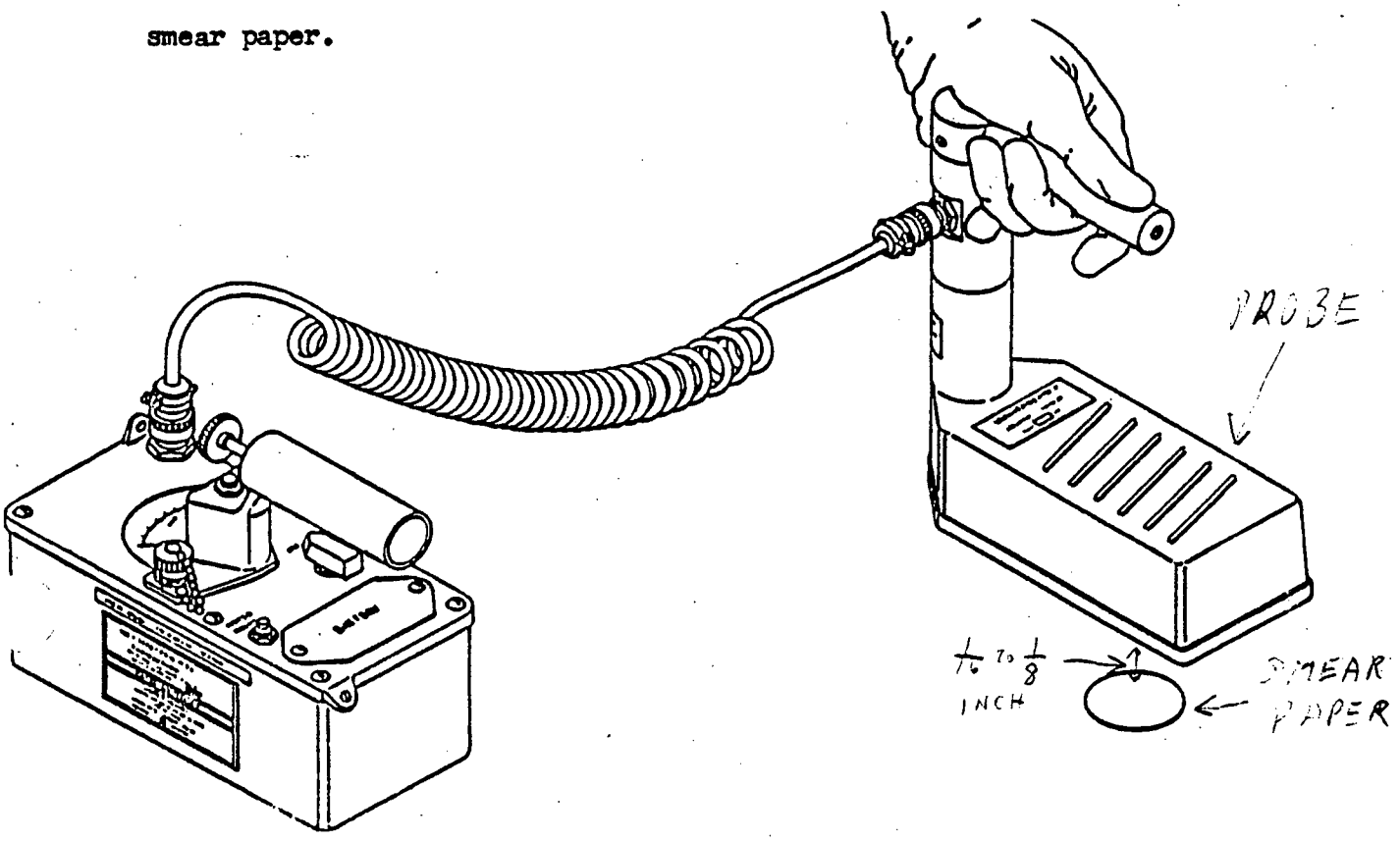

c. Wipe the mask with a smear paper.




d. Place the smear papers on a flat surface with smeared side up. Allow the smear papers to dry.



e. Position the probe of a calibrated radiac set 1/16 to 18 inch above each of the smear papers. Record the meter indication for each smear paper.




f. The radiacmeter indication should be 200 CPM or less above background.

g. If the radiacmeter indicates 200 or more counts-per-minute above background for any single smear paper, consider the AN/UDM-6 unserviceable and remove it from operation until the smear paper is evaluated with laboratory equipment (para. 2-3). If the meter indicates less than 200 counts-per-minute, use the AN/UDM-6 pending evaluation of the smear paper.

h. Replace all components in the case and close the case.

i. Remove protective gloves. Dispose as radioactive waste. (Refer to AR 385-11.)

2-3. Smear Paper Laboratory Evaluation

a. Evaluate each smear paper using laboratory equipment capable of detecting 0.001 microcurie of alpha contamination. Record test results and maintain these records for inspection. If the test reveals the presence of 0.005 microcurie or more of contamination, the user shall immediately withdraw the AN/UDM-6 from use and report the condition through the Radiation Control Officer, (AR 385-11) to the licensee who will furnish disposition instructions and submit required reports to DA and NRC.

b. No maintenance or repair will be performed by the operator. The US Army Ionizing Radiation Dosimetry Center located at Lexington-Bluegrass Depot Activity is the only authorized facility for maintenance or repair of the AN/UDM-6. Requests for maintenance or repair will be submitted to the radioactive material control point for coordination with CECOM and Lexington-Blue Grass Depot Activity.

c. If a using installation/activity does not have the proper laboratory equipment, the smear papers will be processed as follows:

(1) Place the smear papers, each separated by a sheet of paper, in a small envelope marked with the name and location of the user, the serial number(s) of the radioactive test sample(s) and the words: · MAILROOM - DO NOT OPEN. Seal the envelope for forwarding.

(2) In CONUS, forward the smear papers for evaluation using official mail handling channel to: Chief, US Army Ionizing Radiation Dosimetry Center, ATTN: DRSMI-MCI-DC, Lexington, KY 40511.

(3) Commanders at overseas installations will comply with procedures established by the responsible commander.

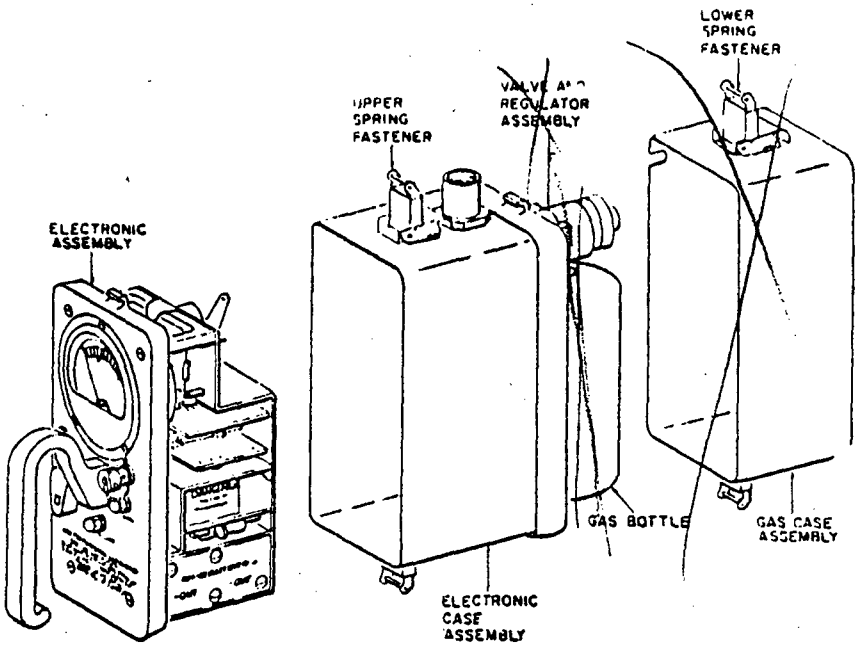



Fig. 2-1. Electronic assembly removed from electronic case assembly.

EL850 [illegible]

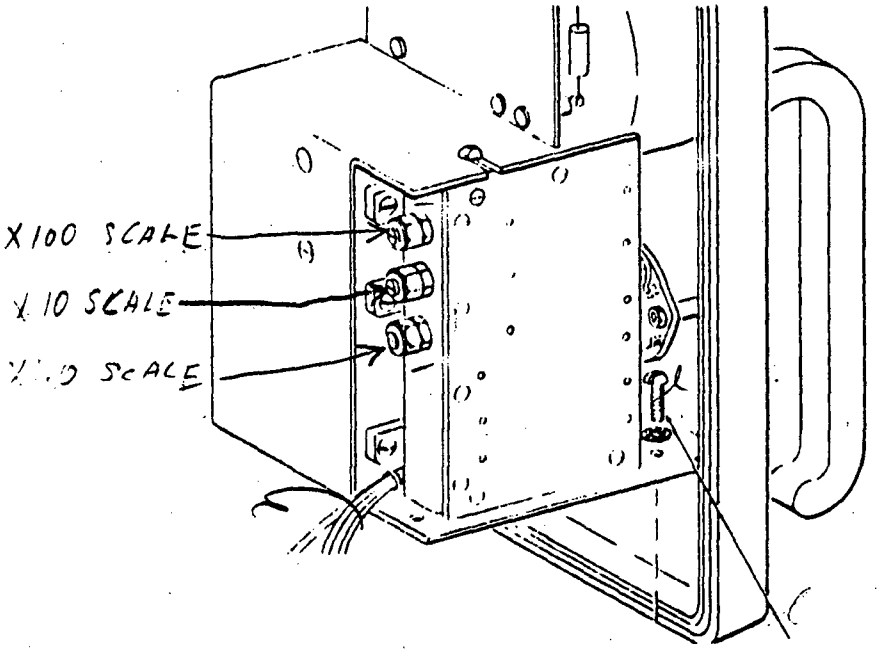



Fig. 2-2. Calibration controls.

EL850 004

2-4. Calibration Procedures

This paragraph provides procedures for calibrating Radiac Sets AN/PDR-54 and AN/PDR-60.

WARNING

Always wash and dry your hands after handling the AN/UDM-6. Check your hands with a low-range alpha radiacmeter; repeat the washing and drying if necessary. Notify the Radiation Protection Officer if washing does not remove contamination.

a. Radiac Set AN/PDR-54.

WARNING

Radiation hazard exists during the following procedure.

(1) Remove the electronic chassis from the case by releasing the spring catches (fig. 2-1).

(2) Connect the radiacmeter for bench test.

(3) Put on protective gloves and open the AN/UDM-6 case.

(4) Place the mask over the $1.4X10^3$ CPM (Counts Per Minute) standard source.

(5) Place the radiacmeter probe on the mask and set the radiacmeter scale switch to the X1 position. Set the gas flow control. Allow 2-minute warm up time.

(6) Observe and note the meter indication.

(7) Remove the radiacmeter probe from the mask.

(8) Rotate the probe 180 degrees and place it on the mask.

(9) Observe and note the meter indication.

(10) Obtain the average of the indications noted in (6) and (9) above. (This is accomplished by adding the two indications and dividing by two.)

(11) If the averaged indication is higher than 543 CPM, turn calibration control X1.0 SCALE (fig. 2-2) slightly counterclockwise. Repeat steps (5) through (10) and adjust control X1.0 SCALE as necessary to obtain an indication of approximately 532 CPM.

(12) If the averaged indication is lower than 521 CPM, turn calibration control X1.0 SCALE slightly clockwise. Repeat steps (5) through (10) and adjust calibration control X1.0 SCALE as necessary to obtain an indication of approximately 532 CPM.

(13) Repeat steps (5) through (12) above to calibrate the remaining scales of the radiacmeter. The chart below gives the control settings, required meter indication ranges, averaged meter indications, and the standard source to be used.

| Standard Source | Scale Switch Setting | Meter Indication Range (CPM) | Calibration Control | Averaged Indication (CPM) |
|---|---|---|---|---|
| $1.4X10^4$ | X10 | 5,214 to 5,426 | X10 SCALE | 5,320 |
| $1.4X10^5$ | X100 | 52,136 to 54,264 | X100 SCALE | 53,200 |

(14) Set the scale switch to OFF.

(15) Set the gas flow control to OFF.

(16) Replace the probe face cover.

(17) Replace the electronic chassis into the case.

(18) Secure the AN/UDM-6.

(19) Remove protective gloves and dispose of as radioactive waste (refer to AR 385-11).

(20) Wash and dry your hands.

(21) Check your hands with a low-range alpha radiacmeter; repeat the washing and drying if necessary. NOTIFY THE RADIATION PROTECTION OFFICER IF WASHING DOES NOT REMOVE CONTAMINATION.

b. Radiac Set AN/PDR-60.

WARNING

Radiation hazard exists during the following procedure.

Do not touch high voltage terminal until the circuit has been discharged.

(1) Release the 2 spring loaded latches (fig. 2-3) and remove the electronic chassis and battery pack from the electronic case assembly.

(2) Discharge the high voltage circuit to ground (fig. 2-4).

(3) Connect the center conductor of a shielded jumper lead to the center post of connector CJ-2 (fig.2-3) in the case assembly.

(4) Connect the other end of the shielded jumper lead center conductor to the high voltage test and signal injection point on the electronic chassis (fig. 2-4).

(5) Connect the jumper lead shield to the ground lead contacts in the case assembly and the electronic chassis.

(6) Connect the AC-3 detector to the electronic chassis.

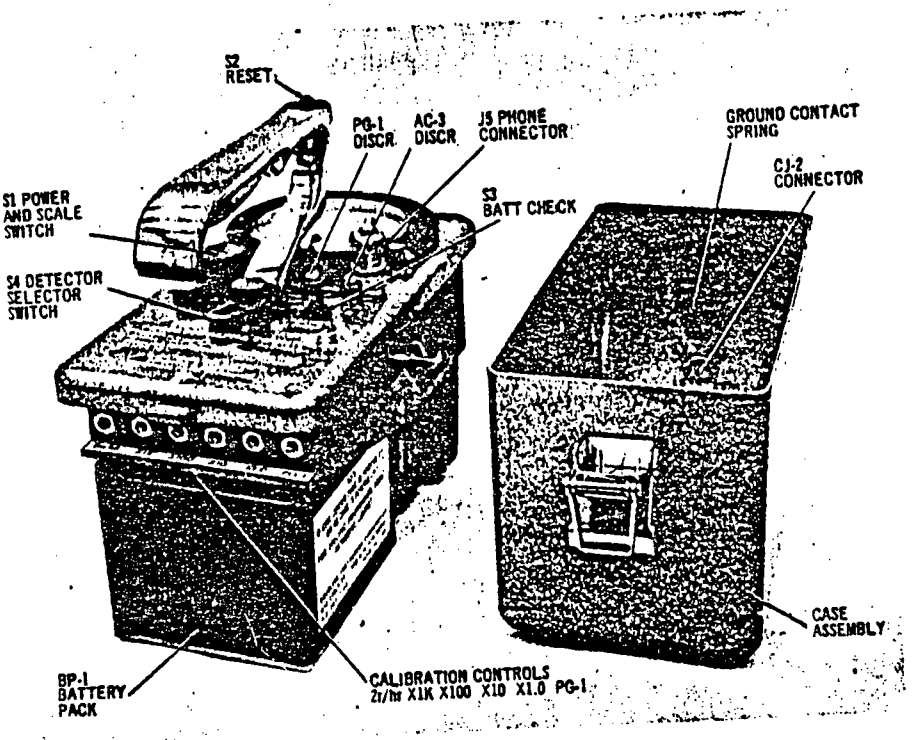



Fig 2-3. AN/PDR-60, calibration controls EL850005

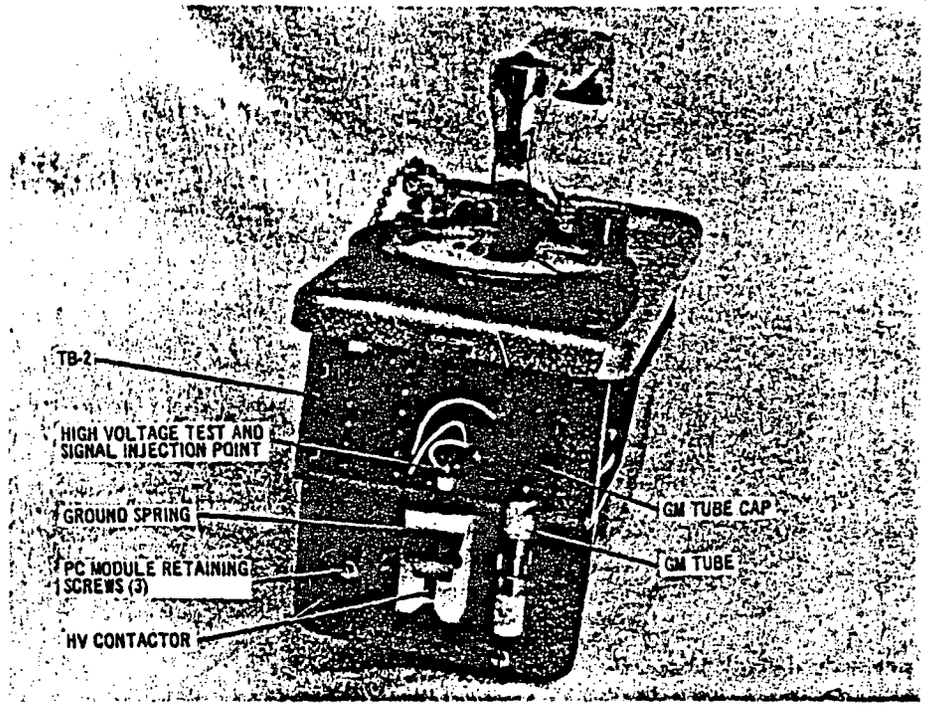



Fig. 2-4. AN/PDR-60, electronic chassis. ELFS0006

(7) Set the detector selector switch to the AC-3 position.

(8) Set the scale switch to the X1.0 position.

(9) Check battery condition.

(10) With the detector face protective cover in place, adjust the AC-3 DISCR control until the radiacmeter indicates approximately 50 CPM average.

(11) Lock the DISCR control.

NOTE

Occasionally the average meter indication will be less than 50 CPM. If this occurs, lock the DISCR control in the fully counterclockwise position.

(12) Put on protective gloves and open the AN/UDM-6 case.

(13) Remove the detector face protective cover.

(14) Place the detector on the $1.4X10^3$ CPM standard source.

(15) Observe and note the meter indication.

(16) Rotate the detector 180 degrees and place it on the $1.4X10^3$ CPM standard source.

(17) Observe and note the meter indication.

(18) Obtain the average of the meter indications noted in (15) and (17) above. (This is accomplished by adding the two indications and dividing by two.) The average indication should be within $\pm$10% of the standard source CPM.

(19) If the average CPM is not as indicated in (18) above, adjust X1.0 calibration control (fig. 2-4) on the electronic chassis.

(20) Repeat steps (14) through (19) if the calibration control has to be adjusted.

(21) Repeat steps (14) through (19) for the other scales of the radiacmeter, adjusting the calibration control for the scale being used, if required.

(22) Recheck the DISCR adjustment (10) above. If the DISCR control requires adjustment, the calibration procedure must be repeated.

(23) Set the scale switch to OFF.

(24) Discharge the high voltage circuit to ground.

(25) Disconnect the AC-3 detector.

(26) Remove the shielded jumper lead.

(27) Replace the electronic chassis into the electronic case assembly.

(28) Secure the AN/UDM-6.

(29) Remove protective gloves and dispose of as radioactive waste (refer to AR 385-11).

(30) Wash and dry your hands.

(31) Check your hands with a low-range alpha radiacmeter; repeat the washing and drying if necessary. NOTIFY THE RADIATION PROTECTION OFFICER IF WASHING DOES NOT REMOVE CONTAMINATION.

# CHAPTER 3
# MAINTENANCE INSTRUCTIONS

## 3-1. Troubleshooting Procedures

Table 3-1 lists the common malfunctions which you may find during the operation or maintenance of the AN/UDM-6 or its components. You should perform the tests/inspections and corrective actions in the order listed.

This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify your supervisor.

**Table 3-1. Troubleshooting**

| MALFUNCTION | TEST OR INSPECTION | CORRECTIVE ACTION |
|---|---|---|
| 1. SOURCE DAMAGE. | | |
| | Step 1. | Use a similar type radiac calibrator and obtain a set of readings. |
| | Step 2. | Compare the two sets of readings with readings obtained from damaged calibrator before damage occurred. |
| | | If readings are still erroneous, contact : Commander, US Army Communications-Electronics Command, ATTN: DRSEL-SF-H, Fort Monmouth, New Jersey; or call AUTOVON 995-4427, for further instructions. |
| 2. CALIBRATION MALFUNCTION. | | |
| | Step 1. | Verify that the radiac set is intended to be calibrated with the AN/UDM-6. |
| | Step 2. | Verify that the correct accessories (i.e., source and attenuator) are being used for the radiac set being calibrated. |
| | | If a malfunction still exists, return the radiac set to the using activity with instructions to return the radiac set to the appropriate maintenance facility (depot) for the required maintenance or repair. |

3-2. Operator Maintenance

a. Operator maintenance is limited to inspection and initial checks and services. No other maintenance or repair will be performed by the operator. The US Army Ionizing Radiation Dosimetry Center is the only authorized facility for maintenance or repair.

b. Requests for maintenance or repair will be submitted to the radioactive material control point for coordination with the CECOM National Inventory Control Point and the US Army Ionizing Radiation Dosimetry Center. Points of contact are:

CECOM National Inventory Control Point (NICP)
Commander, US Army Communications-Electronics Command
ATTN: DRSEL-MME-VC
Fort Monmouth, New Jersey 07703

CECOM National Maintenance Point (NMP)
Commander, US Army Communications-Electronics Command
ATTN: DRSEL-ME-ES
Fort Monmouth, New Jersey 07703

3-3. Storage

a. Store the AN/UDM-6 only in fire-resistant buildings (TM 5-812-1) and in rooms/areas/sections designated for storage of radioactive materials which are free from the danger of flooding, outside the danger of radius of flammables or explosives, and secured against unauthorized removal.

b. Post the area/building with CAUTION - RADIOACTIVE MATERIAL signs as required by AR 385-30.

3-4. Disposition

Reports of excess, unwanted or unserviceable AN/UDM-6's are submitted to the CECOM NICP for review for serviceability, turn-in or disposal as radioactive waste. Requests for disposition instructions are submitted through radiation control command channels to this NICP. The NICP will provide instructions for shipment of the AN/UDM-6 to the appropriate depot.

# APPENDIX A
# REFERENCES

## A-1. General

This appendix lists all forms, technical manuals, and miscellaneous publications referenced in this manual and/or to be utilized in relation to this equipment.

## A-2. Forms

| | |
|---|---|
| Equipment Inspection and Maintenance Worksheet | DA Form 2404 |
| Recommended Changes to Publications | DA Form 2028 |
| Recommended Changes to Equipment Technical Publications | DA Form 2028-2 |
| Punched Transmission Worksheet-Radioisotope Inventory and Leak Test Report | DA Form 3252-R |
| Notice to Employees | NRC-3 |
| Radiological Accident Report | RCSDD-SD 1168 |
| Quality Deficiency Report | SF 368 |
| Radioactive I | SF 413 |
| Report of Item Discrepancy | SF 364 |

## A-3. Technical Manuals

| | |
|---|---|
| Handling and Disposal of Unwanted Radioactive Material | TM 3-261 |
| Fire Protection Manual | TM 5-812-1 |
| List of Applicable Publications (LOAP) for Communications Electronic Equipment | TM 11-5800-213-L |
| Operator's, Organizational, Direct Support, General Support, and Depot Maintenance Manual: Radiac Set AN/PDR-54 (NSN 6665-00-542-1587) | TM 11-6665-208-15 |
| Operator's, Organizational, Direct Support, General Support, and Depot Maintenance Manual: Radiac Set AN/PDR-60 (NSN 6665-00-965-1516) | TM 11-6665-221-15 |
| Operator's and Organizational Maintenance Manual for Radiac Set AN/PDR-56F (NSN 6665-00-211-6895) | TM 11-6665-245-12 |
| The Army Maintenance Management System (TAMMS) | TM 38-750 |
| Transportation Guidance for Safe Transport of Radioactive Materials | TM 55-315 |

## A-4. Miscellaneous Publications

| | |
|---|---|
| Health and Environment | AR 40-5 |
| Control and Recording Procedure for Occupational Exposure to Ionizing Radiation | AR 40-14 |
| Reporting of Transportation Discrepancies in Shipment | AR 55-38 |
| Ionizing Radiation Protection (Receiving, Control, Transportation, Disposal, and Radiation Safety) | AR 385-11 |
| Safety Color Code Markings and Signs | AR 385-30 |
| Accident Reporting and Records | AR 385-40 |
| Packaging Improvement Report | AR 700-58 |
| Radioactive Commodities in the DOD Supply System | AR 700-64 |
| Reporting of Item and Packaging Discrepancies | AR 735-11-2 |

# APPENDIX B
# EXPENDABLE SUPPLIES AND MATERIALS LIST

## Section I. INTRODUCTION

B-1 Scope

This appendix lists expendable supplies and materials you will need to operate and maintain the AN/UDM-6. These items are authorized to you by CTA 50-970, Expendable Items (Except Medical, Class V, Repair Parts, and Heraldic Items).

B-2 Explanation of Columns

**a. Column 1 - Item Number.** This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., "Use plastic gloves, item 1, App. D").

**b. Column 2 - Level.** This column identifies the lowest level of maintenance that requires the item.

C — Operator/Crew

**c. Column 3 - National Stock Number.** This is the National stock number assigned to the item; use it to request or requisition the item.

**d. Column 4 - Description.** Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the part number followed by the Federal Supply Code for Manufacturer (FSCM) in parentheses, if applicable.

**e. Column 5 - Unit of Measure (U/M).** Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

## Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST

| (1) ITEM NUMBER | (2) LEVEL | (3) NATIONAL STOCK NUMBER | (4) DESCRIPTION PART NO. AND FSCM | (5) U/M |
|---|---|---|---|---|
| 1 | C | 8415-00-682-6786 | GLOVES, DISPOSAL PIMKIES (96717) | Pr |
| 2 | C | 8540-00-291-0391 | TOWEL, PAPER UU-7-591 (81348) | Bx |

Form NRC-3
(1-80)
10 CFR 19
10 CFR 20

UNITED STATES NUCLEAR REGULATORY COMMISSION
Washington, D.C. 20555

# NOTICE TO EMPLOYEES

## STANDARDS FOR PROTECTION AGAINST RADIATION (PART 20); NOTICES, INSTRUCTIONS AND REPORTS TO WORKERS; INSPECTIONS (PART 19)

In Part 20 of its Rules and Regulations, the Nuclear Regulatory Commission has established standards for your protection against radiation hazards from radioactive material under license issued by the Nuclear Regulatory Commission. In Part 19 of its Rules and Regulations, the Nuclear Regulatory Commission has established certain provisions for the options of workers engaged in NRC-licensed activities.

### YOUR EMPLOYER'S RESPONSIBILITY

Your employer is required to—

1. Apply these NRC regulations and the conditions of his NRC license to all work under the license.
2. Post or otherwise make available to you a copy of the NRC regulations, licenses, and operating procedures which apply to work you are engaged in, and explain their provisions to you.
3. Post Notices of Violation involving radiological working conditions, proposed imposition of civil penalties and orders.

### YOUR RESPONSIBILITY AS A WORKER

You should familiarize yourself with those provisions of the NRC regulations, and the operating procedures which apply to the work you are engaged in. You should observe their provisions for your own protection and protection of your co-workers.

### WHAT IS COVERED BY THESE NRC REGULATIONS

1. Limits on exposure to radiation and radioactive material in restricted and unrestricted areas;
2. Measures to be taken after accidental exposure;
3. Personnel monitoring, surveys and equipment;
4. Caution signs, labels, and safety interlock equipment;
5. Exposure records and reports;
6. Options for workers regarding NRC inspections; and
7. Related matters.

### REPORTS ON YOUR RADIATION EXPOSURE HISTORY

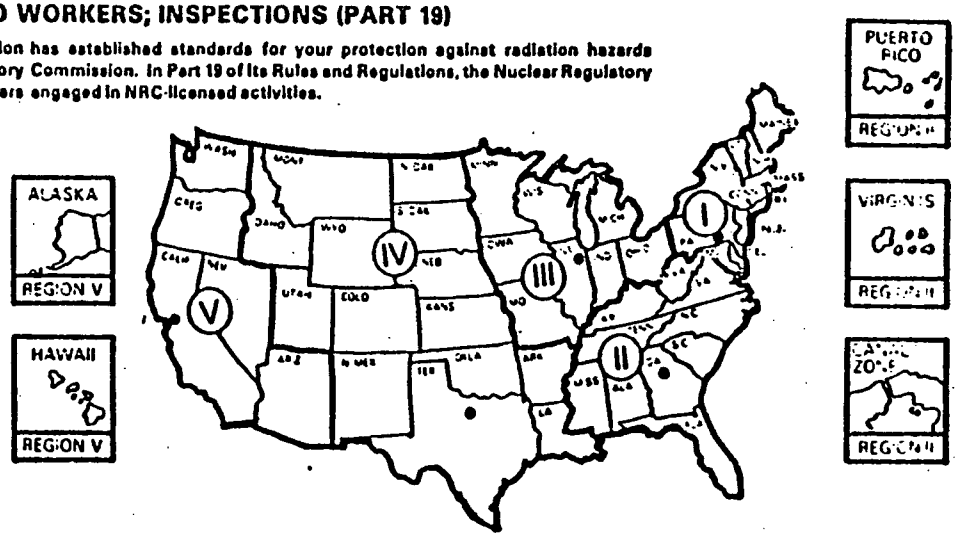
1. The NRC regulations require that your employer give you a written report if you receive an exposure in excess of any applicable limit as set forth in the regulations or in the license. The basic limits for exposure to employees are set forth in Sections 20.101, 20.103, and 20.104 of the Part 20 regulations. These Sections specify limits on exposure to radiation and exposure to concentrations of radioactive material in air.
2. If you work where personnel monitoring is required pursuant to Section 20.202;
   (a) your employer must give you a written report of your radiation exposures upon the termination of your employment, if you request it, and
   (b) your employer must advise you annually of your exposure to radiation, if you request it.

### INSPECTIONS

All activities under the license are subject to inspection by representatives of the NRC. In addition, any worker or representative of workers who believes that there is a violation of the Atomic Energy Act of 1954, the regulations issued thereunder, or the terms of the employer's license with regard to radiological working conditions in which the worker is engaged, may request an inspection by sending a notice of the alleged violation to the appropriate United States Nuclear Regulatory Commission Inspection and Enforcement Regional Office (shown on map at right). The request must set forth the specific grounds for the notice, and must be signed by the worker or the representative of the workers. During inspections, NRC inspectors may confer privately with workers, and any worker may bring to the attention of the inspectors any past or present condition which he believes contributed to or caused any violation as described above.

### POSTING REQUIREMENTS

Copies of this notice must be posted in a sufficient number of places in every establishment where activities licensed by the NRC are conducted, to permit employees working in or frequenting any portion of a restricted area to observe a copy on the way to or from their place of employment.




### UNITED STATES NUCLEAR REGULATORY COMMISSION

A representative of the Nuclear Regulatory Commission can be contacted at the following addresses and telephone numbers. The Regional Office will accept collect telephone calls from employees who wish to register complaints or concerns about radiological working conditions or other matters regarding compliance with Commission rules and regulations.

Regional Offices

| REGION | ADDRESS | TELEPHONE | |
|---|---|---|---|
| | | DAYTIME | NIGHTS AND HOLIDAYS |
| I | Region I, Office of Inspection and Enforcement, USNRC<br>631 Park Avenue<br>King of Prussia, Pennsylvania 19406 | 215 337-5000 | 215 337-5000 |
| II | Region II, Office of Inspection and Enforcement, USNRC<br>101 Marietta St., N.W., Suite 3100<br>Atlanta, Georgia 30303 | 404 221-4503 | 404 221-4503 |
| III | Region III, Office of Inspection and Enforcement, USNRC<br>799 Roosevelt Road<br>Glen Ellyn, Illinois 60137 | 312 932-2500 | 312 932-2500 |
| IV | Region IV, Office of Inspection and Enforcement, USNRC<br>611 Ryan Plaza Drive, Suite 1000<br>Arlington, Texas 76012 | 817 334-2841 | 817 334-2841 |
| V | Region V, Office of Inspection and Enforcement, USNRC<br>1990 N. California Boulevard, Suite 202, Walnut Creek Plaza<br>Walnut Creek, California 94596 | 415 943-3700 | 415 943-3700 |

SUPPLEMENT F

1. Reference: Paragraph 4 of letter/application.

2. Facilities for use and storage of the AN/UDM-6 Radiac Calibrator Set will be designated radiation controlled areas for those purposes as approved by the local RPO.

3. Sets used by the mobile calibration teams (AN/GSM-286/287 Calibration Set/ Secondary Transfer Standards) will be used and stored in specially designed vans, access to which is limited to team members. The sets will be stored in locked cabinets within the vans. At other locations the sets will be used and stored in controlled areas and secured against unauthorized removal. Areas/buildings will be posted with "Caution-Radioactive Materials" signs.

4. LBDA-AIRDC Storage, maintenance and serviceability installation.

a. Construction: (1) The maintenance and serviceability installation is concrete block and steel with steel and concrete roof. The calibration and storage rooms are constructed of 36 inches of poured concrete with door containing ¼ inch of lead shielding.

(2) The storage installation (warehouse) is cinder block and brick construction with asphalt covered wooden roof.

b. Fire Protection: The entire installation is protected by fire sprinkler system which is tied to LBDA's self supporting fire department. The fire department has a maximum response time of 2 to 3 minutes to its furthest building.

c. Security: The security of the installation is such that all buildings are locked when not inhabited and the perimeters of LBDA are secured by chain-linked fence with roving patrols and sentries at the gate.

5. Calibration activities authorized to receive the AN/UDM-6 Radiac Calibrator Set are required to possess measuring/surveying instruments for which the calibrator is used. They are the AN/PDR-54 and AN/PDR-60 standard Army alpha detection instruments (radiac sets) or commercial equivalent instrumentation such as the Eberline Instrument Corporation PAC series portable alpha survey instruments. Calibration activities may also be authorized the AN/PDR-56F standard Army alpha detection instrument in addition to the AN/PDR-54 or AN/PDR-60. In addition, these activities are authorized, as a minimum, the AN/PDR-27( ) standard Army beta-gamma detection instrument for beta-gamma radiation detection. The sensitivity range of the AN/PDR-54 Radiac Set is zero to 1.0E5 counts per minute (cpm) in three decade scales, the AN/PDR-56F Radiac Set is zero to 1.0E6 cpm in four decade scales, and the AN/PDR-60 Radiac Set is zero to 2.0E6 cpm in four decade scales. The sensitivity range for the AN/PDR-27( ) Radiac Set is zero to 500 mR/hr in four decade scales.

6. The AN/PDR-54, AN/PDR-56F and AN/PDR-60 standard Army alpha detection instruments and the AN/PDR-27( ) standard Army beta-gamma detection instrument used for health and safety purposes are calibrated in accordance with the frequency specified in Technical Bulletin 43-180, Calibration Requirements for the Maintenance of Army Materiel, and procedures prescribed in the technical manuals issued with

the instruments. Presently, the calibration frequency specified is once every 90 days. Calibration standards used for the AN/PDR-54 and AN/PDR-60 are the AN/UDM-6 ($^{239}$Plutonium) and AN/UDM-7C Radiac Calibrator Sets. The calibration standard used for the AN/PDR-56F is the AN/UDM-7C Radiac Calibrator Set. Calibration standards used for the AN/PDR-27( ) are the AN/UDM-1 ($^{60}$Cobalt), AN/UDM-1a ($^{137}$Cesium) or equivalent. All calibration standards are certified by, or traceable to, the National Bureau of Standards.

7. Health physics instrumentation is immediately available to all personnel for operations involving ionizing radiation. The radiation detection/measurement instrumentation, method of calibration, frequency and standards utilized by LBDA-AIRDC are contained in NRC Byproduct Material License 16-05033-01, NRC Source Material License SUB-417 and NRC Special Nuclear Material License SNM-623 issued to LBDA-AIRDC.

8. Bioassays available from the Surgeon General are provided when needed.

SUPPLEMENT G

1. Reference: Paragrpah 4 of letter/application.

2. Title 10, Code of Federal Regulations, AR 385-11 and AR 700-64 are followed for disposal of radioactive waste. Presently, as indicated in paragraph 4d of Supplement E, initial request for disposition is submitted to Headquarters, CECOM for review. After determination has been made for final disposition as radioactive waste, CECOM notifies the user to dispose of the radioactive material in accordance with AR 385-11. Headquarters, ARRCOM has been delegated the responsibility of management coordination for radioactive waste disposal. The procedure for the disposal of transuranic elements, including $^{239}$Plutonium, is to provide a request for disposition through Headquarters, ARRCOM to Headquarters, US Department of Energy (DOE), Washington, DC. Subsequently, DOE provides disposition instructions, including compliance requirements to US Department of Transportation regulations, for shipment to DOE installations for ultimate disposal as radioactive waste.

DEPARTMENT OF THE ARMY
HEADQUARTERS US ARMY COMMUNICATIONS-ELECTRONICS COMMAND
AND FORT MONMOUTH
FORT MONMOUTH, NEW JERSEY 07703

REPLY TO
ATTENTION OF:

DRSEL-SF-H

25 FEB 1982

SUBJECT: Environment Assessment and Finding of No Significant Impact for the AN/UDM-6 Radiac Calibrator Set

Commander
US Army Materiel Development and Readiness Command
ATTN: DRCSF-P
5001 Eisenhower Avenue
Alexandria, VA 22333

1. Reference is made to the following:

a. Letter, DRCIS-A, 11 August 1980, subject: National Environment Policy Act (NEPA) Compliance for Proposals Involving Nuclear Licensing.

b. Army Regulation 200-2, entitled Environmental Quality; Environmental Effects of Army Actions dated September 1981.

2. In accordance with references 1a and 1b, the subject environmental documents are provided for your review and evaluation.

FOR THE COMMANDER:

Bern Savaiko

1 Incl
as

BERNARD M. SAVAIKO
Chief, Safety Office

DEPARTMENT OF THE ARMY

US ARMY COMMUNICATIONS-ELECTRONICS COMMAND

# ENVIRONMENTAL ASSESSMENT

AND

# FINDING OF NO SIGNIFICANT IMPACT

AN/UDM-6 RADIAC CALIBRATOR SET

FORT MONMOUTH, NEW JERSEY

JANUARY, 1982

PREPARED BY:

Steven A Horne

STEVEN A. HORNE
Chief, Readiness Division
Safety Office

APPROVED BY:

Bern Savaiko

BERNARD M. SAVAIKO
Chief, Safety Office
Commander Designee

TABLE OF CONTENTS

## LISTING OF TABLES

## LISTING OF ABBREVIATIONS

| | |
|---|---|
| ALI | Annual Limit on Intake |
| AR | Army Regulation |
| ARRCOM | US Army Armament Materiel Readiness Command |
| Bq | Becquerel |
| CECOM | US Army Communications-Electronics Command |
| cpm | counts per minute |
| DA | Department of the Army |
| DOD | Department of Defense |
| DOE | Department of Energy |
| DOT | Department of Transportation |
| EIC | Eberline Instrument Corporation |
| ICRP | International Commission on Radiological Protection |
| LBDA | Lexington Blue-Grass Depot Activity |
| MSC | Major Subordinate Command |
| NICP | National Inventory Control Point |
| NRC | Nuclear Regulatory Commission |
| NSN | National Stock Number |
| Pu-239 | Plutonium-239 |
| RCO | Radiation Control Officer |
| RMCP | Radioactive Material Control Point |
| RPO | Radiation Protection Officer |
| Sv | Sievert |
| TM | Technical Manual |
| TMDE | Test Measurement Diagnostic Equipment |

I. Finding of No Significant Impact

1. Transfer of life-cycle management responsibilities for the AN/UDM-6 Radiac Calibrator Set from the US Army Armament Materiel Readiness Command (ARRCOM) to the US Army Communications-Electronics Command (CECOM) is proposed following Nuclear Regulatory Commission (NRC) approval of the CECOM license application submission. The AN/UDM-6 Radiac Calibrator Set incorporates the special nuclear material Plutonium ($Pu^{239}$) for calibration of alpha detection instrumentation. The AN/UDM-6 Radiac Calibrator Set has been successfully utilized by Army activities for the past 15 years and is the military adopted version of the commercially available Eberline Instrument Corporation (EIC) Model S94-1 Calibration Standard Set. The calibrator set has been selected based on its capability of calibrating standard Army alpha detection instruments or commercial equivalent instrumentation. The Environmental Assessment supports the NRC license application and complies with Army Regulation (AR) 200-2, Environmental Quality, Environmental Effects of Army Actions which requires evaluation of any radionuclide proposed for use within Army activities. The assessment documents all safety protocol implemented during use, possession, transfer, storage and disposal. In addition, this assessment demonstrates compliance with all regulatory requirements inclusive of minimum radiation protection training requirements of authorized users, technical manuals and instructions concerning radiation safety policies, rigorous logistical control, storage facility design, and specific disposal procedures for the calibrator set.

2. Alternative radionuclides have been presented for implementation within the AN/UDM-6 Radiac Calibrator Set, but are considered unacceptable based on similar radiotoxic properties, less than optimal characteristics for calibration, and financial/manpower resources necessary for development of a replacement set. A "no action" proposal is not considered based on federal regulatory requirements and need of calibration standards for continued Army missions.

3. The assessment provides complete dosimetric analyses for external/internal exposure presented to both occupational and non-occupational individuals from highly improbable incidents releasing radioactive materials to the surrounding environ. Included in this assessment are scenarios which involve source damage, improper disposal, installation fire or transport accident for evaluation of radiological or environmental impact. The dosimetric evaluations identify air/water concentration and exposure levels below regulatory requirements. The internal exposure presented individuals through various pathways have also been identified to remain below International Commission on Radiological Protection (ICRP)[1] recommendations. Based on this criteria, stringent military radiation safety policy, and previous successful use without documented hazard, the Environmental Assessment has concluded no discernable radiological health or environmental quality degradation. The Environmental Assessment is available for review upon request from Commander, US Army Communications-Electronics Command, ATTN: DRSEL-SF-H, Fort Monmouth, New Jersey 07703.

## II. Environmental Assessment

### A. Summary and Conclusion

1. The following Environmental Assessment supporting a Finding of No Significant Impact and concurrent with an application for an NRC license to receive, own, acquire, deliver, possess, use and transfer special nuclear material, has been prepared to maintain compliance with AR 200-2. The basic objectives specified in this regulation are to perform all actions with consideration given to minimize adverse effects on the quality of the human environ without impairment to the Army mission.

2. This document outlines:

a. The proposed use, need, and description of the AN/UDM-6 Radiac Calibrator Set, inclusive of maximum safety design specifications and Army policies more restrictive than governing regulatory requirements.

b. Alternatives available for substitution.

c. Radiological impacts with resulting dose assessments from hypothetical accidents or misuse.

The comprehensive evaluation concludes and documents that there is no potential degradation of environmental quality or significant radiological impact to occupational or public health resultant from fielding of the AN/UDM-6 Radiac Calibrator Set.

3. The intended use of the AN/UDM-6 Radiac Calibrator Set is solely for calibration of alpha radiation detection instrumentation employed for tactical (field) and health and safety purposes. Unit description, authorized user qualification, location, control of calibrator use, accountability, transfer and ultimate disposal are outlined in Section B. These meet stringent Army safety policies compliant with governmental agencies having jurisdictional control. Further control has been established as distribution is limited by approval from the Department of the Army (DA) based upon previously established authorization of user organizations to receive the item from a supply standpoint along with specific storage requirements, protective handling and maintenance procedures, and exclusive disposal through the US Department of Energy (DOE).

4. Properly implemented safety procedures for actions involving calibrator sets precludes any unnecessary radiation exposure to the occupational worker or the general public and excludes consideration of any

potential release to the environment. In determining radiological hazards to the occupational worker or the general public, assessments for both internal and external doses are presented. Pu-239 is known to be radiotoxic. The biological effects of Pu-239 have been studied extensively inclusive of basic metabolic properties of this alpha emitter such as poor absorption, poor excretion, and long retention. Alpha particles from such radionuclides are highly ionizing. However, distances traveled in air, materials or tissues are relatively short, therefore creating the maximum potential biological risk to the immediate surrounding tissue upon inhalation or ingestion. ICRP Publication 30 identifies recommended Annual Limits on Intake (ALI) for radionuclides. These recommendations are based upon mathematical and biological parameters of standard man for which exposure risk of the radionuclide to an individual is acceptable. The recommendations are derived from specified quantities which have been identified as not leading to the induction of significant biological effect and are computed in terms of committed dose equivalents spanned over 50 years. The maximum committed dose equivalent for internal dose was determined for an occupational worker upon ingestion of Pu-239 from source damage which resulted in 9.79E-03* sieverts (Sv) (9.79E-01 rem) to the bone surface. This remains below ICRP limit recommendations of 5.00E-01 Sv (5.00E+01 rem) for nonstochastic effects and 5.00E-02 Sv (5.00E+00 rem) stipulated for stochastic effects. Additional hypothetical incidents involving release of radioactive materials to various environmental pathways resultant from installation fire, improper disposal and transport incident are also outlined and summarized in Table A-1. The consideration of external dose was computed from the low percent abundance of Pu-239 gamma energies and resulted in 1.23E-08 Sv per year (1.23E-06 rem per year) for continuous exposure to the 5.44E+04 becquerel (Bq) (1.41E+00 microcurie (uCi)) source. Complete derivation of the evaluations and identification of compliance to regulatory standards are provided for review in Section C. The environmental assessment continually outlines possible modes of exposure and identifies under most severe conditions minimal environmental or radiological health impact.

5. The specific need for the AN/UDM-6 Radiac Calibrator Set is evident as outlined in Section D for compliance to federal regulations governing the calibration intervals and methods for alpha detection instrumentation employed in health and safety and tactical activities. Minimal radiological risk is associated with the AN/UDM-6 Radiac Calibrator Set which has been used successfully within the Army Supply System and commercial industries with no adverse indication demanding discontinuation of calibrator usage or its commercial equivalent. The assessment does not consider the worldwide fielding of the AN/UDM-6 Radiac Calibrator Set environmentally controversial, as it is neither capable of significantly affecting the quality of the human environment nor is it demonstrative of radiological impact.

* The use of exponential (scientific) notation, i.e., 9.79E-03 ($9.79 \times 10^{-3}$) is employed in lieu of standard notation, i.e., 0.00979.

TABLE A-1

Summary of Committed Dose Equivalent Limits to Bone Surface Subsequent to Hypothetical Incidents

| INCIDENT | Sv (rem) |
|---|---|
| Contamination | 4.89 E-03 (4.89E-01) |
| Source Damage | 9.79 E-03 (9.79E-01) |
| Source Incineration | 3.03 E-07 (3.03E-05) |
| Terrestrial Transport | 7.85 E-06 (7.85E-04) |
| Installation Fire | 6.35 E-03 (6.35E-01) |
| Individual Storage Area Fire | 6.47 E-04 (6.47E-02) |
| Transportation | 3.17 E-08 (3.17E-06) |

B. Description and Proposed Action for the AN/UDM-6 Radiac Calibrator Set

1. The AN/UDM-6 Radiac Calibrator Set (equivalent to the EIC Model S94-1 Calibration Standard Set) contains four radioactive disc sources. The sources incorporate approximately 4.66E+04 Bq (1.26E+00 uCi), 4.66E+03 Bq (1.26E-01 uCi), 4.66E+02 Bq (1.26E-02 uCi), and 4.66E+01 Bq (1.26E-03 uCi) as Pu-239 Nitrate. A solution containing a known quantity of Pu-239 Nitrate is electroplated onto a 1.25 inch diameter nickel disc (prior to March 1963 discs were composed of stainless steel). The sources are dried and fired at elevated temperatures to assure the adherence of the radioactive material. One hundred percent of the radioactive source discs are tested for adherence by applying masking tape directly onto the active area. The masking tape is removed and the adhesive side is analyzed for removable contamination of no greater than 1.00E-02 percent of the active material as specified by EIC. The radioactive disc sources are incorporated into separate two inch aluminum "doughnut" shaped housings and held in place with a compression ring yielding an active area of one inch in diameter. The housing frame is marked with the manufacturer's code number (source serial number), radiation caution symbols, radionuclide, and the calibrated source activity in counts per minute (cpm). Each source is attached with three machine screws to an anodized aluminum jig which is designed to hold the probe of an AN/PDR-54 or an AN/PDR-60 Radiac Set at the proper distance above the standard source. The jigs are arranged from left to right in an ascending sequence according to the alpha count rate of each source. The counting rates are on the order of 1.40E+03, 1.40E+04, 1.40E+05, and 1.40E+06 cpm with an accuracy to within ± four percent. The four sources are calibrated with certified National Bureau of Standards reference sources. Each AN/UDM-6 Radiac Calibrator Set incorporates certification documentation as to the accuracy of each radioactive source.

2. The AN/UDM-6 Radiac Calibrator Set consists basically of four jigs containing the Pu-239 alpha sources, a cushioning pad which assures that the source jigs are held in place, and a mask which is a flat rectangular sheet of perforated stainless steel designed to fit any jig reducing the count rate by thirty-eight percent allowing calibration of a second point on each scale of the radiac set. The contents are placed within a wooden carrying case which has a caution radioactive material label affixed to the top identifying the radionuclide, quantity, National Stock Number (NSN), manufacturing date, set serial number, and NRC license number. Reference should be made to Technical Manual (TM) 11-6665-248-10 (Incl 1) for a diagram and complete description of the AN/UDM-6 Radiac Calibrator Set. The TM completely details operation and use with the appropriate warnings and instructions for proper handling, set inspection, testing, storage, disposition, and actions to be taken during emergency situations. Radiation safety policies assure qualified users, proper labeling and operating procedures for maximum user safety. The wooden carrying case provides complete attenuation of the Pu-239 alpha particle sources for storage and transport requirements. All packaging and labeling of the Radiac Calibrator Sets comply with both NRC and Department of Transportation (DOT) specifications.

3. The AN/UDM-6 Radiac Calibrator Set will be utilized by the US Army Ionizing Radiation Dosimetry Center (AIRDC) of the US Army Test Measurement Diagnostic Equipment (TMDE) Support Group located at the Lexington-Blue Grass Depot Activity (LBDA), Lexington, Kentucky, and Department of Defense (DOD) installations and activities at worldwide locations. Radiac Calibrator Sets at DOD installations and activities will be possessed and utilized under the control of DA military and/or civilian personnel on the basis of approved facilities, radiation safety standards, procedures and qualifications of authorized user as outlined in Incl 1 and AR 385-11. The AN/UDM-6 Radiac Calibrator Sets will be issued only to authorized calibration activities at the Direct Support/General Support level. Radiac Calibrator Sets issued to authorized activities are for calibration of specific alpha radiation detection instruments, i.e. the AN/PDR-54 and the AN/PDR-60 Radiac Set. Typically instrumentation will be sent to authorized calibration activities or will be calibrated by a visiting mobile calibration activity (team). Calibrator sets are returned to LBDA for cosmetic repair, replacement of non-radioactive components and examination, and where applicable, leak testing, recalibration, and return to depot stock. All calibration activities will be supervised by a qualified local Radiation Protection Officer (RPO) who will have received at least forty hours training in the principles and practices of radiation protection which includes specific training in the safe use of the calibrator set. The operator/user will have a minimum of eight hours training in basic fundamentals of radiation protection, radiac instrumentation theory, application and survey techniques inclusive of practical training in the operation of the AN/UDM-6 Radiac Calibrator Set. Most of the sets will be used by four to seven-man mobile calibration teams with at least one individual qualified as a local RPO. Operations are performed with maximum safety procedures insuring lowest achievable occupational exposures. For personnel dosimetry purposes, bioassays are available and provided, when needed, by The Surgeon General of the Army.

4. CECOM will individually control the logistics of the AN/UDM-6, serve as National Inventory Control Point (NICP) for the item, and assure that requesting elements are authorized and technically capable of receiving the item in accordance with the NRC license. The Army program for control of radioactive items is prescribed in two regulations, AR 385-11 and AR 700-64. CECOM has adopted special procedures in addition to standard Army supply practices used for all type classified items through maintenance of a computerized data retrieval system that contains information for radioactive commodity type number, location, and responsible RPO. In addition, the control point maintains records of procurements, receipts, shipments, excess items and using/storage locations. The NICP reviews requisitions submitted, authorizes and issues material release orders to the designated depot for shipment of the material to the requisitioner. Each major command has established at the headquarters level a radioactive material control point (RMCP) and appointed a radiation control officer (RCO) to administer control of radioactive items within the command. The RCO reviews and concurs in the qualifications of local RPO's within the command, maintains records of

radioactive items by location and assures periodic inventory and leak tests by using activities, performs periodic inspections/audits of accountable installations/activities to assure that items are properly handled in accordance with Army and NRC regulations, and to assure the submission of inventory and leak test reports and accident/incident reports. The local RPO is responsible for administering the local radiation protection programs. Local programs provide for designated controlled areas, dosimetry, instrumentation, operating procedures supplementing published manuals for the items, receipts, transfers, storage and records. Requisitions originated by using elements are forwarded to NICP where all requisitions are reviewed and approved.

5. Facilities for use and storage of AN/UDM-6 Radiac Calibrator Sets will be designated radiation controlled areas for those purposes as approved by the local RPO. Sets used by the mobile calibration teams will be used and stored in specifically designed vans, access to which is limited to team members. In addition, at other user facilities, the sets will be used and stored in controlled areas and secured against unauthorized removal. Areas/buildings will be posted with appropriate radiation warning signs. LBDA storage, maintenance, and serviceability installations used for bulk storage of the AN/UDM-6 Radiac Calibrator Set are constructed of concrete block and steel. The calibration and storage rooms are constructed of thirty-six inch poured concrete with a door containing one-quarter inch of lead shielding. The installation is protected by a fire sprinkler system which is tied to the LBDA self-support fire department. The fire department has a maximum response time of two to three minutes to its furthest building. The security of the installation is such that all buildings are locked when not inhabited and the perimeter of LBDA is secured by chain-linked fence with roving patrols and sentries at the gate again eliminating any possibility of unauthorized possession.

6. Packaging and Shipment of the AN/UDM-6 is in compliance with DOT regulations and AR 385-11. These regulations require that the information on radioactive shipment documentation contain the proper shipping name (Radioactive Material, NOS), identification number, unit description and weight, type of packaging, radionuclide and quantity, and description of the chemical and physical form. Incl 1 identifies shipping label requirements. The shipment of individual items does not require any label, however, shipment of eight or more units as one package requires a "Radioactive White I" label.

7. Ultimate disposal of the AN/UDM-6 Radiac Calibrator Set will be in accordance with AR 385-11, AR 700-64 and 10 CFR. Request for final waste disposal of Pu-239 as contained in the AN/UDM-6 must be made through Army channels to headquarters, DOE, Washington, DC. This agency provides disposition instructions inclusive of compliance requirements under DOT regulations for shipment to the DOE site located in Oak Ridge, Tennessee. No radioactive waste is anticipated except in cases of damage beyond use of the source.

C. Proposed Environmental Impact for Fielding of the AN/UDM-6 Radiac Calibrator Set.

1. No radiological impact can be associated with the AN/UDM-6 Radiac Calibrator Set under normal operating conditions following proper procedures. The external dose equivalent from gamma emission for an occupational worker was derived from the following dosimetric calculations [2] and assumptions:

a. The total activity of all four sources is 5.22E+04 Bq (1.41E+00 uCi) and is assumed a single disc source of uniform activity distribution.

b. The total activity is assumed contained in the 2.54 centimeter (cm) diameter ($R_o$=1.27 cm) active area of the source yielding an activity concentration per unit area ($C_A$) of 1.03E+04 Bq/cm$^2$ (2.78E-07 Ci/cm$^2$).

c. Assuming an operating position of height (h) 30.5 cm above the disc source and a distance (d) of 30.5 cm away from its center, the flux intensity ($I_o$) is calculated by:

$$I_o \text{ (MeV/cm}^2\text{/sec)} = 2.96E{+}09 E C_A \pi \ln \left[ \frac{(R_o^2 + h^2 - d^2) + \left[ (R_o^2 + h^2 - d^2)^2 + 4d^2h^2 \right]^{1/2}}{2h^2} \right]$$

d. For the absorbed dose rate to tissue, the following formula is employed:

$$\text{Gray/hour (Gy/h)} = 5.76E{-}05 \left( \mu_a^{med} / \rho_{med} \right) I_o/100$$

where $\mu_a^{med}$ = linear absorption coefficient (cm$^{-1}$)

$\rho_{med}$ = mass density of the absorbing medium (g/cm$^3$; for tissue the value is assumed equivalent to water, i.e. 1.0 g/cm$^3$)

$\mu_a^{med}/\rho_{med}$ = mass absorption coefficient (cm$^2$/gm) or equivalent to mass energy absorption coefficients at varying energies in a tissue medium, i.e., ($H_2O$) since $\rho_{med}$ is equivalent to 1.0g/cm$^3$

Calculated values for gamma flux and absorbed dose rate for each energy are summarized in Table C-1. The total absorbed dose rate resulted in 1.41E-12 Gy/h (1.41E-10 rad/hr). The dose equivalent value can be stated as 1.41E-12 Sv/h (1.41E-10 rem/hr) or 1.23E-08 Sv/yr (1.23E-06 rem/yr) for continuous exposure assuming a quality factor and dose modifying factor of one (1) for gamma energies.

TABLE C - 1

Individual Gamma Flux Values and Final Absorbed Dose Rates

| E (MeV) | Gamma Intensity [3] | E′(MeV/disintegration) | $I_o$(MeV/cm$^2$/sec) | $\mu_a$tissue/$\rho$tissue | Gy/h(rad/hr) |
|---|---|---|---|---|---|
| 0.039 | 7.00E-05 | 2.73E-06 | 6.11E-06 | 7.29E-02 | 2.57E-13 (2.57E-11) |
| 0.052 | 2.00E-04 | 1.04E-05 | 2.33E-05 | 3.74E-02 | 5.02E-13 (5.02E-11) |
| 0.129 | 5.00E-05 | 6.45E-06 | 1.44E-05 | 2.65E-02 | 2.20E-13 (2.20E-11) |
| 0.375 | 1.20E-05 | 4.50E-06 | 1.01E-05 | 3.27E-02 | 1.90E-13 (1.90E-11) |
| 0.414 | 1.20E-05 | 5.00E-06 | 1.12E-05 | 3.29E-02 | 2.12E-13 (2.12E-11) |
| 0.650 | 8.00E-07 | 5.20E-07 | 1.16E-06 | 3.27E-02 | 2.18E-14 (2.18E-12) |
| 0.770 | 2.00E-07 | 1.54E-07 | 3.45E-07 | 3.22E-02 | 6.40E-15 (6.40E-13) |
| | | | | TOTAL = | 1.41E-12 (1.41E-10) |

e. The Metric System (SI) value is indicated to be 5.00E-02 Sv per year and can be stated as an NRC equivalent occupational exposure limit for uniform irradiation of the whole body. The NRC occupational exposure limit is stipulated to be five rem per year. As demonstrated, the resultant exposure from continuous use is 2.46E-05 percent of the permissible limits maintaining doses as low as reasonably achievable. Theorectical doses determined are conservative (high) in consideration of actual operational distance, duration of operations, and actual radionuclidic quantities contained in each disc source. Consideration of alpha particle absorption was eliminated based on the approximate distance determination[3] of 3.78 cm travelled in air for the 5.11 MeV and 5.16 MeV alpha particle energy. The alpha particle energies would not penetrate the uppermost epithelial tissue, therefore incapable of reaching radiosensitive tissue unless internally ingested or inhaled.

2. In order to determine radiological impact due to internal ingestion or inhalation the proceeding hypothetical incidents are proposed to determine the uppermost bound of impact. The radiological assessments are expressed in terms of committed dose equivalents determined for organs with the greatest potential of risk resultant from highly improbable incidents involving ingestion or inhalation. The absorption of plutonium following ingestion occurs primarily to endosteal surfaces of bone and is redistributed throughout by resorption deposition processes. The liver has also been assigned an equivalent fractional deposition factor from the transfer compartment as bone surfaces following ingestion, however, has a shorter retention (biological half-life) factor following translocation. Inhalation of Pu-239 has been assigned to inhalation class "W" indicating a retention time in the pulmonary region from ten to one-hundred days. Internal exposure due to the highly ionizing alpha particles of Pu-239 is proposed to demonstrate committed dose equivalent limits magnitudes below ICRP 30 recommendations and permissible levels compliant with regulatory specifications. The following incidents are highly improbable but unquestionably identify that there is no significant environmental impact resultant from fielding of the AN/UDM-6 Radiac Calibrator Set.

a. Source Leakage/Damage Leading to Ingestion:

(1) The AN/UDM-6 Radiac Calibrator Set contains four disc sources which are required to be tested for removable contamination every three months using protective handling procedures. The incidents described concern source leakage without detection or source damage resulting in ingestion with the additional assumptions:

(a) The disc source contains 4.66E+04 Bq (1.26E+00 uCi).

(b) Ten percent of the total activity (4.66E+03 Bq or 1.26E-01 uCi) is distributed on the jig and accessible for contaminating an occupational worker.

(c) Fifty percent of the accessible contamination is received and assumed to be one-hundred percent ingested (2.33E+03 Bq or 6.30E-02 uCi). The resultant committed dose equivalents are summarized in Table C-2.

(2) In the event a disc source becomes scratched or damaged, a total of ten percent of the activity is assumed available for ingestion. The committed dose equivalents are summarized in Table C-3 for comparison.

(3) The tabulated committed dose equivalents are based on ICRP 30 data. The maximum dose equivalent of 9.79E-03 Sv (9.79E-01 rem) to bone estimated for ingestion resultant from source damage is below recommended non-stochastic dose equivalent limits. The total ingested activity of 4.66E+03 Bq (1.26E-01 uCi) is 2.30 percent of the recommended ALI (2.00E+05 Bq) given for ingestion.

(4) The assumptions given for this incident assessment are extreme in consideration of the actual quantities assumed available for contamination or removed from scratching or damage and subsequently ingested. In addition, operator training/guidance from technical manuals prevents mishandling of sources and ensures proper protective handling and testing at required intervals for determination of possible removable contamination.

b. Source Loss Leading to Improper Disposal in a Public Incinerator[4]:

(1) The following assessment proposes incineration of AN/UDM-6 Radiac Calibrator Sets. This incident is considered highly inconceivable due to calibrator size and radioactive warning symbols attached to outer encasements and disc source assemblies. The assumptions[3] employed for estimation of resultant air concentration levels in incinerator emissions are:

(a) Five AN/UDM-6 Radiac Calibrator Sets incinerated yielding an initial activity ($Q_i$) of 2.61E+05 Bq (7.05E+00 uCi) within a municipal incinerator processing 300 tons of refuse per day at fifty percent excess air.

(b) The Pu-239 released during the incineration process ($f_s$) is one hundred percent of the initial activity.

(c) The efficiency of the installed air pollution control systems for particulates is 90 percent (i.e. the fraction of Pu-239 which escapes with stack gases, $f_r = 0.1$)

(d) The aerodynamic mean activity diameter (AMAD) of the released particles is one micron.

TABLE C - 2

Committed Dose Equivalents to Various Organs Following Ingestion of Removable Contamination

| ACTIVITY INGESTED | BONE SURFACE | LIVER | R. MARROW | GONADS |
|---|---|---|---|---|
| 2.33E+03 Bq | 4.89E-03 Sv | 1.03E-03 Sv | 3.73E-04 Sv | 6.06E-05 Sv |
| (6.30E-02 uCi) | (4.89E-01 rem) | (1.03E-01 rem) | (3.73E-02 rem) | (6.06E-03 rem) |

TABLE C - 3

Committed Dose Equivalents to Various Organs Following
Ingestion Resultant from Source Damage

| ACTIVITY INGESTED | BONE SURFACE | LIVER | R. MARROW | GONADS |
|---|---|---|---|---|
| 4.66E+03 Bq | 9.79E-03 Sv | 2.05E-03 Sv | 7.46E-04 Sv | 1.21E-04 Sv |
| (1.26E-01 uCi) | (9.79E-01 rem) | (2.05E-01 rem) | (7.46E-02 rem) | (1.21E-02 rem) |

(e) The number of persons feeding one incinerator disposal route is also assumed to be the exposed population of 73,000 individuals.

(f) The entire activity of Pu-239 is released within a twenty-four hour time frame.

(g) Fifty percent excess of the theoretical volume of air required for complete combustion of one pound (lb) is 2.00E+06 $cm^3$ /lb ($V_a$). The weight of refuse ($W_r$) incinerated is 6.60E+05 pounds.

(h) The atmospheric dispersion coefficient (X/Q) is assumed to be 2.00E-05 seconds/$m^3$.

(2) The total activity released in a day (Q) is calculated using the formula:

$$Q = Q_i f_s f_r$$

The total activity released is 2.61E+04 Bq (7.05E-01 uCi). The continuous release ($Q'$) rate over twenty-four hours is 3.02E-01 Bq/s (8.16E-06 uCi/sec).

(3) The concentration of Pu-239 in the stack gas ($X_s$) is given by:

$$X_s = Q/V_a W_r$$

The average twenty-four hour concentration of Pu-239 is 1.98E-08 Bq/$cm^3$ (5.34E-13 uCi/$cm^3$).

(4) Meteorologic conditions are assumed to be moderately stable with a constant wind speed of one meter per second. The maximum downwind concentration (X) is estimated from the general formula:

$$X = Q' (X/Q)$$

Resultant values indicate a concentration of 6.03E-06 Bq/$m^3$ (1.63E-10 uCi/$m^3$).

(5) Assuming an average daily breathing rate of 20.0 $m^3$ per day, the maximum exposed individual would inhale 1.21E-04 Bq (3.26E-09 uCi) on the day of incineration. Conservatively proposing that the average person inhales an amount of Pu-239 equal to one-third of this concentration, the total activity inhaled would be 4.02E-05 Bq (1.09E-09 uCi).

(6) Committed dose equivalent limits using ICRP 30 dosimetric data are summarized in Table C-4. Realistic consideration of

TABLE C-4

Committed Dose Equivalents to Various Organs Resultant from Inhalation Following Source Incineration

| Effected Group | Activity Inhaled | Bone Surface | Liver | R. Marrow | Gonads |
|---|---|---|---|---|---|
| Average Exposed Person | 4.02E-05 Bq (1.09E-09 uCi) | 1.01E-07 Sv (1.01E-05 rem) | 2.13E-08 Sv (2.13E-06 rem) | 8.04E-09 Sv (8.04E-07 rem) | 1.29E-09 Sv (1.29E-07 rem) |
| Maximum Exposed Person | 1.21E-04 Bq (3.26E-09 uCi) | 3.03E-07 Sv (3.03E-05 rem) | 6.41E-08 Sv (6.41E-06 rem) | 2.42E-08 Sv (2 42E-06 rem) | 3.87E-09 Sv (3.87E-07 rem) |

this incident is eliminated based on user ability to maintain authorized possession with minimal to non-existent occasion arising where transfer of Radiac Calibrator Sets to an incinerator becomes possible.

(7) The maximum downwind concentration was estimated to be 6.03E-06 Bq/$m^3$ (1.63E-16 uCi/ml). The air concentration limit for unrestricted areas as specified in 10 CFR Part 20 is given as 2.22E-03 Bq/$m^3$ (6.00E-14 uCi/ml) for soluble forms and 3.70E-02 Bq/$m^3$ (1.00E-12 uCi/ml) for insoluble forms. This limit is based on the standard for non-occupational radiation exposure which is 5.00E-03 Sv/yr (5.00E-01 rem/yr). The air concentrations resultant from this incident are identified to be magnitudes below regulatory requirements and continue to demonstrate insignificant to non-existent environmental impact even with severe assumptions outlined with each incident.

c. Source Loss Resulting in Improper Disposal Directly to a Public Landfill[4] :

(1) Proposing the five AN/UDM-6 Radiac Calibrator Sets incinerated in Section b(1)(a) are transferred to a solid waste landfill for disposal, exposure to surrounding populations is evaluated. The mode of exposure is presented through ingestion of contaminated ground water which has infiltrated public drinking water supply systems. The subsequent suppositions detail the parameters developed for evaluation of impact to the surrounding environ and feeding population:

(a) One-hundred percent leaching of the total source activity ($A_t$: 2.61E+05 Bq or 7.05E+00 uCi) has occurred entering the ground water without further dispersion ($f_{L1}$ = 1.0).

(b) The total volume ($V_L$) of leachate generated per year from an average twenty-five acre landfill based on US Environmental Protection Agency (EPA) estimates is 6.76E+06 gallons (2.57E+10 ml) accounting only for the average precipitation infiltrate of ten inches per year.

(c) No significant dilution of the contamination zone occurs from surrounding groundwater ($f_{L2}$ = 1.0).

(d) One percent of the contaminated water is withdrawn for domestic water supply ($f_{d1}$) and five percent is consumed as drinking water ($f_{d2}$).

(2) The concentration of Pu-239 in the leachate ($A_L$) as it enters the zone of saturation is calculated by:

$$A_L = A_t f_{L1} f_{L2} / V_L$$

The average Pu-239 concentration in the leachate generated is approximated to be 1.01E+01 Bq/$m^3$ (2.74E-10 uCi/ml).

(3) The amount of activity ingested ($A_{ing}$) as a result of contaminated water in the public drinking water supply is estimated by:

$$A_{ing} = V_L f_{d1} f_{d2} A_L$$

The dietary intake by the entire surrounding population (73,000) would be 1.30E+02 Bq (3.52E-03 uCi). The average individual dietary intake would be 1.79E-03 Bq (4.83E-08 uCi).

(4) The dose commitment to the maximally exposed individual is assessed with the assumption that the annual dietary intake of water ($I_W$) is 3.70E+05 ml and consists entirely of ground water contaminated with Pu-239 at the same concentration as calculated for leachate ($A_L$ = 1.01E+01 Bq/$m^3$) incorporated into the formula:

$$A_{ing} = I_W A_L$$

The total activity estimated to be consumed is 3.74E+00 Bq (1.01E-04 uCi). Committed dose equivalents due to leaching from a landfill to accessible drinking water are summarized in Table C-5.

(5) The maximum permissible water concentration as specified in 10 CFR Part 20 is 1.85E+05 Bq/$m^3$ (5.00E-06 uCi/ml) for soluble forms and 1.11E+06 Bq/$m^3$ (3.00E-05 uCi/ml) for insoluble forms of Pu-239 in unrestricted areas. The concentrations assessed for Pu-239 in the leachate are 5.46E-03 percent of the soluble limit and 9.10E-04 percent of the insoluble limit. It should be noted that no consideration has been given to actual dispersion coefficients or dilution factors which would occur during ground transport tremendously decreasing resultant values.

d. Installation Fire:

(1) The proposed incident involves an installation fire which occurs during bulk storage at LBDA enveloping AN/UDM-6 Radiac Calibrator Sets releasing Pu-239. The warehouse facility is equipped with complex sprinkler systems covering one-hundred percent of the area and an automatic alert to the LBDA firefighting unit which has at maximum a two to three minute response time. The firefighter unit is aware of the radioactive material storage area and has standard operating procedures inclusive of protective clothing, self-contained respiratory devices and procedures limiting water usage and evacuation of personnel from downwind areas immediately if necessary. The hypothetical incident assumed the following for occupationally involved firefighters in the immediate vicinity performing extinguishing operations:

(a) The maximum number of AN/UDM-6 Radiac Calibrator Sets possibly stored at any time in the installation is five hundred for a total storage activity of 2.61E+07 Bq (7.05E+02 uCi).

(b) Prior to extinguishing the fire, ten percent of the units are involved releasing one percent of the total activity as airborne particulates.

TABLE C-5

Committed Dose Equivalents to Various Organs Resultant from
Ingestion Following Leaching of Contaminated Groundwater to Public Drinking Water

| Effected Group | Activity Ingested | Bone Surface | Liver | R. Marrow | Gonads |
|---|---|---|---|---|---|
| Average Exposed Person | 1.79E-03 Bq (4.83E-08 uCi) | 3.76E-09 Sv (3.76E-07 rem) | 7.88E-10 Sv (7.88E-08 rem) | 2.86E-10 Sv (2.86E-08 rem) | 4.65E-11 Sv (4.65E-09 rem) |
| Maximum Exposed Person | 3.74E+00 Bq (1.01E-04 uCi) | 7.85E-06 Sv (7.85E-04 rem) | 1.65E-06 Sv (1.65E-04 rem) | 5.98E-07 Sv (5.98E-05 rem) | 9.72E-08 Sv (9.72E-06 rem) |
| TOTAL PUBLIC | 1.30E+02 Bq (3.52E-03 uCi) | 2.73E-04 Sv (2.73E-02 rem) | 5.72E-05 Sv (5.72E-03 rem) | 2.08E-05 Sv (2.08E-03 rem) | 3.38E-06 Sv (3.38E-04 rem) |

The quantity released during a one hour time interval is 2.61E+04 Bq (7.05E-01 uCi).

(c) The volume of air in the warehouse is 1.23E+04 $m^3$ yielding 2.12E+00 $Bq/m^3$ (5.73E-05 $uCi/m^3$).

(d) The breathing rate of persons involved is 1.2 $m^3/hr$.

(e) The total intake for each firefighter is 2.54E+00 Bq (6.88E-05 uCi) assuming no implementation of respiratory protective devices during the one hour period.

(2) The committed dose equivalents as calculated using ICRP 30 data are given in Table C-6. No estimates were included for the general public due to conservative dose equivalents derived for occupational individuals in the immediate vicinity and dispersion factors which would further reduce dose commitments. It should be noted that no consideration in dose estimates for firefighters included ventilation of the building during extinguishment or the use of respiratory protective devices. The committed dose equivalent limit for bone surface remains below recommended non-stochastic dose equivalent limits. The total inhaled activity is 1.27 percent of the ALI (2.00E+02 Bq) recommendation for inhalation. The air concentration (2.12E+00 $Bq/m^3$ or 5.73E-11 uCi/ml) when averaged over one year is equivalent to 5.81E-03 $Bq/m^3$ (1.57E-13 uCi/ml). The concentration limits as specified in 10 CFR Part 20 are 1.40E-02 $Bq/m^3$ (2.00E-12 uCi/ml) for soluble forms or 1.48E+00 $Bq/m^3$ (4.00E-11 uCi/ml) for insoluble forms. The concentration limits derived in this evaluation are below one third maximum permissible limits accounting for variation of individual doses.

(3) Operations in the unlikely event of occurrence would be conducted with some awareness of the potential hazard and with measures of protection reducing inhalation risks. The probability of fire at the installation involving the AN/UDM-6 Radiac Calibrator Sets approaches zero due to institution structural composition, fire walls between warehouse sections, complex sprinkler systems, and firefighter units which would respond prior to any conceivable incorporation of units containing radioactive materials.

e. Individual Storage Area Fire:

(1) The AN/UDM-6 Radiac Calibrator Sets fielded will be used by mobile calibration teams in specifically designed vans. The calibrator set is stored within a locked fire resistant cabinet. Hypothetically, if the unit were subjected to heat or fire causing breach of the calibrator source integrity, the following assumptions are presented:

(a) Within a fifteen minute time frame, fire surrounds the cabinet causing ten percent release of activity to the calibrator encasement, i.e. 5.22E+03 Bq (1.41E-01 uCi).

TABLE C-6

Committed Dose Equivalents to Various Organs Following Inhalation
Due to Installation Fire

| Activity Inhaled | Bone Surface | Liver | R. Marrow | Gonads |
|---|---|---|---|---|
| 2.54E+00 Bq | 6.35E-03 Sv | 1.35E-03 Sv | 5.08E-04 Sv | 8.13E-05 Sv |
| (6.88E-05 uCi) | (6.35E-01 rem) | (1.35E-01 rem) | (5.08E-02 rem) | (8.13E-03 rem) |

(b) Fifty percent of the activity escapes the encasement to the cabinet interior releasing ten percent to the van interior (2.14E+01 $m^3$) yielding 1.22E+01 Bq/$m^3$ (3.29E-04 uCi/$m^3$).

(c) The breathing rate of an occupational worker is 1.20 $m^3$/hr. Assuming air concentrations are unchanged, the worker failing to implement a protective respiratory device for approximately five minutes would inhale a total activity of 1.22E+00 Bq (3.29E-05 uCi).

(2) The committed dose equivalents using ICRP 30 data are summarized in Table C-7. The evaluation presented considered the minute plausibility of fire enveloping the specifically designed fire-resistant cabinet and the attempt to arrest the fire without respiratory protective devices or air exchange causing dilution and decrease in inhaled activity. Release of activity prior to extinguishment is realistically improbable with the availability of firefighting devices and user response. The total inhaled activity is 6.10E-01 percent of the recommended ALI for inhalation (2.00E+02 Bq). The concentration guides for restricted areas as specified in 10 CFR Part 20 are 1.40E-02 Bq/$m^3$ (2.00E-12 uCi/ml) for soluble forms and 1.48E+00 Bq/$m^3$ (4.00E-11 uCi/ml) for insoluble forms. The presented air concentration is equivalent to 1.22E+01 Bq/$m^3$ (3.29E-10 uCi/ml) or averaged over one year equal to 3.34E-02 Bq/$m^3$ (9.01E-13 uCi/ml). The air concentration levels are below one third of the permissible limits which are based on standards for occupational exposure levels of 5.00E-02 Sv/yr (5.00E+00 rem/yr).

f. Transportation Accidents:

(1) Transportation of the AN/UDM-6 Radiac Calibrator Sets between facilities is infrequent except upon initial delivery from LBDA to the area of proposed user activity which would lend to decrease in probability of incident occurrence. The transport scenario involves vehicular collision resulting in fire, explosion, and subsequent release of calibrator source activity to the environ. Inhalation risk is considered the primary immediate mode of exposure to individuals in the vicinity under the assumptions:

(a) The number of AN/UDM-6 Radiac Calibrator Sets transported is assumed to be fifty percent of the total number possessed yielding a total activity of 1.30E+07 Bq (3.53E+02 uCi).

(b) Fifty percent of the total activity is instantaneously and uniformly distributed within a hemispherical volume whose radius equals 200 meters yielding a total volume of 1.67E+07 $m^3$ and whose activity concentration per unit volume is 3.90E-01 Bq/$m^3$ (1.06E-05 uCi/m3).

(c) Individuals within the prescribed area have a breathing rate of 1.20 $m^3$/hr. Assuming no change in activity per unit volume through dispersion for an hour or evacuation of any individual, the total activity inhaled within the one hour time period would be 4.68E-01 Bq (1.27E-05 uCi).

(2) Approximations of committed dose equivalents to various organs using ICRP 30 evaluation are summarized in Table C-8. The air concentration of

TABLE C-7

Committed Dose Equivalents to Various Organs Following Inhalation
Due to Individual Storage Area Fire

| Activity Inhaled | Bone Surface | Liver | R. Marrow | Gonads |
|---|---|---|---|---|
| 1.22E+00 Bq | 6.47E-04 Sv | 3.05E-03 Sv | 2.44E-04 Sv | 3.90E-04 Sv |
| (3.29E-05 uCi) | (6.47E-02 rem) | (3.05E-01 rem) | (2.44E-02 rem) | (3.90E-02 rem) |

TABLE C-8

Committed Dose Equivalents to Various Organs Resultant from Inhalation Following a Transport Incident

| Activity Inhaled | Bone Surface | Liver | R. Marrow | Gonads |
|---|---|---|---|---|
| 4.68E-01 Bq | 3.17E-08 Sv | 6.72E-09 Sv | 2.54E-09 Sv | 4.06E-10 Sv |
| (1.27E-05 uCi) | (3.17E-06 rem) | (6.72E-07 rem) | (2.54E-07 rem) | (4.06E-08 rem) |

5.50E-01 Bq/$m^3$ (1.50E-11 uCi/ml) when averaged over a one year time interval is 1.51E-03 Bq/$m^3$ (4.11E-14 uCi/ml). This concentration is below maximum permissible unrestricted air concentrations specified in 10 CFR Part 20. Further reduction in quantities inhaled and resultant committed dose equivalents would occur through wind dispersion and evacuation of contaminated areas.

(3) The probability of transport incident as proposed is considered highly improbable due to absence of documented incidents within the history of its possession, publications statistically identifying minimal probability in comparison to total shipment incident and compliance to applicable DOT regulations governing packaging/transport. Any conceivable damage to the unit in transit would not be of a severe nature but rather from jolting or compression which would not release material to the environ. Upon occurrence, damage would be immediately obvious to the authorized user who would take appropriate action to contain the unit for return or disposal as specified in AR 385-11 and associated technical manuals.

(4) Table A-1 summarized resultant committed dose equivalents to bone surfaces from proposed hypothetical incidents. The occupational worker is identified as receiving the maximum unnecessary internal exposure to Pu-239 through improper use or damage to the source contained within the AN/UDM-6 Radiac Calibrator Set. Each proposed incident although regarded as highly inconceivable demonstrated levels below those recommended by ICRP or regulatory standards. The total intake of Pu-239 assessed for the various evaluations are estimates based on general assumptions and are in excess of more realistic or actual quantity intake which would result in decreased committed dose equivalent determinations. Properly implemented procedures for use and indicated safety precautions eliminate association of radiological/environmental impact with the use of the calibrator set. The established safety requirements and strict operational guidelines dismiss consideration of any proposed incident as probable and conclude that no environmental impact or radiological health hazard would arise from implementation or incorporation of the AN/UDM-6 Radiac Calibrator Set within the Army Supply System.

D. Evaluation of Alternatives

1. The radionuclides listed in Table D-1 were evaluated as to feasibility for consideration of possible alternative to Pu-239 as an alpha calibration source. No significant advantages are identified for substitution of these radioisotopes in lieu of Pu-239 contained within the AN/UDM-6 Radiac Calibrator Set. The alternative radionuclides are also known to be considered radiotoxic and possess unacceptable characteristics. For instance, Gold-148 has a less than optimum energy, Polonium-210 has a short half-life, and Curium-244 is more expensive to procure as indicated in Table D-1. These characteristics are unacceptable when overall comparison does not reduce consideration of radiological hazard. The purpose for implementation of Pu-239 is based on quantitative and qualitative analysis of Pu-239 by instrumentation calibrated by the AN/UDM-6 Radiac Calibrator Set. The Pu-239 source is the ideal standard providing calibration of alpha detection instrumentation which

TABLE D-1

Alpha Radionuclides for Instrument Calibration[5]

| Radionuclide | Alpha Energy (MeV) Abundance (Percent) | Half-Life (Years) | Advantage Disadvantage |
|---|---|---|---|
| $^{148}Gd$ | 3.18 | 9.30E+01 | Low Energy |
| $^{230}Th$ | 4.617,(24)<br>4.684,(76) | 7.70E+04 | Radiotoxic |
| $^{239}Pu$ | 5.105,(12)<br>5.143,(15)<br>5.156,(73) | 2.44E+04 | Ideal Energy,<br>Radiotoxic |
| $^{210}Po$ | 5.305,(100) | 3.79E-01 | Short Half-Life |
| $^{241}Am$ | 5.442,(13)<br>5.484,(86) | 4.33E+02 | Radiotoxic |
| $^{238}Pu$ | 5.456,(28)<br>5.499,(72) | 8.78E+01 | Radiotoxic |
| $^{244}Cm$ | 5.764,(23)<br>5.806,(77) | 1.78E+01 | Radiotoxic<br>Expensive |
| $^{252}Cf$ | 6.076,(16)<br>6.119,(84) | 2.65E+00 | Radiotoxic,<br>Expensive,<br>Short Half-Life,<br>Neutron Hazard |

is primarily implemented in detection of Pu-239 contamination.

2. The AN/UDM-6 Radiac Calibrator Set is the military version of the commercially available EIC Model S94-1 Calibration Standard Set which has been successfully fielded and utilized by Army activities worldwide for the past fifteen years. The AN/UDM-6 is specifically used in calibration of the AN/PDR-54 and AN/PDR-60 standard Army alpha detection instruments (radiac sets) or commercial equivalent instrumentation such as the EIC Portable Alpha Counter (PAC) series. Radiac Calibrator Sets are mandatory in maintaining compliance to NRC requirements governing calibration intervals of alpha detection instrumentation used for health/safety and tactical activities. A "no action" alternative cannot be considered based on federal regulatory requirements and activities fulfilling the Army mission.

E. Status of Compliance

The AN/UDM-6 Radiac Calibrator Set containing special nuclear material, Pu-239, is subject to regulation by the NRC. The extent of the regulation is stated in 10 CFR. The CECOM NRC license application transfers management responsibilities from ARRCOM for this material and has identified all areas of compliance to 10 CFR. No specific state or local permits or licenses are required due to Federal control. The proposed action includes transport of calibrator sets between installations for which CECOM has demonstrated compliant measures with regard to shipment and packaging as required by DOT regulations.

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